EUTRA/LTE/IoT R&S®SMBV-K55/-K84/-K85/-K112/-K113/-K115/-K119

User Manual

LTE Rel. 9/Rel. 10/Rel. 11/Rel. 12/ Rel. 13/Rel.14, Enhanced Features, Cellular IoT Rel.14

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User Manual
Version 29

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®SMBV-K55/-K84/-K85/-K112/-K113/-K115/-K119
  1407.9203.xx, 1415.8602.xx, 1415.8619.xx, 1419.1719.xx, 1419.2921.xx, 1419.1583.xx, 1427.8148.xx

This manual describes firmware version 4.15.125.xx and later of the R&S®SMBV100A.

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The following abbreviations are used throughout this description: R&S®SMBV100A is abbreviated as R&S SMBV, R&S®WinIQ-SIM2™ is abbreviated as R&S WinIQSIM2

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1 Preface

1.1 Documentation Overview

This section provides an overview of the R&S SMBV user documentation. Unless specified otherwise, you find the documents on the R&S SMBV product page at:

www.rohde-schwarz.com/manual/smbv100a

1.1.1 Quick Start Guide Manual

Introduces the R&S SMBV and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

1.1.2 Operating Manual and Help

Separate manuals for the base unit and the software options are provided for download:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the quick start guide manual.
- Software option manual
  Contains the description of the specific functions of an option. Basic information on operating the R&S SMBV is not included.

The contents of the user manuals are available as help in the R&S SMBV. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

All user manuals are also available for download or for immediate display on the Internet.

1.1.3 Service Manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS, https://gloris.rohde-schwarz.com).

1.1.4 Instrument Security Procedures

Deals with security issues when working with the R&S SMBV in secure areas. It is available for download on the Internet.

1.1.5 Basic Safety Instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

1.1.6 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S SMBV. It also lists the options and their order numbers and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/smbv100a

1.1.7 Release Notes and Open Source Acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The open source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smbv100a

1.1.8 Application Notes, Application Cards, White Papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/smbv100a.

2 Welcome to the EUTRA/LTE/IoT Options

The R&S SMBV-K55/-K84/-K85/-K112/-K113/-K115/-K119 are firmware applications that add functionality to generate signals in accordance with the 3GPP standard EUTRA/LTE.

In the following, the terms LTE or EUTRA are used interchangeably.

Preamble

All supported **LTE** features are in line with 3GPP Release 14; the following official 3GPP specifications are implemented:

- 3GPP TS 36.211, Version 15.6.0
- 3GPP TS 36.212, Version 15.6.1
- 3GPP TS 36.213, Version 15.6.0

The R&S SMBV-K55/-K84/-K85/-K112/-K113/-K119 key features

The R&S SMBV simulates EUTRA/LTE at the physical channel level. The following list gives an overview of the functions provided for generating an EUTRA/LTE signal:

- Supports FDD and TDD
- Intuitive user interface with graphical display of time plan
- Full support of P-SYNC, S-SYNC and DL reference signal derived from cell ID
- PBCH, PDSCH, (E)PDCCH, PCFICH, PHICH supported
- Downlink 256QAM for PDSCH and PMCH
- PDCCH with full DCI configuration (all DCI formats supported), incl. DCI Format 1C for eIMTA-RNTI
- Channel coding and scrambling for PDSCH and PBCH (including MIB)
- Automatic PDSCH scheduling from DCI
- Automatic scheduling of downlink transmissions according to long HARQ patterns
- Full downlink MIMO and transmit diversity support
- Uplink MIMO support
- Supports PUSCH with channel coding and scrambling
- Configuration of all PRACH and PUCCH formats
- Fixed reference channels (FRC) in line with 3GPP TS 36.141
- Downlink test models (E-TMs) in line with 3GPP TS 36.141, incl. E-TMs for 256QAM
- Test case wizard
- Simulation of single-layer, dual-layer and up to eight-layer beamforming scenarios (transmission modes 7, 8 and 9) on antenna ports 5 and 7 to 14
- Support of MBMS single frequency network (MBSFN) subframes on antenna port 4
- Generation of positioning reference signals (PRS) on antenna port 6

- Generation of LTE-Advanced downlink and uplink carrier aggregation scenarios (up to 5 carriers) with support for cross-carrier scheduling; incl. uplink carrier aggregation with mixed duplexing
- LTE-Advanced enhanced SC-FDMA with PUSCH/PUCCH synchronous transmission and clustered PUSCH
- Support of CSI reference signals
- Support of DL LAA bursts configuration
- Support of QAM256 in uplink

The R&S SMBV-K115 key features

The R&S SMBV simulates eMTC and NB-IoT at the physical channel level. The following is an overview of provided functions:

- Supports uplink eMTC and NB-IoT configuration, as well as downlink NB-IoT configuration
- Supports IoT standalone configuration and mixed configuration with LTE
- Supports NB-IoT in-band and guard band opiating modes
- Intuitive user interface with graphical display of time plan
- Support of coverage enhancement CE modes A and B and CE levels 0, 1 and 2
- Support of the new NB channels and synchronization signals (NPSS, NSSS and DL reference signal derived from NCell ID)
- MPBCH, PDSCH, PBCH supported
- DCI-based configuration of NPDCCH and NPDSCH
- Channel coding and scrambling for NPDCCH, NPDSCH and NPBCH (including SIB type 1)
- Supports NPUSCH with channel coding and scrambling
- NPRACH configuration
- Support of all specified modulation schemes

This operating manual contains a description of the functionality that the application provides, including remote control operation.

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMBV operating manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMBV100A

2.1 Accessing the EUTRA/LTE Dialog

To open the dialog with EUTRA/LTE settings

► In the block diagram of the R&S SMBV, select "Baseband > EUTRA/LTE".

A dialog box opens that display the provided general settings.

The signal generation is not started immediately. To start signal generation with the default settings, select "State > On".

2.2 Scope

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, it includes:

- Managing settings and data lists, like storing and loading settings, creating and accessing data lists, or accessing files in a particular directory.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMBV operating manual.

2.3 Notes on Screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as many as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

3 About the EUTRA/LTE Options

For better understanding of the required configuration settings, this section lists:

- Some background information on basic terms and principles used in the EUTRA/LTE technology
- Information on functions specific to the instrument

3.1 Introduction to the EUTRA/LTE Technology

This section provides an introduction to the EUTRA/LTE technology.

3.1.1 LTE Downlink Transmission Scheme

The downlink transmission scheme for E-UTRA FDD and TDD modes is based on conventional OFDM. In an OFDM system, the available spectrum is divided into multiple subcarriers, which are orthogonal to each other. Each of the subcarriers is independently modulated by a low rate data stream.

The OFDM signal is generated using the inverse fast Fourier transform (IFFT) digital signal processing. The IFFT converts a number N of complex data symbols used as frequency domain bins into the time domain signal. Such an N-point IFFT is illustrated on Figure 3-1.

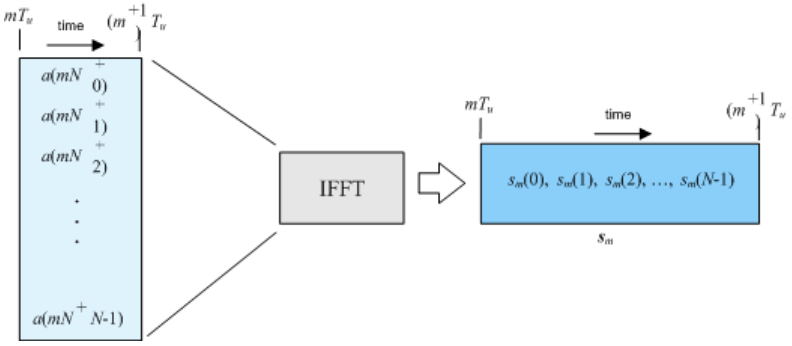


Figure 3-1: OFDM useful symbol generation using an IFFT (3GPP TR 25.892)

a(mN+n) = n^{th} subchannel modulated data symbol
$mT_u < t \leq (m+1)T_u$ = time period

The vector s_m is defined as the useful OFDM symbol. It is the time superposition of the N narrowband modulated subcarriers. Therefore, from a parallel stream of N sources of data, each one independently modulated, a waveform composed of N orthogonal subcarriers is obtained. Each of the subcarriers is a frequency sinc function.

The Figure 3-2 illustrates the mapping from a serial stream of QAM symbols to N parallel streams, used as frequency domain bins for the IFFT. The N-point time domain blocks obtained from the IFFT are then serialized to create a time domain signal. Not shown in the figure is the process of cyclic prefix insertion.

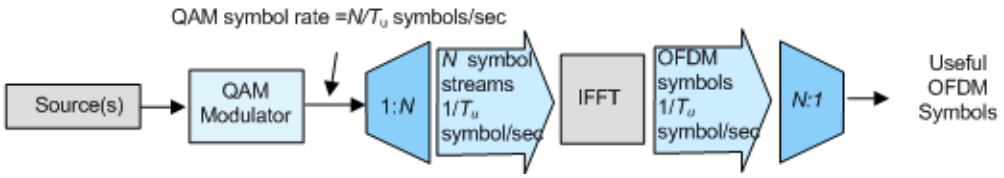


Figure 3-2: OFDM signal generation chain (3GPP TR 25.892)

In contrast to an OFDM transmission scheme, OFDMA allows the access of multiple users on the available bandwidth. Each user is assigned a specific time-frequency resource. As a fundamental principle of E-UTRA, the data channels are shared channels. For each transmission time interval of 1 ms, a new scheduling decision is taken regarding which users are assigned to which time/frequency resources during this transmission time interval.

3.1.1.1 OFDMA Parameterization

Two radio frame structures, one for FDD (frame structure type 1) and one for TDD (frame structure type 2) mode are defined. These EUTRA frame structures are described in TS 36.211.

Channel Bandwidth

OFDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidth listed in Table 3-1.

The bandwidth is expressed as number of resource blocks in the range from 6 to 110 resource blocks (RB), which results in bandwidths from 1.08 MHz to 19.8 MHz.

Table 3-1: Channel bandwidth according to 3GPP TS 36.804

Channel bandwidth	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Number of RBs	6	12	25	50	75	100
Number of occupied subcarriers	73	181	301	601	901	1201
FFT size	**128**, 256, 512, 1024, 2048	**256**, 512, 1024, 2048	**512**, 1024, 2048	**1024**, 2048	1536, **2048**	**2048**

Frame Structure Type 1 (FDD)

The FDD frame structures type 1 is based on a 10 ms radio frame that is divided into 20 equally sized slots of 0.5 ms. A subframe consists of two consecutive slots, so one radio frame contains 10 subframes.

Frame format 1 (FDD mode) illustrates frame structure type 1 (T_s is expressing the basic time unit corresponding to 30.72 MHz). Frame format 1 is applicable to both full and half duplex FDD.

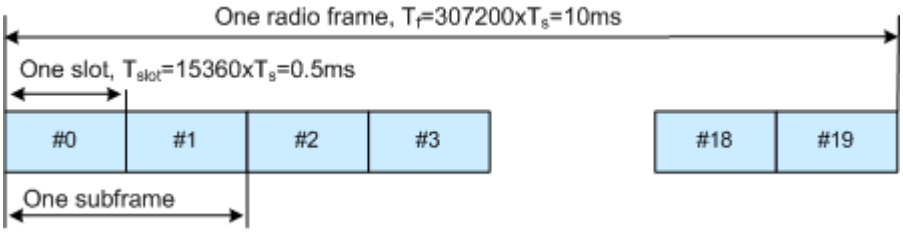


Figure 3-3: Frame format 1 (FDD mode)

Related settings

See:

- "Duplexing" on page 64
- Chapter 4.3, "DL Frame Configuration Settings", on page 120
- Chapter 6.1, "OFDMA Time Plan", on page 448.

Frame Structure Type 2 (TDD)

The TDD frame format 2 is based on a 10 ms radio frame, but the frame is divided into two half-frames, 5 ms each. Each half-frame consists of five 1 ms long subframes, which are reserved either for downlink or uplink transmission or are caring special information (see Figure 3-4).

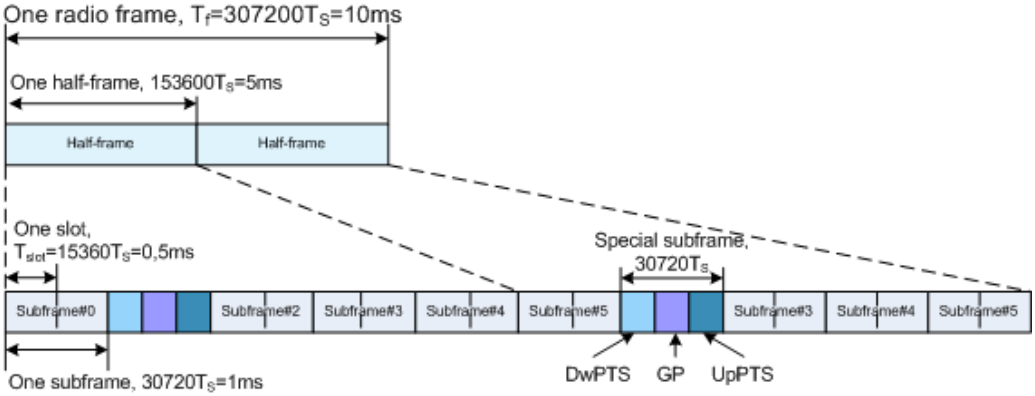


Figure 3-4: Frame format 2 (TDD mode), 5 ms switching periodicity

All non-special subframes are divided into two 0.5 ms long slots. The special subframes consist of three fields DwPTS (downlink pilot timeslot), GP (guard period), and UpPTS (uplink pilot timeslot). The length of these fields can vary in specified limits so that the total special subframe's length is maintained constant (1 ms). The 3GPP specification defines 10 special subframe configurations for normal cyclic prefix type and eight for extended cyclic prefix type. These subframe configurations specify the allowed DwPTS/GP/UpPTS lengths' combinations.

The 3GPP specification defines seven different uplink-downlink configurations, i.e. defines the downlink-to-uplink switch-point periodicity (5 ms or 10 ms) and the allowed combination of downlink, uplink, and special slots. In all the uplink-downlink configurations and for any downlink-to-uplink switch-point periodicity, subframe 0, subframe 5,

and DwPTS are always reserved for downlink transmission. UpPTS and the subframe following the special subframe are always reserved for uplink transmission.

Figure 3-5 shows the supported uplink-downlink configurations according to TS 36.211.

UL/DL Configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Figure 3-5: Uplink-downlink configurations

D = Denotes a subframe reserved for downlink transmission
U = Denotes a subframe reserved for uplink transmission
S = Denotes the special subframe

Related settings

See:

- "Duplexing" on page 64
- Chapter 4.2.5, "TDD Frame Structure Settings", on page 94
- Chapter 6.3, "TDD Time Plan", on page 451.

3.1.1.2 Downlink Resource Grid

The Figure 3-6 shows the structure of the downlink resource grid for one downlink slot. The available downlink bandwidth consists of N^{DL}_{BW} subcarriers with a spacing of Δf = 15 kHz. In the case of multi-cell MBMS transmission, a subcarrier spacing of Δf = 7.5 kHz is also possible. N^{DL}_{BW} can vary to allow for bandwidth operation up to 20 MHz.

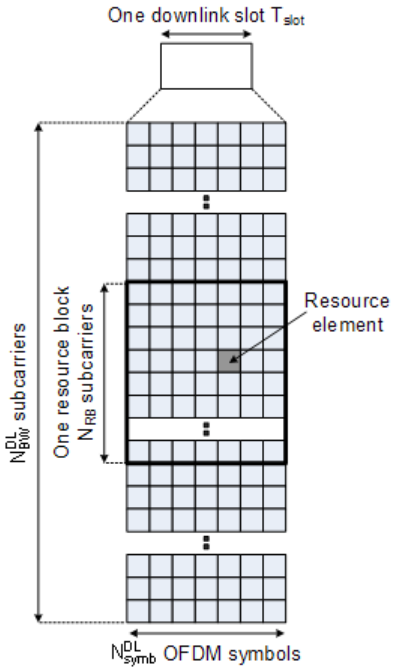


Figure 3-6: Downlink resource grid (3GPP TS 36.211)

One downlink slot consists of N^{DL}_{Symb} OFDM symbols. To each symbol, a cyclic prefix (CP) is appended as guard time. N^{DL}_{Symb} depends on the cyclic prefix length. The generic frame structure with normal cyclic prefix length contains N^{DL}_{Symb} = 7 symbols. This translates into a cyclic prefix length of T_{CP}≈5.2µs for the first symbol and T_{CP}≈4.7µs for the remaining six symbols. Additionally, an extended cyclic prefix is defined to cover large cell scenarios with higher delay spread and MBMS transmission. The generic frame structure with extended cyclic prefix of T_{CP-E}≈16.7µs contains N^{DL}_{Symb} = 6 OFDM symbols (subcarrier spacing 15 kHz). The generic frame structure with extended cyclic prefix of T_{CP-E}≈33.3µs contains N^{DL}_{Symb} = 3 symbols (subcarrier spacing 7.5 kHz). The Table 3-2 gives an overview of the different parameters for the generic frame structure.

Table 3-2: Parameters for downlink generic frame structure

Configuration	Number of symbols N^{UL}_{symb}	Cyclic prefix length, samples	Cyclic prefix length, us
Normal cyclic prefix Δf=15 kHz	7	160 for first symbol 144 for other symbols	5.2 us for first symbol 4.7 us for other symbols
Extended cyclic prefix Δf=15 kHz	6	512	16.7 us
Extended cyclic prefix Δf=7.5 kHz	3	1024	33.3 us

Related settings

See:

- Chapter 6.1, "OFDMA Time Plan", on page 448
- Chapter 6.3, "TDD Time Plan", on page 451

3.1.1.3 Downlink Data Transmission

Data is allocated to the UEs in terms of resource blocks. A physical resource block consists of 12 (24) consecutive subcarriers in the frequency domain for the Δf = 15 kHz (Δf = 7.5 kHz) case. In the time domain, a physical resource block consists of DL N_{symb} consecutive OFDM symbols, see Figure 3-6. N^{DL}_{symb} is equal to the number of OFDM symbols in a slot. The resource block size is the same for all bandwidths, therefore the number of available physical resource blocks depends on the bandwidth. Depending on the required data rate, each UE can be assigned one or more resource blocks in each transmission time interval of 1 ms. The scheduling decision is done in the base station (eNodeB). The user data is carried on the physical downlink shared channel (PDSCH).

Related settings

See Chapter 4.4, "Enhanced PBCH, PDSCH and PMCH Settings", on page 149.

3.1.1.4 Downlink Control Information Transmission

Control information is mapped to the resource elements in terms of resource elements groups (REG). A REG consists of four consequent resource elements within one resource block which are not used for cell-specific reference signals. Thus, there are two types of resource blocks, resource blocks containing three REGs and resource blocks containing only two REGs.

Two REGs are available within the OFDM symbols with allocated reference signals. These are the OFDM symbol 0 in the first slot in a subframe and in the OFDM symbol 1 in the four-antenna system case. 3 REGs are then available in the OFDM symbols 2 and in the OFDM symbol 1 if one- or two-antenna system are used (see Figure 3-7 and Figure 3-9).

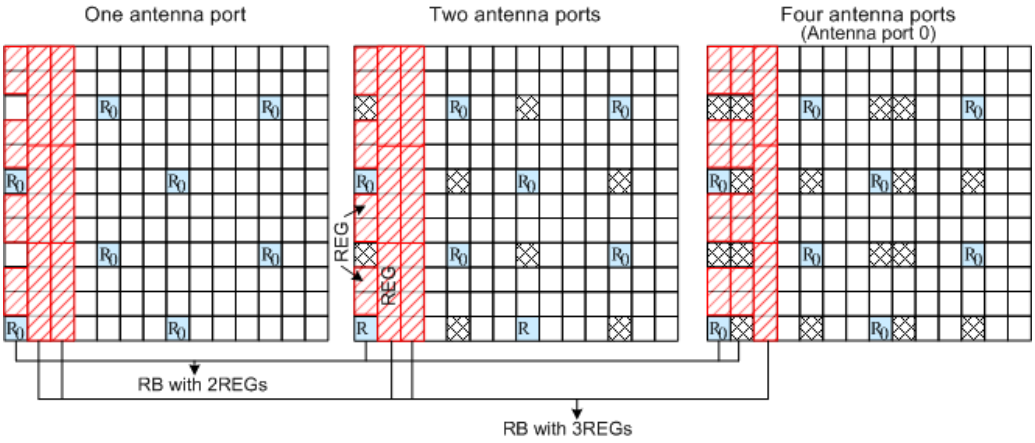


Figure 3-7: Resource elements groups (REG)

Three physical DL channels are carrying the control information: the Physical Control Format Indicator Channel (PCFICH), the Physical Hybrid ARQ Indicator Channel (PHICH) and the Physical Downlink Control Channel (PDCCH).

- The **PCFICH** carries the information about the number of OFDM symbols used for transmission of PDCCH in a subframe and is mapped to four REGs within the first OFDM symbol.
- The **PHICH** carries the HARQ ACK/NACK messages and is transmitted in terms of PHICH groups. A PHICH group uses three REGs. For normal CP, a PHICH group consists of up to eight ACK/NACK messages. Four ACK/NACK messages are carried by one PHICH group if an extended CP is used.

  For frame format 1 and non-MBSFN transmission, the PHICH can be transmitted:
  - Over only the first OFDM symbol (or the so called normal PHICH duration).
  - In case of extended PHICH duration, over the first three OFDM symbols.
- Downlink control signaling on the Physical Downlink Control Channel (**PDCCH**) is used to convey the scheduling decisions to individual UEs. The PDCCH is located in the first OFDM symbols of a slot.

  The maximum number of OFDM symbols used for the transmission of a PDCCH is determined by the number of RB used:
  - For channel bandwidth with ≤ 10 RBs, four OFDM symbols are necessary (OFDM symbol 0 to 3)
  - For channel bandwidths with ≥ 10 RBs, three OFDM symbols are sufficient (OFDM symbol 0 to 2).

  The minimum number of OFDM symbols used for the transmission of a PDCCH is determined by the PHICH duration and the channel bandwidth.
  The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several control channel elements (CCEs), where a CCE corresponds to 9 REGs.

Related settings

See:

- "PHICH Duration" on page 97

- Chapter 4.6, "Enhanced PCFICH, PHICH and PDCCH Channel Configuration", on page 166.

3.1.1.5 Downlink Reference Signal Structure and Cell Search

The downlink reference signal structure is important for cell search, channel estimation, and neighbor cell monitoring.

For the LTE downlink, five types of reference signals are defined:

- Cell-Specific Downlink Reference Signals
  The cell-specific reference signals are common signals in a cell, that are intended for all UE within this cell.
- MBSFN Reference Signals
  These reference signals are used for channel estimation and demodulation of signals transmitted by MBSFN.
- UE-Specific Reference Signal (DMRS)
  These reference signals are intended for a specific user.
- Positioning Reference Signals
- CSI Reference Signals
  These reference signals are intended channel quality measurements and frequency-dependent scheduling.

Related settings

See:

- "Downlink Reference Signal Structure" on page 99
- Chapter 4.2.7.3, "Positioning Reference Signal (PRS) Settings", on page 101
- Chapter 4.2.7.4, "CSI-RS Settings", on page 106.

Mapping of Reference Signals to Antenna Ports

The LTE standard specifies so-called antenna ports (AP). Antenna ports are logical elements, used to describe identical propagation conditions. The mapping of these antenna ports to the physical antennas is not specified by 3GPP.

LTE specifies AP 0 to AP 5 and defines one reference signal per downlink antenna port (see Table 3-3). LTE-Advanced introduces new reference signals, new control channels and defines additional antenna ports, AP 6 to AP 22 and AP 107 to AP 110.

From LTE Rel. 14 on, also the AP 23 to AP 46 are supported and the multiple CSI-RS configuration mapped on them. See also Chapter 3.1.8, "LTE Release 13/14 Introduction", on page 53.

Table 3-3: Mapping of reference signals to antenna ports

Antenna port (AP)	Reference signal
AP 0 to AP 3	Cell-specific reference signals (CS-RS)
AP 4	MBSFN-RS
AP 5	UE-specific reference signals (DMRS) for single-layer transmission (TM7)

Antenna port (AP)	Reference signal
AP 6	Positioning reference signals (PRS)
AP 7 to AP 8	UE-specific reference signals (DMRS) for up to 2 layers beamforming (TM8/TM9/TM10)
AP 9 to AP 14	UE-specific reference signals (DMRS) for multi-layer beamforming (TM9/TM10)
AP 15 to AP 22 AP 23 to AP 46	Channel state information reference signals (CSI-RS)
AP 107 to AP 110	Demodulation reference signal associated with EPDCCH

The Figure 3-8 [1MA169] illustrates the mapping of the logical antenna ports to physical transmit antennas.

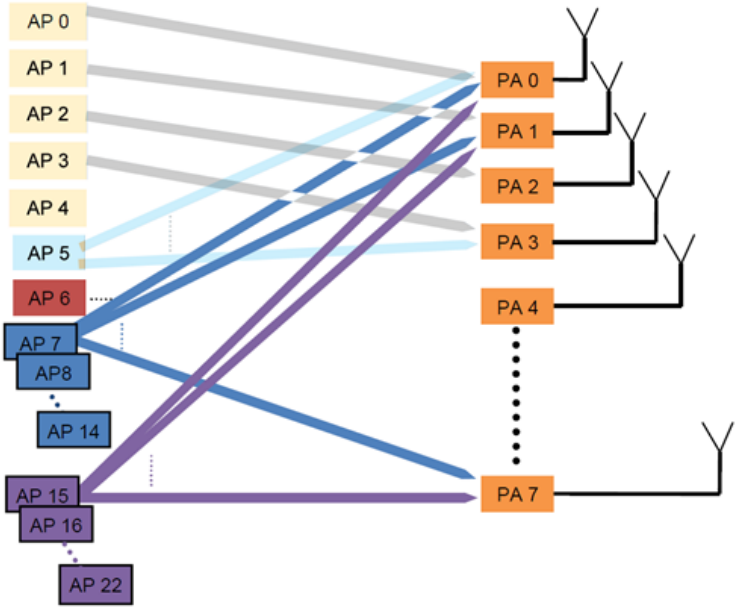


Figure 3-8: Mapping of logical antenna ports to physical transmit antennas (3GPP Rel. 10)

AP = Antenna port
PA = Physical antenna

See also:

- Table 3-6
- Chapter 3.1.5, "LTE Release 10 (LTE-Advanced) Introduction", on page 44

Related settings

See Chapter 4.5, "DL Antenna Port Mapping Settings", on page 160.

Cell-Specific Downlink Reference Signals

The Figure 3-9 shows the principle of the downlink reference signal structure for one-antenna, two-antenna, and four-antenna transmission (antenna ports 0 to 3, AP 0 to

AP 3). Specific predefined resource elements in the time-frequency domain carry the reference signal sequence. Besides first reference symbols, there can be a need for second reference symbols. The different colors in the figure represent the sequences transmitted from up to four transmit antennas.

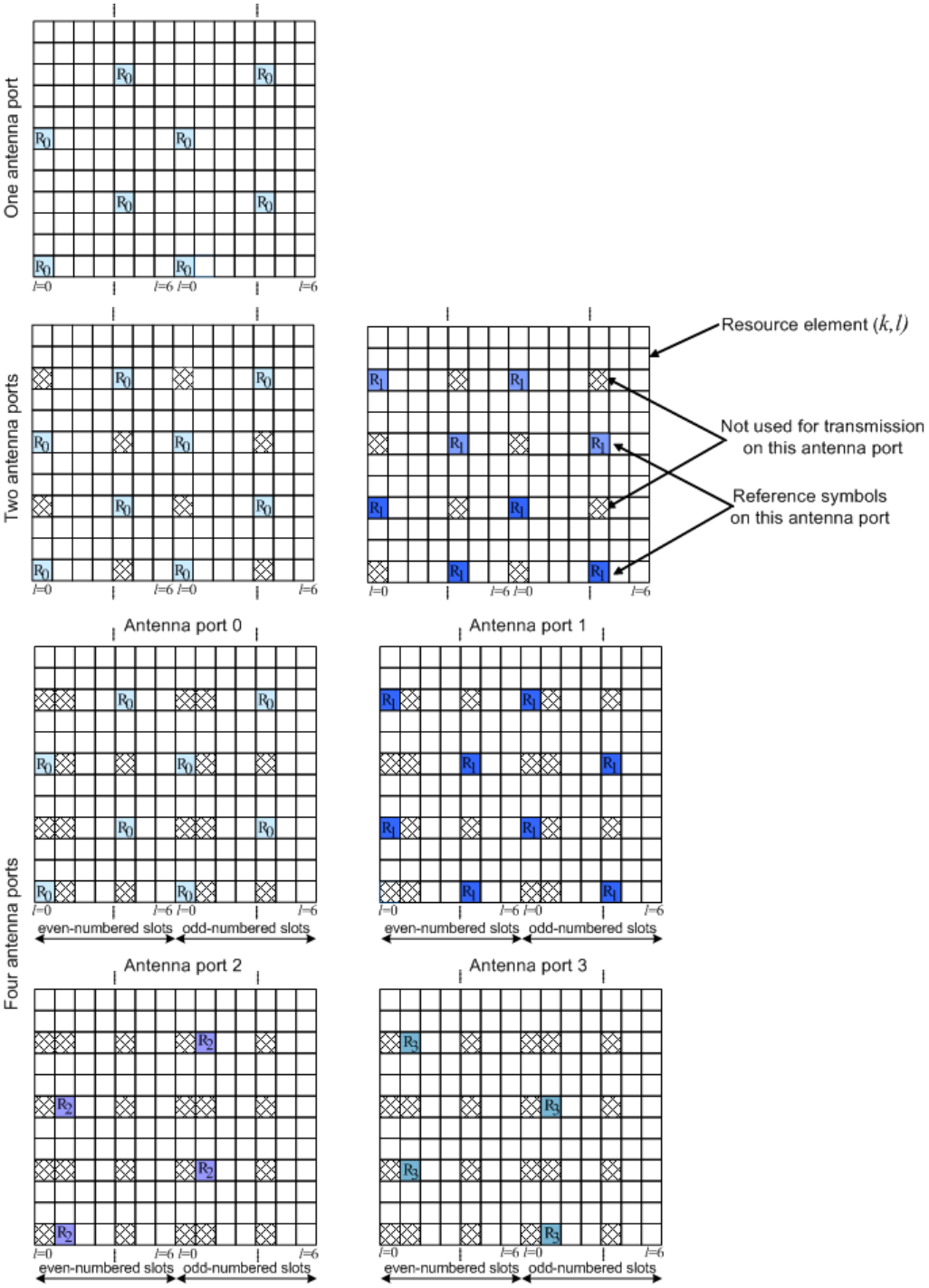


Figure 3-9: Downlink reference signal structure (normal cyclic prefix)

The reference signal sequence carries the cell identity. There are 504 unique physical layer cell identities, grouped into 168 unique physical cell identity groups that contain three unique identities each. Each reference signal is generated as a pseudo-random sequence that depends on the physical layer cell identity.

Frequency hopping can be applied to the downlink reference signals. The frequency hopping pattern has a period of one frame (10 ms).

During cell search, the handset identifies different types of information: symbol and radio frame timing, frequency, cell identification, overall transmission bandwidth, antenna configuration, and cyclic prefix length.

Besides the reference signals, synchronization signals are therefore needed during cell search. EUTRA uses a hierarchical cell search scheme similar to WCDMA. This means that the synchronization acquisition and the cell group identifier are obtained from different SYNC signals. Thus, a primary synchronization signal (**P-SYNC** or **PSS**) and a secondary synchronization signal (**S-SYNC** or **SSS**) are defined with a pre-defined structure. They are transmitted on the 72 center subcarriers (around DC sub-carrier) within the same predefined slots (twice per 10 ms) on different resource elements, see Figure 3-10. This figure is taken from TS 36.211.

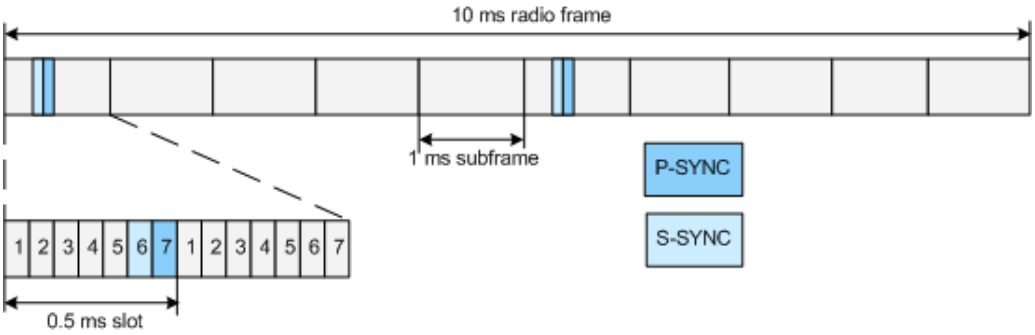


Figure 3-10: P-SYNC and S-SYNC structure (normal CP; 1.25 MHz bandwidth)

As additional help during cell search, a common control physical channel (CCPCH) is available which carries BCH type of information, e.g. system bandwidth. It is transmitted at predefined time instants on the 72 subcarriers centered on the DC subcarrier.

To enable the UE to support this cell search concept, it was agreed to have a minimum UE bandwidth reception capability of 20 MHz.

Related settings

See "Synchronization Signal Settings" on page 100.

MBSFN Reference Signals

MBSFN reference signals are defined fro extended cyclic prefix only. The MBSFN reference signals are transmitted on antenna port 4 (AP 4) and only when the PMCH is transmitted.

The Figure 3-11 shows the resource elements used by the MBSFN reference signal if Δf=15 kHz .

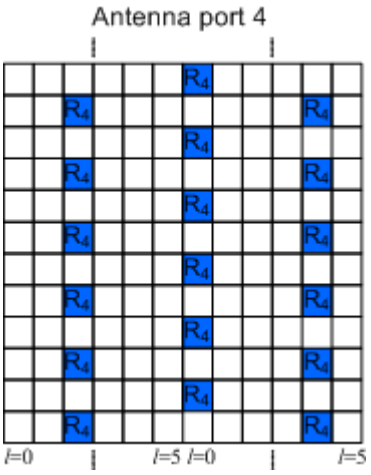


Figure 3-11: MBSFN reference signal structure (extended cyclic prefix, carrier spacing 15 KHz)

Related settings

See Chapter 4.2.3, "MBSFN Settings", on page 78.

UE-Specific Reference Signal (DMRS)

These reference signals are intended for a specific user and mapped to predefined PDSCH RBs of this particular user. The resource elements predefined for the UE-specific RS do not overlap with the resource elements reserved for the cell-specific reference signals.

For single-antenna transmission, the UE-specific reference signals are transmitted on antenna port 5, 7 or 8 (AP 5, AP 7, and AP 8). If a spatial multiplexing is applied, the UE-specific reference signals are transmitted on antenna ports 7 to 10 (AP 7 to AP 10).

The UE-specific RS are also called demodulation reference signals (DMRS) and are intended for channel estimation and demodulation instead of the common reference signals. One typical example of the application of UE-specific RS is the channel estimation and demodulation, if beamforming transmission is used. This is also called transmission using antenna port 5 (AP 5).

In contrary to the common reference signals that are not precoded, the UE-specific RS are precoded in the same way as the PDSCH they are mapped to.

See Figure 3-12 and Figure 3-13 for illustration of the mapping of the UE-specific reference signals to the resource elements.

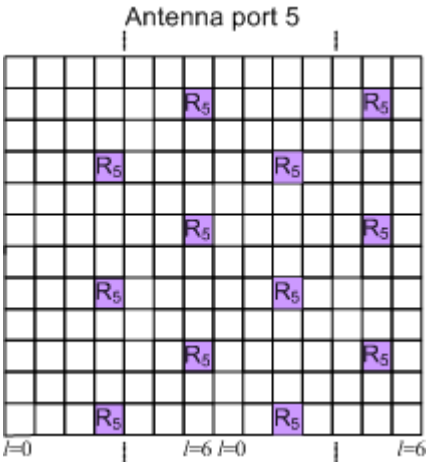


Figure 3-12: UE-specific reference signals, antenna port 5 (normal cyclic prefix)

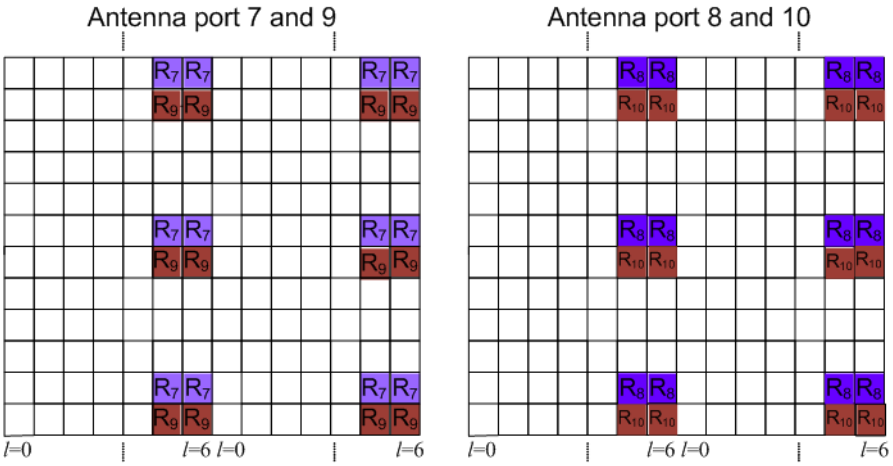


Figure 3-13: UE-specific reference signals, antenna ports 7 to 10 (normal cyclic prefix, downlink subframe)

See also "Transmission mode TM10 and DCI format 2D" on page 51.

Positioning Reference Signals

The positioning reference signals are transmitted only in downlink subframes configured for positioning reference signals transmission. Positioning reference signals are transmitted on antenna port 6 (AP 6).

The Figure 3-14 shows the mapping of the positioning reference signals for the one and two PBCH antenna ports case (normal cyclic prefix). Refer to the specification for information about the mapping in all other cases.

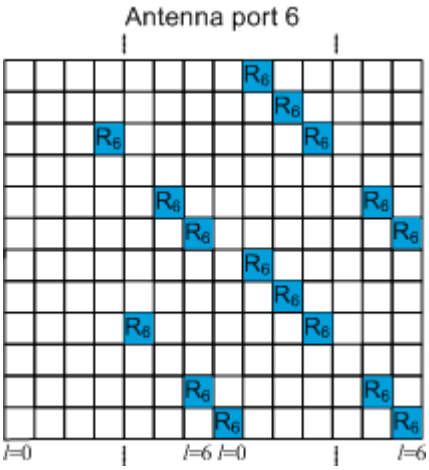


Figure 3-14: Mapping of PRS (normal cyclic prefix), one and two PBCH antenna ports.

Related settings

See Chapter 4.2.7.3, "Positioning Reference Signal (PRS) Settings", on page 101 .

CSI Reference Signals

The CSI reference signals (CSI-RS) are intended for the acquisition of channel-state information (CSI) for UE working in transmission mode 9 or 10 (TM9 or TM10). This is because in TM9, the DMRS are used for channel estimation.

The CSI-RS structure depends on the number of CSI-RS (1, 2, 4 or 8) configured in a cell and can differ between the cells. This is illustrated on Figure 3-15 [TS 36.211].

Up to LTE Rel. 13, the CSI-RS are transmitted on antenna ports 15 to 22 (AP 15 to AP 22).

From LTE Rel. 14 on, also the AP 23 to AP 46 are supported and the multiple CSI-RS configuration mapped on them. See also Chapter 3.1.8, "LTE Release 13/14 Introduction", on page 53.

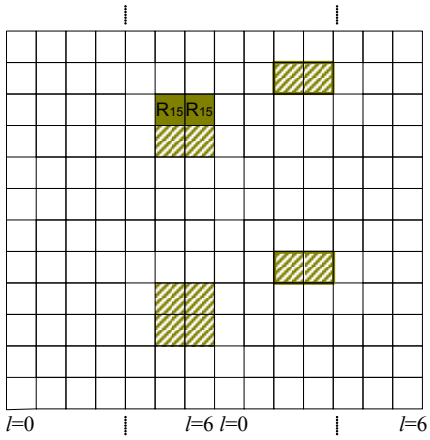


Figure 3-15: Mapping of a CSI-RS on antenna port 15 (CSI configuration 0, normal cyclic prefix)

Pattern = Example of possible position of the CSI-RSs
Dark green = Example of allocated CSI-RS signals in a cell
Border = Example of muted (ZeroTxPower) CSI-RSs

The CSI-RS can be configured with different transmission periods (5 ms to 80 ms) and per subframe (see Table 4-3).

In normal operation, the CSI-RS is transmitted on the allocated resource elements (dark green color on Figure 3-15). The remaining possible but not allocated resource elements (the pattern elements on the same figure) are used for PDSCH transmission. The 3GPP specification allows the configuration of an extra subset of resource elements. These resource elements are reserved for CSI-RS transmission and have the same structure as the CSI-RS but use a zero transmission power (ZeroTxPower). Nothing is transmitted during these resource elements.

Related settings

See:

- Chapter 4.2.7.4, "CSI-RS Settings", on page 106
- Chapter 4.4.3, "CSI-RS Settings", on page 156
- "CSI Awareness State" on page 201

3.1.1.6 Downlink Physical Layer Procedures

For E-UTRA, the following downlink physical layer procedures are especially important:

- **Cell search and synchronization**
  See "Cell-Specific Downlink Reference Signals" on page 26.
- **Scheduling**
  Scheduling is done in the base station (eNodeB). The downlink control channel PDCCH informs users about their allocated time/frequency resources and the transmission formats to use. The scheduler evaluates different types of information, e.g. quality-of-service parameters, measurements from the UE, UE capabilities, and buffer status.
- **Link adaptation**
  Link adaptation is already known from HSDPA as adaptive modulation and coding. Also in E-UTRA, modulation and coding for the shared data channel is not fixed, but rather is adapted according to radio link quality. For this purpose, the UE regularly reports channel quality indications (CQI) to the eNodeB.
- **Hybrid automatic repeat request (ARQ)**
  Downlink hybrid ARQ is also known from HSDPA. It is a retransmission protocol. The UE can request retransmissions of incorrectly received data packets.

3.1.2 LTE Uplink Transmission Scheme

During the study item phase of LTE, alternatives for the optimum uplink transmission scheme were investigated. While OFDMA is seen optimum to fulfill the LTE requirements in downlink, OFDMA properties are less favorable for the uplink. This is due to

weaker peak-to-average power ratio (PAPR) properties of an OFDMA signal, resulting in worse uplink coverage.

Thus, the LTE uplink transmission scheme for FDD and TDD mode is based on SC-FDMA (single carrier frequency division multiple access) with cyclic prefix. SC-FDMA signals have better PAPR properties compared to an OFDMA signal. This was one of the main reasons for selecting SC-FDMA as LTE uplink access scheme. The PAPR characteristics are important for cost-effective design of UE power amplifiers. Still, SC-FDMA signal processing has some similarities with OFDMA signal processing, so parameterization of downlink and uplink can be harmonized.

There are different possibilities how to generate an SC-FDMA signal. DFT-spread-OFDM (DFT-s-OFDM) has been selected for EUTRA. The principle is illustrated on Figure 3-16. This figure is taken from 3GPP R1-050584, "EUTRA Uplink Numerology and Design".

For DFT-s-OFDM, a size-M DFT is first applied to a block of M modulation symbols. QPSK, 16QAM and 64 QAM are used as uplink EUTRA modulation schemes, the latter being optional for the UE. The DFT transforms the modulation symbols into the frequency domain. The result is mapped onto the available subcarriers. In EUTRA uplink, only localized transmission on consecutive subcarriers is allowed. An N point IFFT where N>M is then performed as in OFDM, followed by addition of the cyclic prefix and parallel to serial conversion.

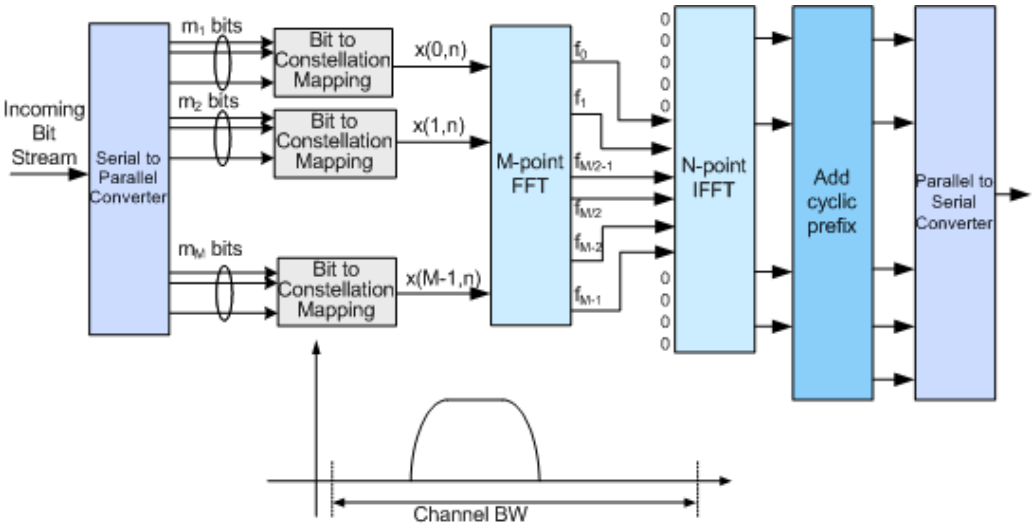


Figure 3-16: Block diagram of DFT-s-OFDM (localized transmission)

The DFT processing is therefore the fundamental difference between SC-FDMA and OFDMA signal generation. This is indicated by the term DFT-spread-OFDM. In an SCFDMA signal, each subcarrier used for transmission contains information of all transmitted modulation symbols. This due to fact that the input data stream has been spread by the DFT transform over the available subcarriers. In contrast, each subcarrier of an OFDMA signal only carries information related to specific modulation symbols.

3.1.2.1 SC-FDMA Parameterization

The EUTRA uplink structure is similar to the downlink. An uplink radio frame consists of 20 slots of 0.5 ms each, and 1 subframe consists of 2 slots. The slot structure is shown on Figure 3-17 (taken from TS 36.211).

Each slot carries N^{UL}_{symb} SC-FDMA symbols, where N^{UL}_{symb} = 7 for the normal cyclic prefix and N^{UL}_{symb} = 6 for the extended cyclic prefix. SC-FDMA symbol number 3 (i.e. the 4th symbol in a slot) carries the reference signal for channel demodulation.

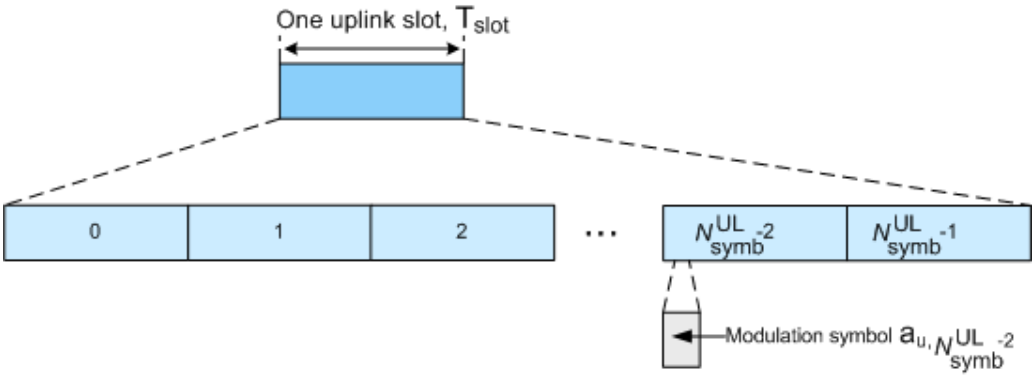


Figure 3-17: Uplink slot structure

Also for the uplink, a bandwidth agnostic layer 1 specification has been selected. The table below shows the configuration parameters in an overview table.

Configuration	Number of symbols N^{UL}_{symb}	Cyclic prefix length in samples	Cyclic prefix length in µs
Normal cyclic prefix Δf=15 kHz	7	160 for first symbol 144 for other symbols	5.2 us for first symbol 4.7 us for other symbols
Extended cyclic prefix Δf=15 kHz	6	512	16.7 us

Related settings

See:

- "Link Direction" on page 64
- Chapter 4.2.5, "TDD Frame Structure Settings", on page 94
- Chapter 6.2, "SC-FDMA Time Plan", on page 449
- Chapter 6.3, "TDD Time Plan", on page 451.

3.1.2.2 Uplink Data Transmission

In uplink, data is allocated in multiples of one resource block. Uplink resource block size in the frequency domain is 12 subcarriers, i.e. the same as in downlink. To simplify the DFT design in uplink signal processing only factors 2, 3, and 5 are allowed.

The uplink transmission time interval (TTI) is 1 ms (same as downlink).

User data is carried on the physical uplink shared channel (**PUSCH**).

Related settings

See:

- Chapter 4.10.7, "PUSCH Structure", on page 223
- Chapter 4.12.4, "Physical Uplink Shared Channel (PUSCH)", on page 245
- Chapter 4.13, "Enhanced PUSCH Settings", on page 291

3.1.2.3 Uplink Control Information Transmission

According to the LTE specifications, one of the following channels carries the uplink control information depending on whether an uplink resource has been assigned to the UE or not:

- Physical Uplink Shared Channel (PUSCH)
- Physical Uplink Control Channel (PUCCH)

Control information (CQI reports and ACK/NACK information related to data packets received in the downlink) is multiplexed with the PUSCH, if the UE has been granted with UL-SCH transmission.

The PUCCH carries uplink control information, e.g. CQI reports, HARQ ACK/NACK information, or scheduling requests (SR), in case the UE has not been assigned an UL-SCH transmission. The PUCCH is transmitted on a reserved frequency region at the edges of the total available UL bandwidth. One PUCCH resource comprises a pair of resource blocks within slot 0 and 1 that are located in the upper and the lower part of the spectrum. PUCCH is allocated as shown on the Figure 3-18 [TS 36.211].

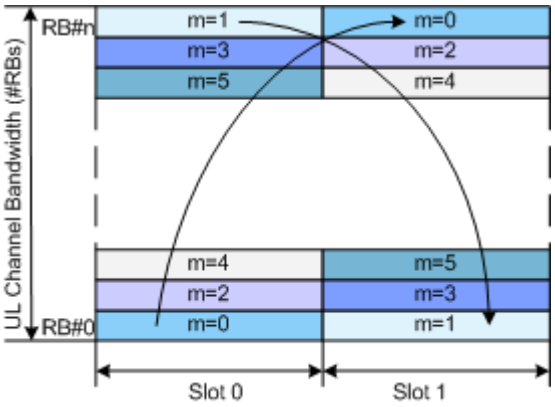


Figure 3-18: PUCCH mapping

TS 36.211 specifies seven PUCCH formats, see Table 3-4.

Table 3-4: PUCCH formats

PUCCH format	Description	Physical bits	Modulation scheme	ODFM symbols used for DRS (normal CP)	ODFM symbols used for DRS (extended CP)
1	Scheduling request (SR)	0	-	2, 3, 4	2, 3
1a	ACK/NACK ACK/NACK + SR	1	BPSK	2, 3, 4	2, 3
1b	ACK/NACK for MIMO ACK/NACK + SR	2 4	QPSK	2, 3, 4	2, 3
2	CQI CSI + ACK/NACK	20	QPSK	1, 5	3
2a	CSI + ACK/NACK	21	QPSK+BPSK	1, 5	-
2b	CSI + ACK/NACK for MIMO	22	QPSK+QPSK	1, 5	-
3*)	ACK/NACK (if DL carrier aggregation with more than 2 cells) ACK/NACK + SR	48	QPSK	1, 5	3
4 and 5	ACK/NACK (if DL carrier aggregation with more than 5 cell)	Depends on RB size (number of used subcarriers and for F4 also number of RBs), CP and PUCCH format	QPSK	3	2

*) eMTC does not support PUCCH formats 3, 4 and 5

The different PUCCH formats are mapped to the reserved PUCCH region. The mapping is performed so that there can be only one resource block per slot that supports a combination of PUCCH formats 1/1a/1b and 2/2a/2b.

For simultaneous transmission of multiple users on the PUCCH, different PUCCH resource indices are used. Multiple UEs are distinguished within one resource block by using different cyclic shifts (CS) of the CAZAC (constant amplitude zero auto-correlation) sequence. For PUCCH formats 1/1a/1b, three different orthogonal cover sequences (OC) can also be used. For the different PUCCH formats, different number of PUCCH resource indices are available within a resource block (see Table 3-5). The actual number of the used orthogonal sequences is also determinated by the parameter delta_shift, used to support working in different channel conditions.

Table 3-5: PUCCH resource indices per PUCCH format

PUCCH format	PUCCH resource indices	Number available within a resource block
1/1a/1b	N(1)_PUCCH	36 for normal CP 24 for extended CP
2/2a/2b	N(2)_PUCCH	12
3*)	N(3)_PUCCH	5
4*)	N(4)_PUCCH	1
5*)	N(5)_PUCCH	3

*) eMTC does not support PUCCH formats 3, 4 and 5

Related settings

See:

- Chapter 4.10.8, "PUCCH Structure", on page 224
- Chapter 4.14, "Enhanced PUCCH Settings", on page 300

3.1.2.4 Uplink Reference Signal Structure

Uplink reference signals are used for two different purposes:

- For channel estimation in the eNodeB receiver to demodulate control and data channels
- To provide channel quality information as a basis for scheduling decisions in the base station.
  This purpose is also called channel sounding.

The uplink reference signals are based on CAZAC (constant amplitude zero auto-correlation) sequences.

Sounding reference signals (SRS)

The specification defines two types of sounding reference signals (SRS), periodic SRS and aperiodic SRS. A user equipment (UE) can be configured with both SRS trigger types.

- Periodic SRS occurs at regular time intervals.
  It is referred as "trigger type 0" SRS and is known form LTE Rel. 8
- The aperiodic SRS transmission is a single (one-shot) transmission
  It is referred as "trigger type 1" SRS and is introduced by LTE Rel. 10.
  Aperiodic SRS is triggered by the "SRS Request" flag in one of the DCI formats 0/1A/4/2B/2C/2D.
  Triggering aperiodic SRS by using DCI format 0 requires one dedicated SRS set of parameters whereas the triggering by using DCI formats 1A/2A/2B/2C uses a common SRS set. For the triggering by DCI format 4, the specification defines three SRS sets.

Related settings

See:

- Chapter 4.10.5, "UL Reference Signals", on page 220
- Chapter 4.10.9, "Cell-Specific SRS Settings", on page 226
- Chapter 4.12.6, "Sounding Reference Signal (SRS)", on page 251
- "Aperiodic SRS State" on page 200
- "DCI Format 1A" on page 186

3.1.2.5 Uplink Physical Layer Procedures

For EUTRA, the following uplink physical layer procedures are especially important:

Non-synchronized random access

The random access is used to request initial access, as part of handover, when transiting from idle to connected, or to re-establish uplink synchronization. The structure is shown on Figure 3-19 (taken from TS 36.211).

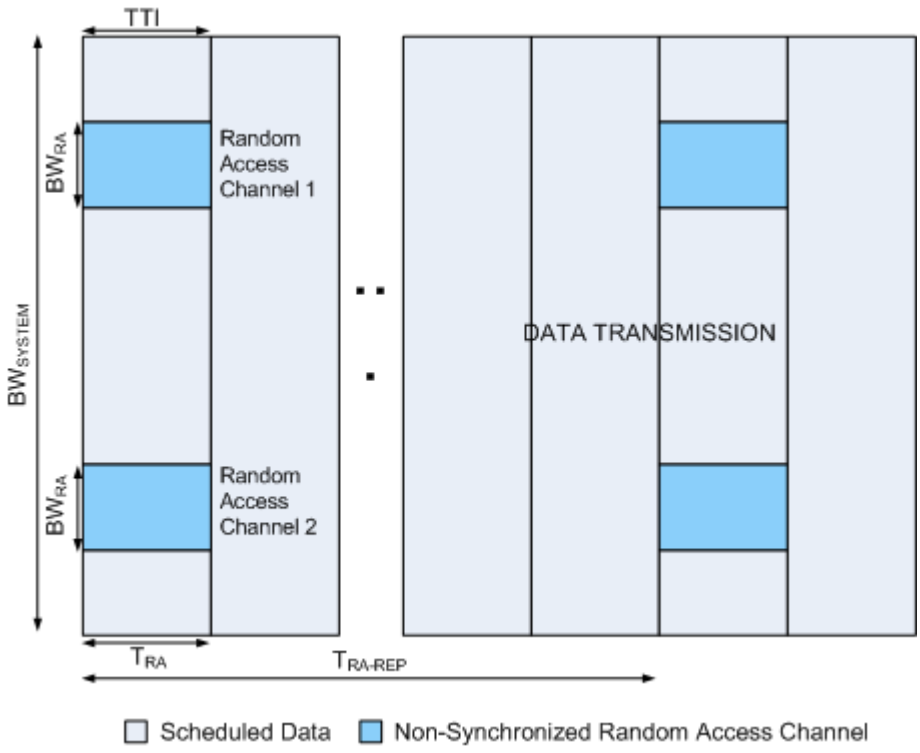


Figure 3-19: Random access structure, principle

Multiple random access channels can be defined in the frequency domain within one access period TRA to provide enough random access opportunities.

For the random access, a preamble is defined as shown on Figure 3-20 (taken from TS 36.211). The preamble length depends on the preamble format. The preamble bandwidth is 1.08 MHz (72 subcarriers). Higher layer signaling controls in which subframes

the preamble transmission is allowed, and the location in the frequency domain. Per cell, there are 64 random access preambles. They are generated from Zadoff-Chu sequences.

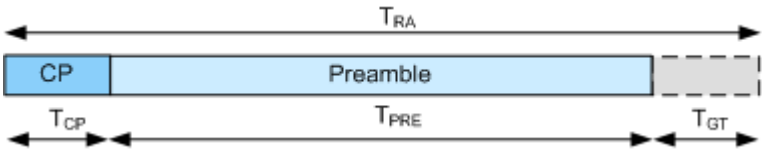


Figure 3-20: Random access preamble

The random access procedure uses open loop power control with power ramping similar to WCDMA. After sending the preamble on a selected random access channel, the UE waits for the random access response message. If no response is detected, then another random access channel is selected and a preamble is sent again.

Related settings

See:

- Chapter 4.10.6, "PRACH Settings", on page 221
- Chapter 4.12.9, "PRACH Power Ramping", on page 287
- Chapter 4.12.10, "PRACH Configuration", on page 288

Uplink scheduling

As in the downlink direction, the uplink scheduling is *dynamical scheduling* of uplink resources performed by eNodeB on a subframe basis. The eNodeB assigns certain time/frequency resources to the UEs and informs UEs about transmission formats to use. Scheduling decisions affecting the uplink are communicated to the UEs via the physical downlink control channel (PDCCH) in the downlink. The scheduling decisions can be based on QoS parameters, UE buffer status, uplink channel quality measurements, UE capabilities, UE measurement gaps, etc.

The LTE specification defines a second uplink scheduling method, the *semi-persistent scheduling (SPS)*. The semi-persistent scheduling is used to reduce the control signaling overhead for regularly occurring services and transmissions of relative small payloads. With SPS, the scheduling decisions are not transmitted every subframe but once. Via the PDCCH, the UEs first receive information on the SPS periodicity, that is information about the SPS pattern or the subframes on which scheduling decisions can be transmitted. Semi-persistent scheduling is then activated and deactivated by an explicit trigger, the SPS C-RNTI. The dynamic scheduling commands have higher priority than the SPS.

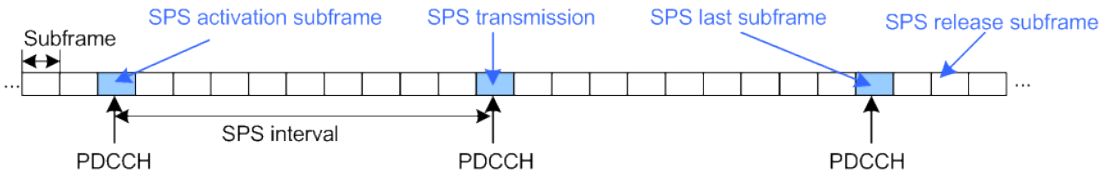


Figure 3-21: Semi-persistent scheduling (SPS)

In carrier aggregation transmission, SPS is allowed only on the primary component carrier.

Related settings

See Chapter 4.8, "SPS Configuration Settings", on page 202.

Uplink link adaptation

As uplink link adaptation methods, transmission power control, adaptive modulation and channel coding rate, and adaptive transmission bandwidth can be used.

Uplink timing control

Uplink timing control is required to time align the transmissions from different UEs with the receiver window of the eNodeB. The eNodeB sends the appropriate timing-control commands to the UEs in the downlink, commanding them to adapt their respective transmit timing.

Hybrid automatic repeat request (ARQ)

The eNodeB uses the uplink hybrid ARQ protocol to request retransmissions of incorrectly received data packets.

3.1.3 LTE MIMO Concepts

Multiple Input Multiple Output (MIMO) systems form an essential part of LTE to achieve the ambitious requirements for throughput and spectral efficiency. MIMO refers to the use of multiple antennas at the transmitter and at the receiver.

3.1.3.1 Downlink MIMO

For the LTE downlink, a 2x2 configuration for MIMO is assumed as baseline configuration, i.e. two transmit antennas at the base station and two receive antennas at the terminal. Configurations with four or more antennas are also being considered.

Different MIMO modes are envisaged. It has to be differentiated between spatial multiplexing and transmit diversity, and it depends on the channel condition which scheme to select.

Related settings

See:

- Chapter 4.2.8, "MIMO", on page 118
- Chapter 4.4.2, "Precoding Settings", on page 150
- Chapter 4.5, "DL Antenna Port Mapping Settings", on page 160.

Spatial Multiplexing

Spatial multiplexing allows transmitting different streams of data simultaneously on the same downlink resource blocks (see Figure 3-22 for illustration of the principle). These

data streams can belong to one single user (single user MIMO / SU-MIMO) or to different users (multi-user MIMO / MU-MIMO). While SU-MIMO increases the data rate of one user, MU-MIMO allows increasing the overall capacity.

Spatial multiplexing is only possible if the mobile radio channel allows it.

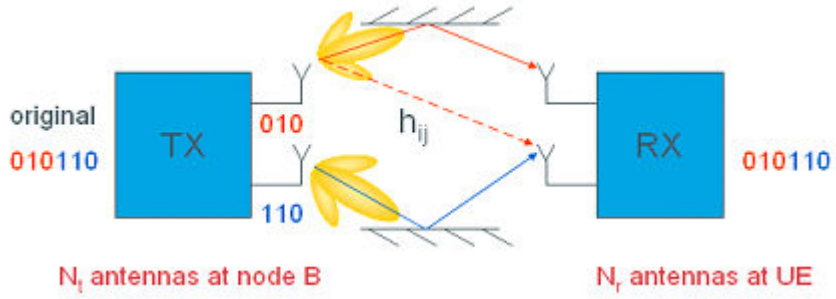


Figure 3-22: Spatial multiplexing

In the Figure 3-22, each transmit antenna transmits a different data stream. Each Rx antenna receives the data streams from all transmit antennas. The channel (for a specific delay) can thus be described by the following channel matrix H:

$$H = \begin{bmatrix} h_{11} & h_{12} & \cdots & h_{1N_t} \\ h_{21} & h_{22} & & h_{2N_t} \\ \vdots & & \ddots & \vdots \\ h_{N_r1} & h_{N_r2} & \cdots & h_{N_rN_t} \end{bmatrix} \quad \begin{matrix} \leftarrow N_t \rightarrow \\ \\ \\ \\ \updownarrow N_r \end{matrix}$$

In this general description, N_t is the number of transmit antennas, N_r is the number of receive antennas, resulting in a 2x2 matrix for the baseline LTE scenario. The coefficients h_{ij} of this matrix are called channel coefficients from transmit antenna *j* to receive antenna *i*, thus describing all possible paths between the transmitter and the receiver.

The number of data streams that can be transmitted in parallel over the MIMO channel is given by min $\{N_t, N_r\}$. It is limited by the rank of the matrix H. The transmission quality degrades significantly in case the singular values of matrix H are not sufficiently strong. This can happen in case the two antennas are not sufficiently de-correlated, for example in an environment with little scattering or when antennas are too closely spaced.

Codewords and spatial layers

A block of information bits that can be separately processed before it is transmitted in a subframe, is called codeword [17].

A spatial layer indicates the number of spatial streams that can be simultaneously transmitted [17]. The number of layers for transmission is less than or equal to the number of transmit antenna ports and depends on the rank of the matrix H.

In LTE Rel. 8/9, up to two codewords can be transmitted simultaneously and mapped onto up to four layers. There is a fixed mapping between codewords to layers, see Figure 3-23.

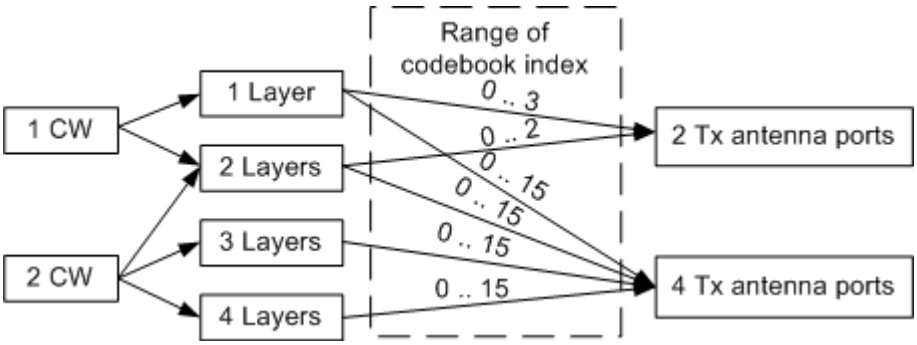


Figure 3-23: Codeword to layer mapping for downlink spatial multiplexing (LTE Rel. 8/9)

Precoding

Precoding on transmitter side is used to support spatial multiplexing, see Figure 3-24 (from TS 36.211). This is achieved by applying a precoding matrix W to the signal before transmission.

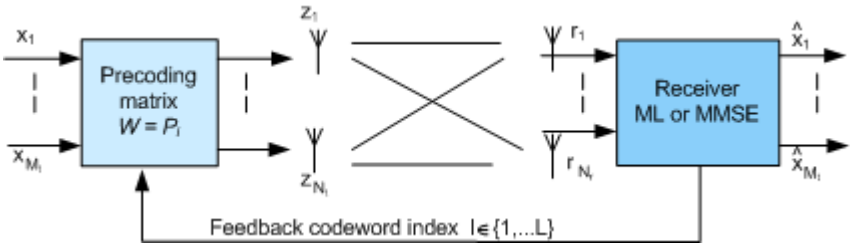


Figure 3-24: Precoding principle

The optimum precoding matrix W is selected from a predefined "codebook" which is known at the eNodeB and at the UE. Unitary precoding is used, i.e. the precoding matrices are unitary: $W^H W = I$. The UE estimates the radio channel and selects the optimum precoding matrix. The optimum precoding matrix is the one which offers maximum capacity. The UE provides feedback on the uplink control channel regarding the preferred precoding matrix (precoding vector as a special case). Ideally, this information is made available per resource block or at least group of resource blocks, since the optimum precoding matrix varies between resource blocks. The Figure 3-25 (from TS 36.211) gives an overview of EUTRA downlink baseband signal generation including the steps relevant for MIMO transmission.

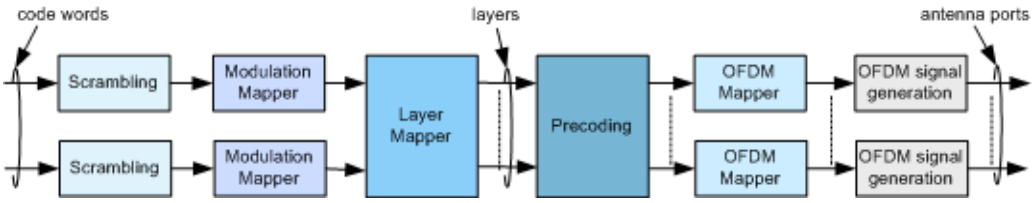


Figure 3-25: Overview of downlink baseband signal generation

Transmission modes

LTE defines the following transmission modes for the PDSCH (TS 36.213).

Table 3-6: Downlink transmission modes overview

Transmission mode	Transmission scheme
Tx Mode 1	Single-antenna transmission (AP 0); SISO/SIMO but no MIMO
Tx Mode 2	Transmit diversity
Tx Mode 3	• Transmit diversity • Open-loop spatial multiplexing with large delay CDD; SU-MIMO (single user MIMO)
Tx Mode 4	• Transmit diversity • Closed-loop spatial multiplexing; SU-MIMO
Tx Mode 5	• Transmit diversity • MU-MIMO (multi-user MIMO)
Tx Mode 6	• Transmit diversity • Closed-loop spatial multiplexing using a single transmission layer
Tx Mode 7	Single-antenna port transmission (AP 5); single layer beamforming
Tx Mode 8	• Dual layer transmission (AP 7 and AP 8); dual layer beamforming • Single-antenna port (AP 7 or AP 8)
Tx Mode 9	Multi-layer transmission (AP 9 to AP 14); MU-MIMO, SU-MIMO, 8 layer beamforming
Tx Mode 10	Multi-layer transmission (AP 9 to AP 14), CoMP (coordinated multi-point operation)

See also "Mapping of Reference Signals to Antenna Ports" on page 25.

Transmit Diversity

Instead of increasing data rate or capacity, MIMO can be used to exploit diversity. If the channel conditions do not allow spatial multiplexing, a transmit diversity scheme is used instead, so switching between these two MIMO modes is possible depending on channel conditions. Transmit diversity is used when the selected number of streams (rank) is one.

Beamforming

The beamforming is a method to shape the transmitted signal in the receiver's direction. In LTE, the beamforming is defined as transmission mode 7, 8 and 9 (Tx Mode 7/8/9). Beamforming uses the special antenna ports 5 and 7 to 14, see Table 3-6.

The channel estimation in a beamforming scenario is based on the UE-Specific Reference Signal (DMRS).

3.1.3.2 Uplink MIMO

Uplink MIMO schemes for LTE differ from downlink MIMO schemes. Up to LTE Rel. 9, only uplink MU-MIMO is specified. Multiple user terminals can transmit simultaneously on the same resource block. This is also referred to as spatial domain multiple access

(SDMA). The scheme requires only one transmit antenna at the UE. The UEs sharing resource blocks have to apply mutually orthogonal pilot patterns.

For information on the SU-MIMO and the LTE-Advanced MIMO concept, see Chapter 3.1.5.3, "Enhanced MIMO Schemes", on page 47.

3.1.4 LTE MBMS Concepts

In LTE, MBMS transmission is performed as single-cell transmission or as multi-cell transmission. In multi-cell transmission, the cells and content are synchronized to enable for the terminal to soft-combine the energy from multiple transmissions. The superimposed signal looks like multipath to the terminal. This concept is also known as single frequency network (SFN). The EUTRAN can configure which cells are part of an SFN for transmission of an MBMS service. The MBMS traffic can share carrier with the unicast traffic or be sent on a separate carrier. For MBMS traffic, an extended cyclic prefix is provided. Specific reference signals are used in the subframes that carry MBMS SFN data (see "MBSFN Reference Signals" on page 28).

MBMS data is carried on the MBMS traffic channel (MTCH) as logical channel. The MBMS control channel MCCH carries the MBMS control information. Both logical channels, the MTCH and the MCCH, are mapped onto the physical multicast channel PMCH in the multi-cell transmission case. If a single-cell transmission is used, they are mapped on the PDSCH.

Related settings

See Chapter 4.2.3, "MBSFN Settings", on page 78.

3.1.5 LTE Release 10 (LTE-Advanced) Introduction

This description gives a brief description only of the LTE-A features currently covered by the software option R&S SMBV-K85. The full set of LTE-Advanced features is described in 1MA232.

For a complete LTE-Advanced technology introduction and an insight description of the LTE-A features, refer to:

- White Paper 1MA169 "LTE-Advanced Technology Introduction"
- Application Note 1MA166 "LTE-Advanced Signals Generation and –Analysis"

3.1.5.1 Carrier Aggregation

The LTE-A Rel. 10 specification uses the aggregation of multiple LTE carriers. Two or more component carriers (CC) are grouped to support wider transmission bandwidths of up to 100 MHz. To an LTE Rel. 8 terminal, each component carrier appears as an LTE carrier. An LTE Rel. 10 terminal can exploit the total aggregated bandwidth. As backward compatibility is fulfilled, a LTE-Advanced cell can serve both LTE Rel. 8 and LTE Rel. 10 terminals simultaneously.

Spectrum deployment can be either contiguous with adjacent component carriers, or non-contiguous with non-adjacent component carriers (see Figure 3-26, 1MA169). The individual component carriers can belong to the same frequency band (intra-band) or to different frequency bands (inter-band). Component carriers transmitted by the same eNodeB provide the same cell coverage.

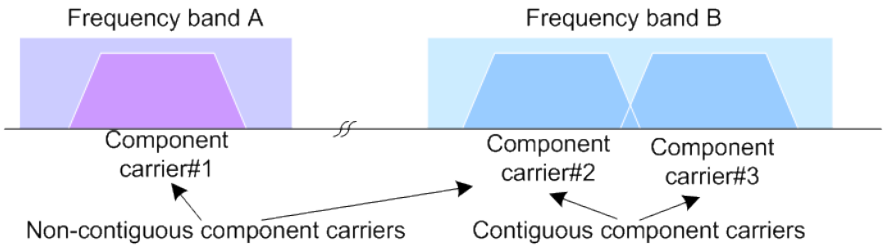


Figure 3-26: Carrier aggregation

The LTE-A specification defines two different approaches about informing the UE about the scheduling for each band: a separate PDCCH for each carrier or a common PDCCH for multiple carriers (cross-carrier scheduling).

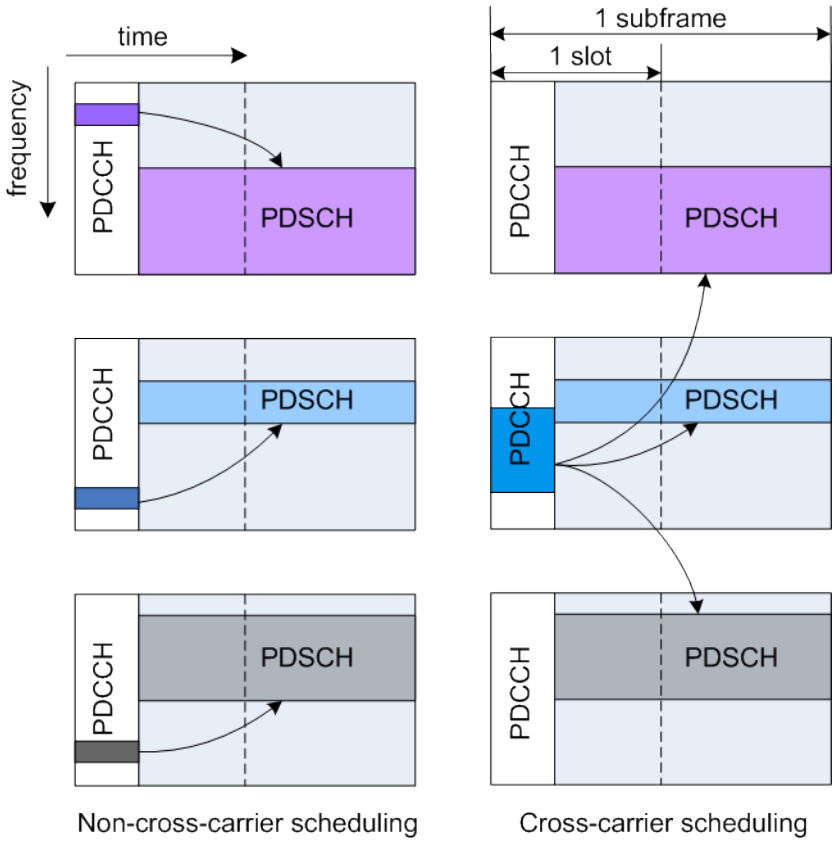


Figure 3-27: LTE-A scheduling approaches

In the dedicated/non-cross-carrier approach, the PDCCH on a component carrier assigns PDSCH resources on the same component carrier. The used PDCCH structure is identical to the LTE Rel. 8/9 PDCCH structure.

In the cross-carrier approach, the PDCCH on a component carrier assigns resources on one of multiple component carriers. The component carriers are identified by the new introduced DCI field, the CIF (carrier indicator field).

Related settings

See:

- Chapter 4.2.2, "DL Carrier Aggregation Configuration", on page 71.
- Chapter 4.6, "Enhanced PCFICH, PHICH and PDCCH Channel Configuration", on page 166
- Chapter 4.7, "User Configuration Settings", on page 195.

3.1.5.2 Enhanced Uplink SC-FDMA

The LTE-A Rel. 10 enhances the uplink transmission scheme compared to the LTE Rel. 8 uplink with the following:

- Control-data decoupling
  In LTE Rel. 8/9, a UE only uses physical uplink control channel (PUCCH) when it does not have any data to transmit on PUSCH. If a UE has data to transmit on PUSCH, it would multiplex the control information with data on PUSCH. This behavior is not valid in LTE-Advanced, which means that simultaneous PUCCH and PUSCH transmission is possible in uplink direction.
- Non-contiguous data transmission
  LTE-Advanced extends the uplink transmission scheme by allowing clustered PUSCH. The uplink transmission is not restricted to the use of consecutive subcarriers. Clusters of resource blocks can be allocated (two "sets" of consecutive PUSCH resource block groups according to resource allocation type 1 as defined in TS 36.213).

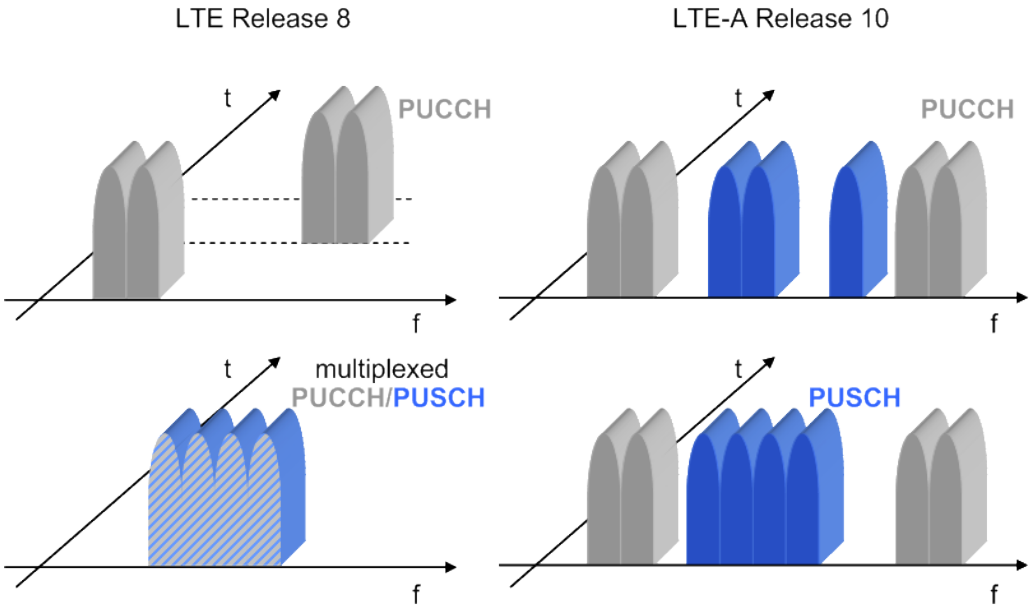


Figure 3-28: LTE Release 8 and LTE-A Release 10 UL transmission schemes

Related settings

See:

- Chapter 4.11, "UL Frame Configuration Settings", on page 228
- Chapter 4.12, "User Equipment Configuration", on page 237.

3.1.5.3 Enhanced MIMO Schemes

LTE Rel. 8 supports MIMO schemes in downlink direction. In downlink direction, up to four transmit antennas can be used whereas the maximum number of codewords is two irrespective of the number of antenna ports. LTE-Advanced extends the MIMO capabilities of LTE Rel. 8/9 to now supporting eight downlink antennas (8x8 antenna configuration) and four uplink antennas (4x4 antenna configuration), see Figure 3-29, and Figure 3-30, 1MA169.

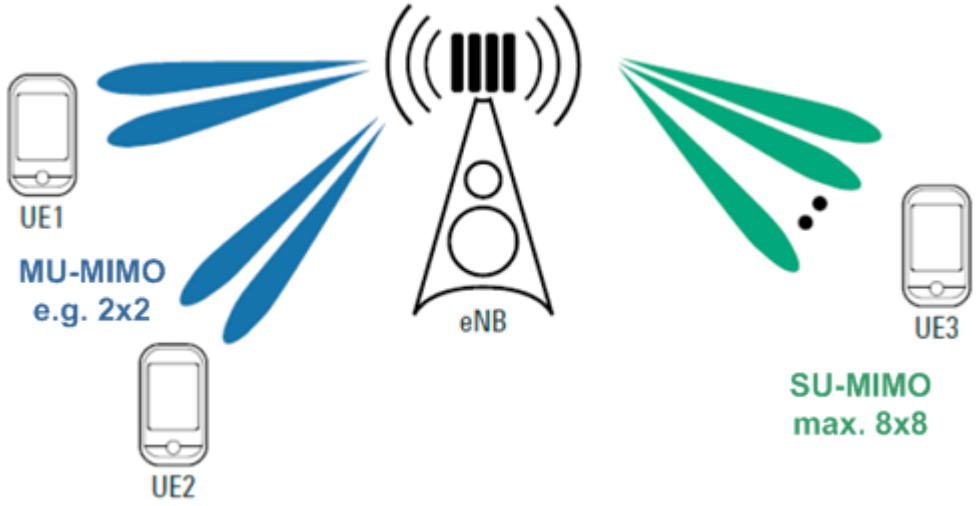


Figure 3-29: Supported transmit layers in LTE-Advanced (downlink)

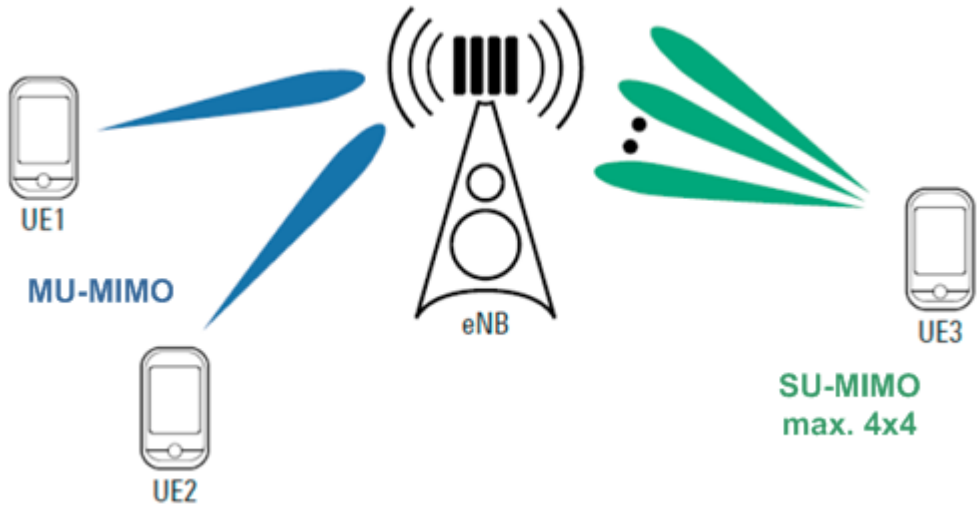


Figure 3-30: Supported transmit layers in LTE-Advanced (uplink)

In addition to the spatial multiplexing schemes, transmit diversity is possible in both downlink and uplink direction.

Downlink MIMO

The following is a list of the main differences compared to LTE Rel. 8/9:

- Layer mapping for downlink spatial multiplexing that uses the AP 7 to AP 14 for up to 8 layer PDSCH
  See "Mapping of Reference Signals to Antenna Ports" on page 25 and Figure 3-23
- Scheduling of downlink resources uses the DCI format 2C and transmission mode 9 (TM9)
  See "Transmission modes" on page 43
- Introduced are the PDSCH demodulation reference signals DMRS
  See "UE-Specific Reference Signal (DMRS)" on page 29
- Channel state estimation reference signals (CSI-RS)
  See "CSI Reference Signals" on page 31

Uplink MIMO

The following is a list of the main difference compared to LTE Rel. 8/9:

- PUSCH transmission uses up to two codewords, up to four layers and up to four antenna ports to support SU-MIMO
- If two PUSCH codewords are used, these codewords can use different modulation schemes
- Defined are different codebooks depending on the used number of antenna ports and layers

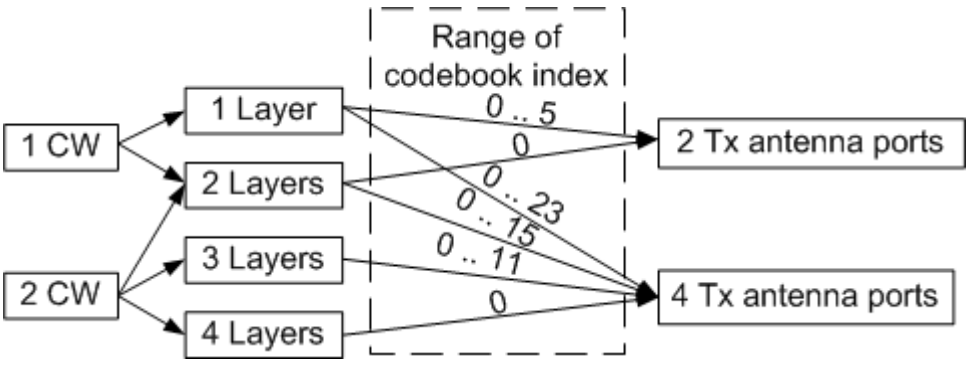


Figure 3-31: Codeword to layer mapping for uplink spatial multiplexing (LTE Rel. 10)

- PUCCH can be transmitted on up to two antenna ports
- SRS can be transmitted on up to four antenna ports

See Table 3-7

Table 3-7: Uplink transmission modes overview

Transmission mode	Transmission scheme
Tx Mode 1	No spatial multiplexing; transmission on a single antenna port
Tx Mode 2	Spatial multiplexing

Related settings

See:

- Chapter 4.11.3, "UL Allocation Table", on page 232
- Chapter 4.12.2, "Physical Uplink Control Channel (PUCCH)", on page 240, Chapter 4.12.4, "Physical Uplink Shared Channel (PUSCH)", on page 245, Chapter 4.12.5, "Demodulation Reference Signal (DRS)", on page 249, Chapter 4.12.6, "Sounding Reference Signal (SRS)", on page 251 and Chapter 4.12.8, "Antenna Port Mapping", on page 285
- Chapter 4.13, "Enhanced PUSCH Settings", on page 291
- Chapter 4.14, "Enhanced PUCCH Settings", on page 300

3.1.6 LTE Release 11 Introduction

This section gives a brief description only of the LTE-A Rel. 11 features currently covered by the software option R&S SMBV-K112.

For a complete LTE-Advanced (3GPP Rel. 11) technology introduction and an insight description of the LTE-A features, refer to:

- White Paper 1MA232 "LTE-Advanced (3GPP Rel. 11) Technology Introduction"

LTE carrier aggregation enhancements

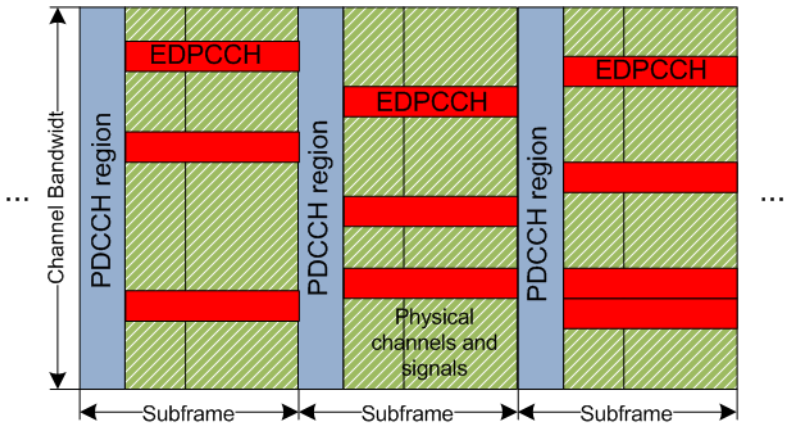
LTE-Advanced 3GPP Rel. 11 introduces the following new features:

- Multiple timing advances (TA) for uplink carrier aggregation
- Non-contiguous intra-band carrier aggregation
- Two special subframe configurations for LTE TDD
  - Special subframe configuration 9 with normal cyclic prefix in downlink
  - Special subframe configuration 7 with extended cyclic prefix in downlink
- Support of different UL/DL configurations on different bands
  If TDD carrier aggregation is used, the individual carriers can use different UL/DL configurations
- Enhanced TxD schemes for PUCCH format 1b with channel selection

New control channel: enhanced PDCCH (EPDCCH)

LTE-Advanced 3GPP Rel. 11 introduces the new downlink control channel to support new features and to increase the control channel capacity.

The enhanced physical downlink control channel (EPDCCH) carries the downlink control information. Compared to the PDCCH, the EPDCCH is not allocated on the first symbols of a subframe as it is with PDCCH but uses resource blocks normally reserved for the PDSCH.



EPDCCH is a user-specific control channel. It is always transmitted in an EPDCCH set. For each component carrier and user, you can define one or two EPDCCH sets. Each EPDCCH set consists of 2, 4 or 8 physical resource block (PRB) pairs that do not have to be contiguous in frequency.

Each PRB pair consists of a number of enhanced control channel elements (ECCE). Each ECCE consists of 4 or 8 enhanced resource element groups (EREG), where there are 16 EREG per PRB pair. If the subsequent EREGs are allocated within a single PRB pair, the EPDCCH transmission is referred as localized. Opposite, if the EREGs are distributed over several PRB pairs, the transmission is referred as distributed. The two different transmission schemes can be used depending on the availability of reliable channel feedback and knowledge about the channel state conditions. Distributed transmission for instance can be used to exploit frequency diversity.

DMRSs associated with EPDCCH are transmitted on antenna ports AP 107 to AP 110. In the resource blocks mapping grid, these APs replace the AP 7 to AP 10 used for DMRS. See also Figure 3-13.

DMRSs for EPDCCH are scrambled with higher layer user-specific identifier $n^{EPDCCH}_{ID,m}$, where m = 0 or 1 and indicates the EPDCCH set.

Related settings

See:

- Chapter 4.3.4, "EPDCCH Configuration Settings", on page 132
- "(E)PDCCH" on page 179
- DCI Format 2/2A/2B/2C/2D > "HARQ-ACK Resource Offset"

Coordinated multi-point operation for LTE (CoMP)

CoMP is a new interference mitigation technique that aims to improve coverage of high data rates and increase cell-edge throughput. CoMP also aims to optimize the transmission and reception from multiple transmission points (TP). A TP is a term that describes the location, where the transmission physical occurs. TPs can be the sectors on the same site, different remote radio heads (RRH), or different cells for example.

In CoMP scenarios, a UE can receive signals from up to 3 transmission points (TP). During reception, the UE is unaware which of the TP is transmitting. All TPs transmit-

ting to a particular UE can use the same scrambling sequence for generation of the user-specific reference signals (DMRS). The same applies for the cell-specific reference signals (CSI-RS).

According to TS 36.211, the CSI-RS sequence is generated as a function of the variable N_{ID}^{CSI}, where $N_{ID}^{CSI} = N_{ID}^{cell}$ unless configured by higher layers. The CSI-RS sequence can be initialized with the cell identity as it is in the legacy systems and if CoMP is used, it can be initialized with "virtual cell ID". The latter is introduced to support measurements from different TPs.

According to TS 36.211, the demodulation reference signals (DMRS) for PDSCH are generated as a function of the variable n_{ID} and n_{SCID}.

- Up to LTE Rel. 11, the $n_{ID} = N_{ID}^{cell}$.
  The DMRS sequence is initialized with the physical cell identity (PCI) N_{ID}^{cell}.
- In LTE Rel. 11, the following applies:
  - $n_{ID} = N_{ID}^{cell}$ or
  - If signaled by the DCI or higher-level, $n_{ID} = n_{ID}^{DMRS,i}$
    Where i = 0, 1 and $n_{ID}^{DMRS,i}$ are two DMRS scrambling identity.
- The n_{SCID} is the scrambling identity and it is $n_{SCID} = 0$ or given by the corresponding field of DCI format 2B, 2C or 2D.

Related settings

See:

- Chapter 4.3.5, "Scrambling Configuration Settings", on page 136
- "DCI Format 2/2A/2B/2C/2D" on page 192
  - DCI format 2C and 2D: "Ant. Port(s), Layers, SCID"
  - DCI format 2B: "Scrambling Identity"
- "Scrambling Identity n_SCID" on page 154

Transmission mode TM10 and DCI format 2D

The TM10 is intended for multi-layer PDSCH transmission with up to eight layers and in case of coordinated multi-point operation (CoMP).

The transmission mode TM10 is similar to the transmission mode TM9. It uses DCI format 2D that serves the same purpose as the DCI format 2C does for the TM9. Both formats carry the same information fields but the DCI format 2D comprises four additional bits. The first two indicate one of four pre-configured sets of parameters and are related to the rate matching information and the QCL (quasi-co-located) indicator.

Related settings

See:

- "Tx Modes" on page 198
- "Transmission Scheme" on page 152
- "DCI Format" on page 180
- "DCI Format 2/2A/2B/2C/2D" on page 192

3.1.7 LTE Release 12 Introduction

This section gives a brief description only of the LTE-A Rel. 12 features that are covered by the software option R&S SMBV-K113.

For a complete LTE-Advanced (3GPP Rel. 12) technology introduction and an insight description of the LTE-A features, refer to:

- White Paper 1MA252 "LTE-Advanced (3GPP Rel. 12) Technology Introduction"

Higher-order modulation (256QAM)

TS 36.213 adds a modulation and coding scheme index table to allow signaling of the 256QAM modulation. The new modulation and coding scheme index table is referred as MSC table 2.

Related settings

See:

- "DL Frame Configuration" > "User Configuration" > MSC Table
- "MBFSN" > Use Table 2 and Modulation
- "DL Frame Configuration" > "Subframe" > Modulation
- "DL Frame Configuration" > "Dummy Data Configuration" > Modulation

LTE TDD-FDD joint operation including carrier aggregation

Combination of component carriers with TDD and FDD duplexing in both the downlink and in the uplink, including independent UL/DL configuration per component carrier.

See:

- "General UL Settings" > "CA" > Duplexing
- "General DL Settings" > "CA" > Duplexing

Enhanced interference mitigation & traffic adaption (eIMTA)

eIMTA (enhanced interference mitigation & traffic adaptation) is an enhancement to LTE TDD for UL-DL interference and load management. This feature is also known as dynamic or flexible TDD.

If eIMTA is used, an eNodeB can change the TDD pattern (TDD UL/DL Configuration) on a frame basis and adapt the frame structure to the traffic. That is, an eNodeB can decide to reconfigure a subset of the UL and special subframes to DL subframes. LTE-Advanced UEs that support eIMTA can receive DL transmissions in these subframes. An eNodeB does not send an UL DCI to legacy UEs for these subframes, so that legacy UEs cannot schedule UL transmissions in these subframes.

The following layer 1 parameters are supported:

- Dedicated eIMTA-RNTI used for CRC scrambling of the PDCCH
  See "DL Frame Configuration" > "User Configuration" > eIMTA-RNTI
- Modified DCI format 1C that indicates the UL/DL configuration numbers (1, 2, ...I).

Each UL/DL configuration number consist of 3 bits and corresponds to one of the UL/DL configurations (see Figure 3-5). Each UL/DL configuration is applied for a specific number of frames, where the number of frames is signaled by higher levels.
See "DL Frame Configuration" > "PDCCH" > "DCI Table" > DCI Format 1C for eIMTA.

According to TS 36.212, further parameters are set by higher-level signaling.

Further DL MIMO enhancements (enhanced 4Tx codebook)

To achieve better system throughput, Rel. 12 introduces a new enhanced 4Tx codebook as one of the DL MIMO enhancements.

The enhanced 4Tx codebook is specified in TS 36.213.

Figure 3-32 shows an example of the single-layer case. For reference information on all codebooks, see TS 36.213.

i_1	i_2 = 0	1	2	3	4	5	6	7
0 – 15	$W^{(1)}_{i_1,0}$	$W^{(1)}_{i_1,8}$	$W^{(1)}_{i_1,16}$	$W^{(1)}_{i_1,24}$	$W^{(1)}_{i_1+8,2}$	$W^{(1)}_{i_1+8,10}$	$W^{(1)}_{i_1+8,18}$	$W^{(1)}_{i_1+8,26}$
i_1	i_2 = 8	9	10	11	12	13	14	15
0 - 15	$W^{(1)}_{i_1+16,4}$	$W^{(1)}_{i_1+16,12}$	$W^{(1)}_{i_1+16,20}$	$W^{(1)}_{i_1+16,28}$	$W^{(1)}_{i_1+24,6}$	$W^{(1)}_{i_1+24,14}$	$W^{(1)}_{i_1+24,22}$	$W^{(1)}_{i_1+24,30}$

where $W^{(1)}_{m,n} = \frac{1}{2}\begin{bmatrix} v'_m & \\ \varphi'_n v'_m & \end{bmatrix}$

Figure 3-32: Codebook for 1-leyer CSI reporting [1MA252, TS 36.213]

See:

- "Use Alternative Codebooks" on page 165
- "Use Alternative Codebooks" on page 154

3.1.8 LTE Release 13/14 Introduction

This section gives a brief introduction only of the LTE-A Rel. 13 features that are covered by the software option R&S SMBV-K119.

For technical details, refer to the 3GPP Rel. 13 specifications TS 36.211, TS 36.212 and TS 36.213.

Up to LTE Rel. 12, all LTE networks use licensed spectrum bands. LTE Rel. 13 adds among others the downlink LAA (license assisted access) functionality. It enhances the carrier aggregation concept to use the unlicensed 5 GHz spectrum of the ISM (industrial, scientific and medical) band.

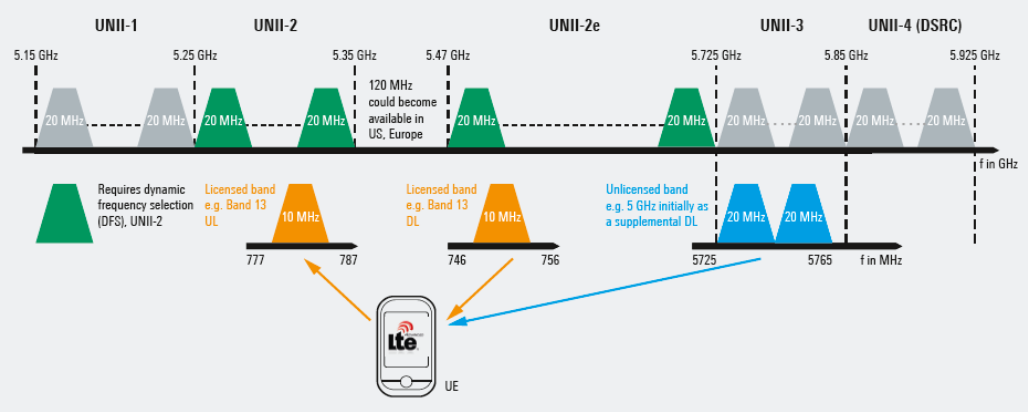


Figure 3-33: Carrier aggregation of licensed and unlicensed spectra [Rohde & Schwarz poster "Evolution of Carrier Aggregation (3GPP Releases 10 to 13)"

Mechanisms for spectrum sharing

Since the unlicensed spectrum has to be shared fairly, LTE is extended to include the following mechanisms:

- Clear channel assessment (CAA) based on listen-before-talk (LTB) functionality
- Discontinuous transmission (DTX) on a carrier with maximum channel occupancy time (MCOT)
- Dynamic frequency selection (DFS) for radar avoidance in certain bands

LAA SCells

Foreseen is a carrier aggregation of up to five component carriers, where the PCell must be within the licensed spectrum. Up to four component carriers (SCells) can use unlicensed frequency bands and span a 20 MHz channel bandwidth. Each component carrier can use a 2x2 MIMO operation. LAA SCells support only downlink operation by using frame structure type 3 with normal cyclic prefix (CP). LAA SCells do not support transmission modes 5, 6 and 7 for PDSCH.

Related settings

See:

- "General DL Settings > Carrier Aggregation" > Duplexing

3.1.8.1 Frame Structure Type 3 (LAA) and Partial Subframes

The frame structure type 3 is applicable for LAA SCells. It allows DL transmission in bursts with burst duration of up to 10 ms, where the 10 ms correspond to the allowed MCOT. Except from the discovery reference signal (DRS), channels cannot be sent outside the bursts.

LAA SCell using frame structure type 3 is always regarded as FDD component carriers. Hence, depending on the duplexing mode the PCell uses, the resulting configuration is FDD only or carrier aggregation with mixed TDD-FDD component carriers.

Radio frames with frame structure type 3 are 10 ms, composed of 20 slots with length of 0.5 ms each. Two consecutive slots build a subframe. Downlink transmission uses one or more consecutive subframes, starting **at the first or seventh symbol** within a subframe and ending with the last subframe. The last subframe can be either fully occupied or following one of the DwPTS durations, specified for frame structure type 2 (see "Frame Structure Type 2 (TDD)" on page 20).

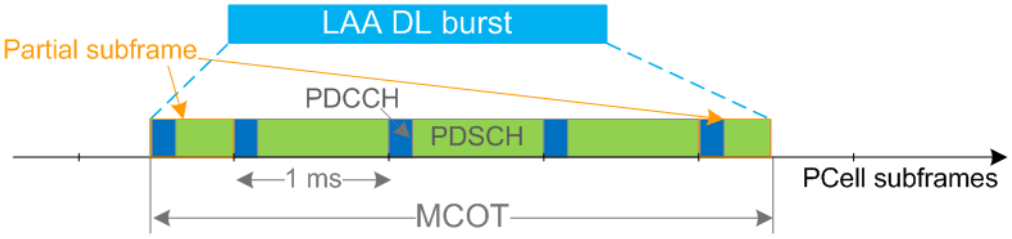


Figure 3-34: DL LAA burst transmission

LAA DL burst = Example of burst consisting of 3 consecutive and 2 partial subframes
PCell = LTE primary cell
MCOT = Maximum channel occupancy time ≤ 10 ms
1 ms = LTE PCell and LAA SCell slot duration
PDCCH, PDSCH = Channels are always sent within the bursts
Partial subframe = Starting at second slot boundary and ending as a DwPTS subframe

Partial subframes

LTE Rel. 13 introduces the concept of partial subframes, where the following applies:

- Starting subframe
  LAA DL burst can start at the LTE subframe boundary (`subframeStartPositon`) or at the boundary of the second slot of a subframe (`secondSlotStartingPositon`).
  A partial starting subframe is followed by a subframe with all symbols used.
- Ending subframe `n`
  The last subframe of a LAA DL burst can end on the LTE subframe boundary or on a symbol boundary as in DwPTS (`endingDwPTS`)
  Thus, the duration of the last subframe of a DL LAA burst can consist of 14 OFDM symbols or of 3, 6, 9, 10, 11 or 12 OFDM symbols. Where the lalter corresponds to the Downlink Pilot Time Slot (DwPTS) structure of the TDD frame.
  Ending subframe is configured by the dedicated DCI format 1C, see Chapter 3.1.8.2, "DCI Format 1C", on page 55.

Related settings

See:

- "DL Frame Configuration" > LAA

3.1.8.2 DCI Format 1C

DCI format 1C carries the field "Subframe Configuration for LAA" which specifies the number of symbols to be used for transmission.

Assuming n is the last subframe, DCI format 1C can be sent in the following ways:

- **n or n-1**:
  In the next-to-last subframe (n-1) or in the last subframe n.
- **n and n-1**:
  If present in both, then both subframes have to use identical subframe configuration.
- **n**:
  If "Subframe Configuration for LAA < 14", no other physical channels are sent in subframe n

Related settings

See:

- "DL Frame Configuration > (E)PDCCH > DCI Table" > User
- "DL Frame Configuration > (E)PDCCH > DCI Table > DCI Format = 1C" > DCI Format 1C for LAA

3.1.8.3 Physical Channels and Signals in an LAA SCell

LAA SCell supports:

- PDSCH, (E)PDCCH, CRS, CSI-RS and DRS

LAA SCell does not support:

- PHICH, PBCH and PMCH

Discovery reference signal (DRS)

DRS is 1ms (or 12 OFDM symbols) long and is transmitted at most once in any subframe during periodical occasions refereed as DRS measurement timing configuration (DMTC). The DMTC occasions have duration of 6 ms and a configurable period of 40 ms, 80 ms or 160 ms.

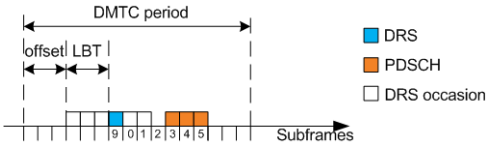


Figure 3-35: DRS allocation

DRS = Discovery reference signal
LBT = Listen-before-talk
DMTC = DRS measurement timing configuration
DRS occasion = Subframes during the DMTC period where DRS can occur
PDSCH = Physical DL shared channel

If part of DRS, PSS and SSS are always transmitted, regardless of the subframe where the DRS occasion appears. Simultaneous transmission of DRS and PDSCH/(E)PDCCH is allowed in subframe#0 and subframe#5.

Related settings

See:

- "General DL Settings > Signals" > "DRS"
- "General DL Settings > Signals > DRS" > CSI-RS > "Config"

3.1.8.4 Full Dimension MIMO (FD-MIMO)

Full Dimension MIMO is a MIMO method that employs antennas capable of beam steering in the 3D space. This 3D steering is realized by an antenna system that can form horizontal and vertical beams.

A vertical beam steering allows for focusing on different floor of a multi-story building, whereas horizontal beams facilities MU-MIMO transmission, as described in Chapter 3.1.5.3, "Enhanced MIMO Schemes", on page 47. Antenna focusing in the vertical axis is also known as elevation beam steering; similarly, the horizontal one is referred to as azimuth beam steering.

Precise 3D beam steering requires measuring and reporting channel state information for each beam separately. The CSI-RS structure specified in the LTE standards up to LTE Rel. 12 is sufficient for the MU-MIMO case but not for the requirements of the 3D MIMO scenarios.

Thus, LTE Rel. 13 extends the specification to include multiple CSI-RS configurations per cell. It also extends the range of supported antenna ports by allowing transmission on AP 23 to AP 46. Moreover, it introduces a CDM scheme to support the mapping to the physical resources.

According to TS 36.211, CSI reference signals are transmitted on 1, 2, 4, 8, 12, 16, 20, 24, 28, or 32 antenna ports. Since there are a total number of 32 antennas and eight different CSI configurations, the specification limits the amount of possible combination by applying an aggregation rule. Table 3-8 lists the possible combinations.

Table 3-8: Aggregation of CSI-RS configurations [TS 36.211]

Total number of antenna ports $N_{res}^{CSI} * N_{ports}^{CSI}$	**Number of antenna ports per CSI-RS configuration** N_{ports}^{CSI}	**Number of CSI-RS configurations** N_{res}^{CSI}
12	4	3
16	8	2
20	4	5
24	8	3
28	4	7
32	8	4

Related settings

See:

- Chapter 4.2.7.4, "CSI-RS Settings", on page 106

- Chapter 4.5, "DL Antenna Port Mapping Settings", on page 160

3.1.8.5 PUCCH Formats 4 and 5

From LTE Rel. 14 on, the specification is extended with carrier aggregation of up to 32 carriers, both in the downlink and in the uplink direction. For the carrier aggregation in uplink, two new PUCCH formats are defined, PUCCH format 4 and PUCCH format 5.

Carrier aggregation with more than 5 carriers is not supported by the current firmware version, but you can configure the PUCCH formats. Other than in all other PUCCH formats, PUCCH format 4 spans more than one contiguous resource blocks and thus uses larger resource block in the time domain.

For overview information on the PUCCH formats, see Chapter 3.1.2.3, "Uplink Control Information Transmission", on page 35.

Related settings

See:

- " Range n(4)_PUCCH/Range n(5)_PUCCH" on page 226
- "Number of Antenna Ports for PUCCH per PUCCH Format" on page 241
- Chapter 4.14, "Enhanced PUCCH Settings", on page 300

3.1.8.6 TDD Special Subframe Configuration 10

From LTE Rel. 13 on, the specification is extended to support special subframe configuration 10, both in the downlink and in the uplink direction. The PUSCH in UpPTS follows a cell-specific configuration and can be configured independently for each user.

For overview information on the TDD frame structure, see "Frame Structure Type 2 (TDD)" on page 20.

Related settings

See:

- Chapter 4.2.5, "TDD Frame Structure Settings", on page 94
- "TDD Special Subframe Config" on page 76
- "TDD Special Subframe Config" on page 213
- "PUSCH in UpPTS" on page 248

3.1.8.7 DMRS Enhancements and DCI Format 2C/2D

Starting from LTE Rel. 13, the transmission modes TM9 and TM10 can utilize new antenna ports, the AP11 and AP13, for one or two-layer transmissions and for transmit diversity.

DCI format 2C/2D carry the field "Ant. Port(s), Layers, SCID" which specifies the combination of used antenna ports, scrambling identity and number of layers (TS 36.212).

The value range of this field depends on the higher-layer parameters `semiOpenLoop` and `dmrs-tableAlt`.

Related settings

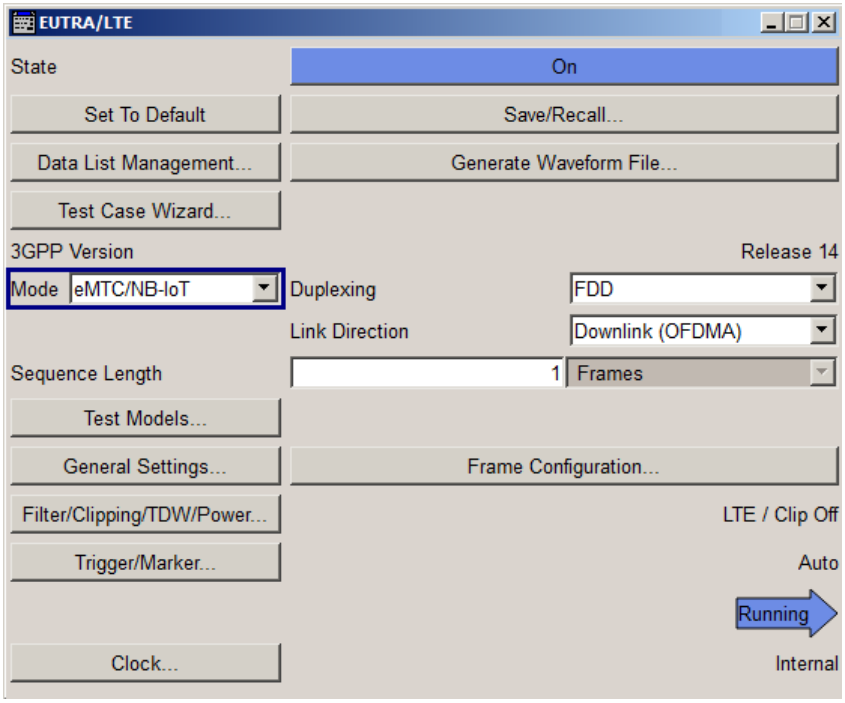
See:

- "DL Frame Configuration > General > Configure User > Tx Mode = TM9|TM10" > DMRS Alt Table and Semi Open Loop
- "DL Frame Configuration > (E)PDCCH > DCI Table > DCI Format = 2C/2D" > DCI Format 2/2A/2B/2C/2D
- "DL Frame Configuration > General > Configure User > Tx Mode = TM9|TM10 > Antenna Mapping > Config" > User-Specific Antenna Port Mapping
- "DL Frame Configuration > Subrame > PDSCH > Enchanced Settings > Config" > Number of Layers, Antenna Ports and Mapping Table

4 EUTRA/LTE User Interface

To access the dialog for setting the EUTRA/LTE digital standard, select "Baseband block > EUTRA/LTE" or use the menu tree under "Baseband".

4.1 Main Dialog for EUTRA/LTE Signals



The dialog is split into several sections for configuring the standard:

- The upper menu section is where the EUTRA/LTE digital standard is enabled and reset, the default settings are called, and where the generated waveform file can be selected.
- The middle menu section is where EUTRA/LTE related settings such as the link direction and the sequence length can be selected.
- The buttons in the lower menu section lead to submenus to configure the EUTRA/LTE signal and setting the filter, trigger, and clock parameters.

State
Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Remote command:
[:SOURce<hw>]:BB:EUTRa:STATe on page 515

Set to Default
Calls the default settings. The values of the main parameters are listed in the following table.

Parameter	Values
State	Not affected by "Set to Default"
Duplexing	FDD
Link Direction	Downlink (OFDMA)
Sequence Length	1 Frame
DL Channel Bandwidth	10 MHz
Physical Resource Block Bandwidth	12 * 15 kHz
Number Of Resource Blocks per Slot	50
Occupied Bandwidth /MHz	9.015
Sampling Rate /MHz	15.360
FFT Size	1024
Cell ID	0
Cyclic Prefix	Normal
PHICH Duration	Normal
Global MIMO Configuration	1 Tx Antenna
Simulated Antenna	Antenna 1

Remote command:
[:SOURce<hw>]:BB:EUTRa:PRESet on page 517

Save/Recall...
Calls the "Save/Recall" menu.

From the "Save/Recall" menu, the "File Select" windows for saving and recalling EUTRA/LTE configurations and the "File Manager" is called.

EUTRA/LTE configurations are stored as files with the predefined file extension *.eutra. The file name and the directory they are stored in are user-definable.

The complete settings in the "EUTRA/LTE" dialog are saved and recalled.

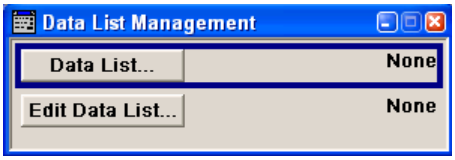
"Recall EUTRA/LTE Setting"
Opens the "File Select" window for loading a saved EUTRA/LTE configuration.
The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

"Save EUTRA/LTE Setting"
Opens the "File Select" window for saving the current EUTRA/LTE signal configuration.
The name of the file is specified in the "File name" entry field. The file is saved by pressing the "Save" button.

"File Manager" Calls the "File Manager".
The "File Manager "is used to copy, delete, and rename files and to create directories.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog` on page 517
`[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD` on page 518
`[:SOURce<hw>]:BB:EUTRa:SETTing:STORe` on page 518
`[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST` on page 518
`[:SOURce<hw>]:BB:EUTRa:SETTing:DEL` on page 517

Data List Management
Calls the "Data List Management" menu. This menu is used to create and edit a data list.



All data lists are stored as files with the predefined file extension `*.dm_iqd`. The file name and the directory they are stored in are user-definable.

The data lists must be selected as a data source from the submenus under the individual function.

Note: All data lists are generated and edited with the `SOURce:BB:DM` subsystem commands. Files containing data lists usually end with `*.dm_iqd`. The data lists are selected as a data source for a specific function in the individual subsystems of the digital standard.

Example: Creating and editing the data list:

```
SOUR:BB:DM:DLIS:SEL "eutra"
SOUR:BB:DM:DLIS:DATA 1,1,0,1,0,1,0,1,1,1,1,0,0,0
SOUR:BB:DM:DLIS:DATA:APP 1,1,0,1,0,1,0,1,1,1,1,0,0
```

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA on page 568
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect on page 569
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA on page 692
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect on page 692

Generate Waveform File…
Calls the "Generate Waveform" dialog used to store the current EUTRA/LTE signal as ARB signal in a waveform file.

This file can be loaded in the "ARB" dialog and processed as multi-carrier or multi-segment signal.

The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

Remote command:
[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate on page 519

Test Case Wizard
Opens the Test Case Wizard dialog (see Chapter 7, "Performing BS Tests According to TS 36.141", on page 456).

Mode
In instruments equipped with options R&S SMBV-K55 and R&S SMBV-K115, selects the standard to that the displayed settings belong.

If the instrument is equipped with one of these two options, the corresponding mode is selected automatically but the parameter "Mode" is not displayed.

"Mode"	Description	Required options
"LTE"	Standalone LTE IoT related settings and parameters are hidden.	R&S SMBV-K55 (optionally also R&S SMBV-K85)
"eMTC/NB-IoT"	Standalone IoT Configuration of parameters specified only for LTE is not possible.	R&S SMBV-K115
"LTE/eMTC/NB-IoT"	Mixed LTE and IoT Allows mixed LTE and IoT configurations, for example for interoperability tests.	R&S SMBV-K55 and R&S SMBV-K115

Remote command:
[:SOURce<hw>]:BB:EUTRa:STDMode on page 516

3GPP Version
Displays the current version of the 3GPP standard.

The default settings and parameters provided are oriented towards the specifications of the version displayed.

Remote command:
[:SOURce]:BB:EUTRa:VERSion? on page 519

Duplexing
Selects the duplexing mode. The duplexing mode determines how the uplink and downlink signals are separated.

"TDD" In TDD mode, the same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink or only uplink can be generated.

"FDD" In FDD mode, different frequencies are used for downlink and uplink directions.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DUPLexing on page 516

Link Direction
Selects the transmission direction.

"Downlink (OFDMA)" The transmission direction selected is base station to user equipment. The signal corresponds to that of a base station. For the downlink, the physical layer mode is always set to OFDMA.

"Uplink (SC-FDMA)" The transmission direction selected is user equipment to base station. The signal corresponds to that of a user equipment. For the uplink, the physical layer mode is always set to SC-FDMA.

Remote command:
[:SOURce<hw>]:BB:EUTRa:LINK on page 516

Sequence Length
Sets the sequence length of the signal in number of frames. One frame corresponds to 10 ms. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

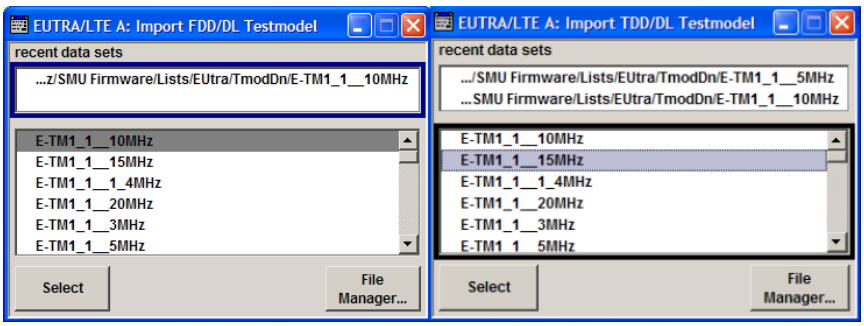
Max. No. of Frames = Arbitrary waveform memory size/(sampling rate x 10 ms).

If the Realtime Feedback functionality is enabled, the signal of UE1 does not depend on the sequence length, since this signal is not calculated in advance. The configuration of the sequence length is then only required, if also the signal of UE2, UE3 or UE4 is used.

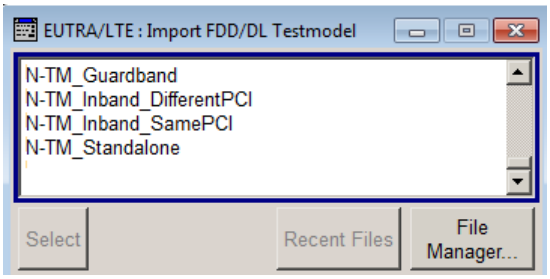
Remote command:
[:SOURce<hw>]:BB:EUTRa:SLENgth on page 519

Test Models
Accesses a dialog for selecting of:

- One of the EUTRA Test Models (E-TM) defined in TS 36.141



- One of the NB-IoT Test Models (N-TM) defined in TS 36.141.



- Self-defined test setups

The DL test models are predefined configurations of LTE settings. Three main groups of test models are defined, the E-TM1, E-TM2 and E-TM3. All test models use the following parameters:

- Single antenna port, single codeword, single layer and no precoding
- Duration of one frame
- Normal cyclic prefix
- Localized virtual resource blocks, no intra-subframe hopping for PDSCH
- UE-specific reference signals are not used

The data content of the physical channels and signals are defined in the 3GPP specification. Each E-TM is defined for six different channel bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz. The test models are defined for specific test purpose.

EUTRA Test Model	Defined for tests on
E-TM1.1	• BS output power • Unwanted emissions • Transmitter intermodulation • RS absolute accuracy
E-TM1.2	• ACLR • Operating band unwanted emissions
E-TM2	• Total power dynamic range (lower OFDM symbol power limit at min power) • EVM of single 64QAM PRB allocation (at min power) • Frequency error (at min power)
E-TM3.1	• Output power dynamics • Transmitted signal quality (Frequency error and EVM for 64QAM modulation, at max power)

EUTRA Test Model	Defined for tests on
E-TM3.2	Transmitted signal quality: • Frequency error • EVM for 16QAM modulation
E-TM3.3	Transmitted signal quality: • Frequency error • EVM for QPSK modulation

The NB-IoT DL test models (N-TM) are predefined configurations of settings for NB-IoT tests. Supported are the following N-TMs:

- NB-IoT guard band operation
- NB-IoT guard band operation in combination with LTE E-TM1.1 carriers
- NB-IoT in-band operation, where NB-IoT and LTE use different PCIs
- NB-IoT in-band operation, where NB-IoT and LTE share the same PCI
- NB-IoT in-band operation in combination with LTE E-TM1.1 carriers
- NB-IoT standalone operation

According to TS 36.141, all test models use the following parameters:

- Single antenna port
- Duration of 10 subframes or 10 ms
- Normal cyclic prefix
- The ration of synchronisation signal EPRE and NRS EPRE is 0 dB
- NPDCCH format 1

Remote command:
`[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL` on page 518
`[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD` on page 518

General DL Settings/General UL Settings
The name of the button depends on the chosen link direction.

Calls the "General DL Settings / General UL Settings" dialog for configuring the EUTRA/LTE system.

The dialogs are described respectively in Chapter 4.2, "General DL Settings / General TDD DL Settings", on page 67 and Chapter 4.10, "General UL Settings", on page 209.

Remote command:
n.a.

Frame Configuration
Calls the "Frame Configuration" dialog for configuring the allocation of the resource blocks to the different users, and the configuration of the users.

The dialog depends on the chosen link direction. The menu is described in Chapter 4.3, "DL Frame Configuration Settings", on page 120 and Chapter 4.11, "UL Frame Configuration Settings", on page 228 respectively.

Remote command:
n.a.

Filtering/Clipping/Power
Calls the menu for setting baseband filtering, clipping, and the general power settings. The current filter and the clipping state are displayed next to the button.

The menu is described in Chapter 8.1, "Filter/Clipping/Power Settings", on page 492.

Remote command:
n.a.

Trigger/Marker
Calls the dialog for selecting the trigger mode and trigger source, for configuring the marker signals, and for setting the time delay of an external trigger signal. This dialog is described in Chapter 8.3, "Trigger/Marker/Clock Settings", on page 504.

The currently selected trigger mode and trigger source are displayed next to the button.

Remote command:
n.a.

Execute Trigger
Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute` on page 531

Arm
Stops signal generation. This button appears only with "Running" signal generation in the "Armed_Auto" and "Armed_Retrigger" trigger modes.

Signal generation can be restarted by a new trigger (internally with "Execute Trigger" or externally).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute` on page 531

Clock
Calls the menu for selecting the clock source and for setting a delay.

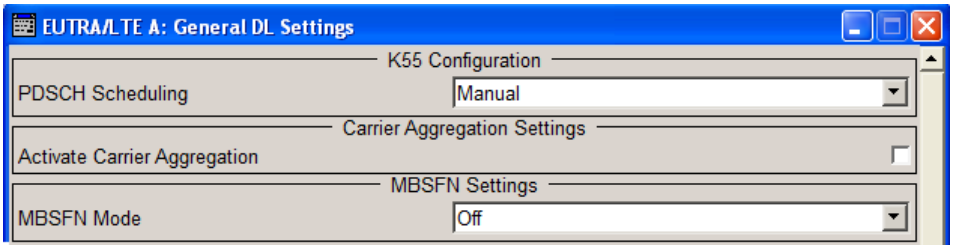
This menu is described in Chapter 8.3.4, "Clock Settings", on page 510.

Remote command:
n.a.

4.2 General DL Settings / General TDD DL Settings

The "General DL Settings" dialog allows configuring the EUTRA/LTE system for transmission direction downlink, i.e. the signal of one BS or one cell.

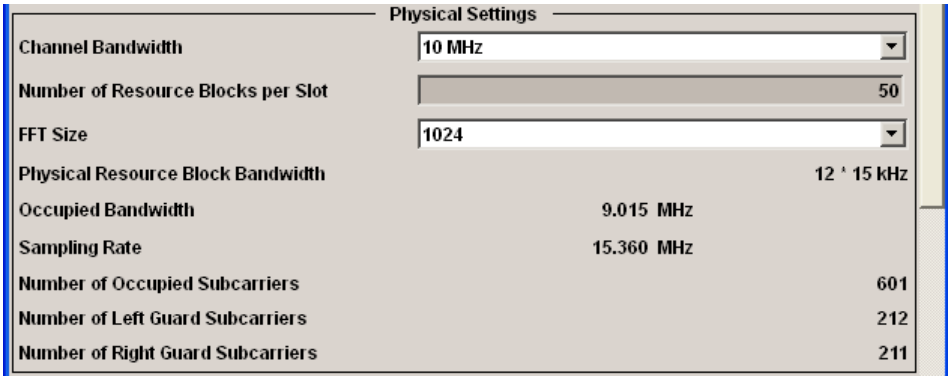
The dialog consists of several sections



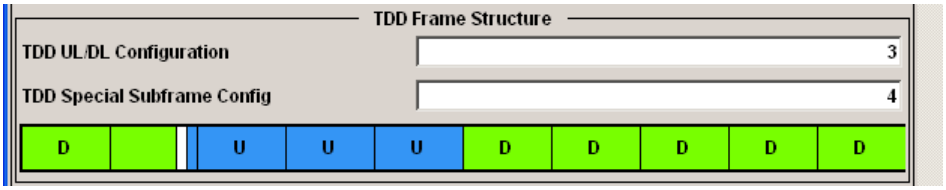
Because the EUTRA/LTE standard defines no differences between TDD and FDD signals on the physical layer if only one link direction is considered at once, the "General TDD DL Settings" dialog comes with the same parameters as the "General DL Settings" dialog and is only extended with the TDD Frame Structure Settings section.

In the "K55 Configuration" section, a selection is made, whether the PDSCH Scheduling is performed manual or according to the configuration made for the DCIs.

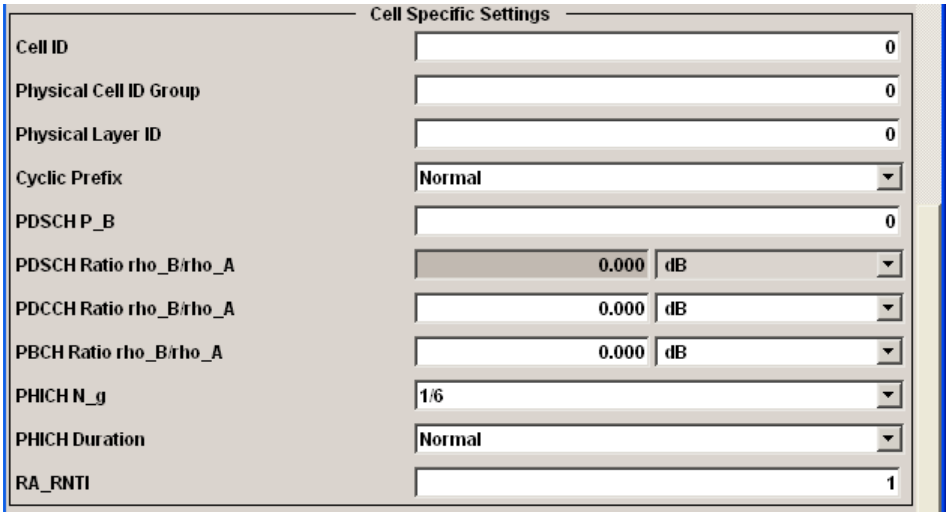
In the "Physical Settings" section, the channel bandwidth respectively the number of resource blocks per slot is selected. The other parameters are fixed and read-only.



The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by adjustment of the UL/DL configuration and the special subframe configuration.

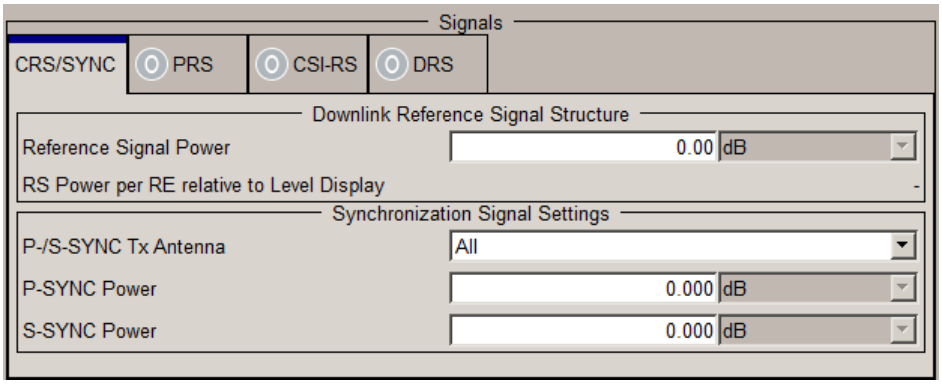


In the "Cell Specific Settings" section, the physical layer cell identity settings and the DL power control settings are configured.

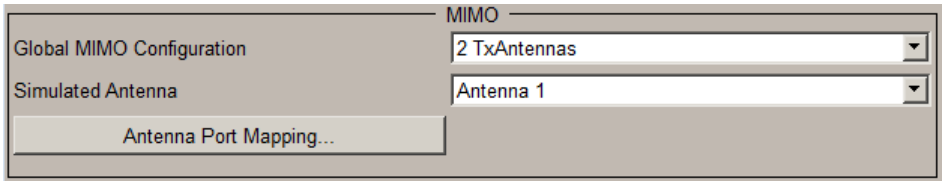


In the "Signals" section, you set the settings related to the "Downlink Reference Signal Structure" and the "Synchronization Signal Settings", the "Positioning Reference Signal Settings" and the "CSI-RS Structure".

If the required options are installed, the "DRS (Discovery Reference Signals)" and the "NB-IoT Reference Signals" are also present.



In the "MIMO" section, the global MIMO configuration and the simulated antenna are selected.



- PDSCH Scheduling Settings....70
- DL Carrier Aggregation Configuration....71
- MBSFN Settings....78
- Physical Settings....91
- TDD Frame Structure Settings....94

- Cell-Specific Settings 95
- Downlink Signals Settings 98
- MIMO 118

4.2.1 PDSCH Scheduling Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General Settings > Scheduling".

   In the "Scheduling" section, you define whether the PDSCH Scheduling is performed manually, according to the configuration made for the DCIs or according to the required HARQ processes and redundancy versions.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE` on page 539

Overview of the scheduling methods

In the R&S SMBV, there are different approaches to configure and schedule the different PDSCH allocations:

- Manually and with full flexibility ("Manual")
  This is the default scheduling mode and the mode with full flexibility; you can configure any of the available settings.
  There is no cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings. The configuration is performed on a subframe basis and you are responsible for the content of the PDSCH allocations.
- According to the configuration made for the DCIs ("Auto/DCI")
  This is the mode supporting you to configure the precoding settings for spatial multiplexing according to TS 36.211.
  This mode assures a 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.
  There are however limitations in the configuration flexibility, especially regarding the power setting, see "Limitations and interdependencies in the Auto/DCI and Auto Sequence modes" on page 70.
  See also "Switching between "Auto/DCI" and "Manual" modes" on page 71.

Limitations and interdependencies in the Auto/DCI and Auto Sequence modes

The generation of a compliant signal requires some limitations in the configuration flexibility, especially regarding the power setting:

- The value of the parameter Reference Signal Power is fixed to 0dB.
- The PDSCH Rho A of each allocation belonging to a user is set as configured with the parameter P_A for the corresponding user in the "Configure User" dialog.
- All four users are activated with enabled Scrambling and Channel Coding.

- Not all combinations of DCI Table, Users and UE_ID/n_RNTI are allowed, see Table 4-1.

Table 4-1: DCI Formats dependencies

User	UE ID/n_RNTI	DCI Format
User x	As defined for the corresponding user	0,1,1a,1b,1d,2,2a,2c,3,3a
P-RNTI	65534	1a,1c
SI-RNTI	65535	
RA-RNTI	As defined with the parameter "General DL Setting" > RA_RNTI	

Switching between "Auto/DCI" and "Manual" modes

- Switching from "Auto/DCI" mode to "Manual"
  Enables all parameters in the DL allocation table for configuration without to change their values.
- Switching from "Manual" to "Auto/DCI" mode
  Triggers a reset of the subframe configuration prior to reconfiguration of the PDSCH allocations according to the settings made for the PDCCH DCIs, that is the settings made in the DL allocation table are lost.

4.2.2 DL Carrier Aggregation Configuration

Option: R&S SMBV-K55 and R&S SMBV-K85.

The "DL Carrier Aggregation Configuration" dialog provides the settings for the configuration of one primary cell (PCell) and up to four secondary cells (SCell). In real system, the RRC messages signal all the relevant system information for a certain SCell. In this implementation, all relevant and configurable SCell settings are grouped in the "DL Carrier Aggregation Configuration" dialog. The remaining cell-specific settings are identical for all component carriers.

4.2.2.1 About DL Carrier Aggregation

This section lists implementation-related information. For background information on this topic, refer to Chapter 3.1.5, "LTE Release 10 (LTE-Advanced) Introduction", on page 44.

In this description, the terms cell and component carrier (CC) are used interchangeably.

SCell settings derivation

The settings of each component carrier are calculated automatically form the configured PCell settings. They depend on the parameters in the "DL Carrier Aggregation

Configuration" dialog. The following list provides an overview of the restrictions and interdependencies between related parameters if DL carrier aggregation is enabled:

- Combination of FDD and TDD is supported in "PDSCH Scheduling > Auto/DCI and Auto Sequence" modes
- Combination of TDD carriers with different UL/DL configuration or special subframe configuration is supported in "PDSCH Scheduling > Auto/DCI and Auto Sequence" modes
- Simultaneous support of LTE and LTE-A users is provided
  (See User Configuration Settings > Activate CA).
- To enable cross-carrier scheduling, the DCI formats are extended to support the CIF field.
  The DCIs have to be configured individually per component carrier.
- The "Control Region for PDCCH" and the PHICH parameters "PHICH Duration" and "PHICH N_g" can have different values in the component carrier. The component carriers use different Number of PHICH Groups, because the number of PHICH groups is calculated based on the parameter "N_g".
  The cell-specific settings in the "Cell" tab correspond to the configuration of the PCell.
- The "Control Region for PDCCH" of all SCells is set to the same value, unless the 3GPP standard specifies a specific value. Special values are defined for example in the special subframes in TDD mode.
  The PHICH Duration of the SCells is adjusted automatically if necessary. For example, if this parameter is set to "Extended" in the PCell, the SCell are generated with extended PHICH duration. This applies even if the "PDCCH Start" is not set properly for the SCell.
  However, the PHICH duration in a SCell is adjusted if the selected narrow channel bandwidth in this SCell leads to insufficient number of PDCCH symbols. Therefore, different channel bandwidth results in different Number of PDCCH Bits / REGs / CCEs.
- The parameter Number of PHICH Groups can have different values in the SCells, because it is calculated based on the parameter "N_g".
- If a SCell spans channel bandwidth with fewer RBs than the PCell, the instrument ignores the allocations or part of the them that is outside of the SCell channel bandwidth.

Supported LTE-A bandwidth

The LTE specification defines a maximum Channel Bandwidth of 20 MHz and aggregation of up to 5 component carriers. This achieves a 100 MHz bandwidth.

The R&S SMBV configured to generate more than one component carrier automatically applies the multi-carrier function. In this case, the maximum bandwidth of the generated LTE-A signal depends on the installed options.

Using the maximum sampling rate, the R&S SMBV equipped with the options R&S SMBV-B10/K522 can internally generate multicarrier signals with up to 160 MHz RF bandwidth.

For more information, see data sheet.

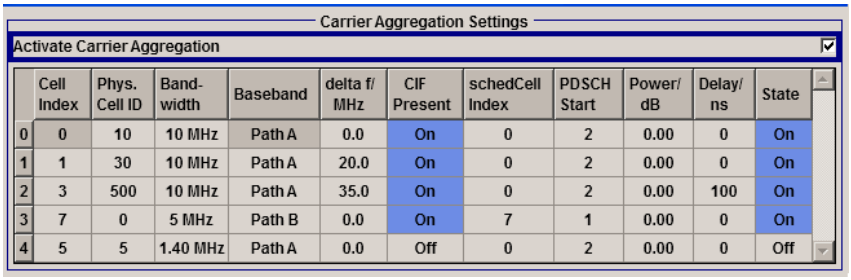
4.2.2.2 How to Enable Carrier Aggregation and Cross-Carrier Scheduling

This section provides step-by-step instructions on how to use the settings to generate an LTE-A signal.

To enable carrier aggregation and cross-carrier scheduling

In the following, a general example is provided. Only the related settings are discussed.

1. Select "Baseband > EUTRA/LTE".
   Configure the settings of the PCell as required. For example, select one of the predefined "Test Setups/Models".
2. To enable carrier aggregation:
   a) Select "General DL Settings > DL Carrier Aggregation Configuration > Activate Carrier Aggregation > On"
   b) Select "DL Frame Configuration > User Configuration".
   Enable "Activate CA" per user as required.
3. In the "General DL Settings > DL Carrier Aggregation Configuration > Component Carrier Table" dialog, configure the settings of the SCells (see example on the following figure).



	Cell Index	Phys. Cell ID	Band-width	Baseband	delta f/ MHz	CIF Present	schedCell Index	PDSCH Start	Power/ dB	Delay/ ns	State
0	0	10	10 MHz	Path A	0.0	On	0	2	0.00	0	On
1	1	30	10 MHz	Path A	20.0	On	0	2	0.00	0	On
2	3	500	10 MHz	Path A	35.0	On	0	2	0.00	100	On
3	7	0	5 MHz	Path B	0.0	On	7	1	0.00	0	On
4	5	5	1.40 MHz	Path A	0.0	Off	0	2	0.00	0	Off

4. To enable cross-carrier scheduling for a certain component carrier:
   a) Set the "DL Carrier Aggregation Configuration > SCell# > schedCell Index = 0"
   In the example, the component carriers SCell#1, SCell#2 and SCell#4 can be cross-scheduled over the PCell
   b) Enable the "DL Carrier Aggregation Configuration > SCell# > CIF Present" parameter.
   In this example, the component carriers SCell#1 and SCell#2 is cross-scheduled over the PCell.
   c) To enable a component carrier, set "DL Carrier Aggregation Configuration > SCell# > State > On".
5. Enable LTE signal generation "EUTRA/LTE State > On".
6. If necessary, use the Fading simulator to configure the propagation conditions.

7. If necessary, adjust the RF frequency of the path to the middle frequency of the resulting total signal bandwidth.
8. Activate the RF output.

   The instrument generates the signal in the path as multicarrier signal. The signal is composed of three carriers, the PCell, the SCell#1 and SCell#2. Each of the component carriers spans "Channel Bandwidth = 10 MHz"; the SCells use carrier frequency offset of 20 MHz and 35 MHz.
   In two path instrument, the SCell#3 is generated by the path B. The instrument uses the internal coupled mode, that is path B is controlled via path A. The signal generated by path B has identical parameters with the settings made for path A. The component carrier-specific parameters, like the "Channel Bandwidth" are set automatically.
   The SCell#4 is disabled.
   Tip: How to configure an LTE-A signal with independent fading per component carrier

   - If independent fading is required for each of the component carriers:
   - Configure one component carrier per path
   - Use the "Save/Recall" function to transfer the settings file to further instruments
   - Adjust the component carrier settings as necessary.

4.2.2.3 Carrier Aggregation Settings

Provided are the following settings:

Activate Carrier Aggregation....74
Component Carrier Table....75
└ Cell Index....75
└ Physical Cell ID....75
└ Bandwidth....75
└ Baseband....75
└ delta f / MHz....76
└ Duplexing....76
└ TDD UL/DL Configuration....76
└ TDD Special Subframe Config....76
└ CIF Present....76
└ sched. Cell Index....77
└ PDSCH Start....77
└ Power / dB....77
└ Delay / ns....77
└ State....77

Activate Carrier Aggregation
Enables/disables the generation of several component carriers.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe` on page 584

Component Carrier Table
The table provides the settings of the component carriers. The first row displays the settings of the PCell; the following four rows provide the configurable settings of the up to four SCells.

The PCell settings resemble the settings configured in the

The PCell settings resemble the settings configured in the "General DL Settings" dialog.

Cell Index ← Component Carrier Table
Sets the cell index of the corresponding SCell, as specified in TS 36.331. The SCell index is required for signaling on the DCI DCI Format Configuration field.

The cell index of the PCell is always 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex` on page 586

Physical Cell ID ← Component Carrier Table
Sets the physical Cell ID of the corresponding SCell.

The physical Cell ID of the PCell is set by the parameter "General DL Settings" > Cell ID".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID` on page 585

Bandwidth ← Component Carrier Table
Sets the bandwidth of the corresponding component carrier/SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW` on page 584

Baseband ← Component Carrier Table
Determines the baseband block that generates the selected component carrier.

Note: For two path instruments, setting this parameter to "Path B", enables LTE signal simulation in the second path. All other digital standards and digital modulation modes are disabled in this path.

Enabling path B to simulate a component carrier automatically couples path A and path B, i.e. path B is controlled via path A. The signal generated by path B has identical parameters with the settings made for path A. The component carrier-specific parameters, like the "Channel Bandwidth", are set automatically.

If more than one component carriers are configured per baseband, the multi-carrier function of the R&S SMBV is automatically enabled. In this case, the maximum frequency offset "delta f" between the central frequencies of the cells is limited by the instrument's hardware.

Note: The LTE-A signal is generated as multi-carrier waveform by one baseband and hence all the component carriers/cells can only be faded jointly.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB` on page 584

delta f / MHz ← Component Carrier Table
Sets the frequency offset between the central frequency of the SCell and the frequency of the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq` on page 584

Duplexing ← Component Carrier Table
Selects the duplexing mode of the PCell.

- Without R&S SMBV-K113
  The duplexing mode of the SCells is set accordingly.
- Option: R&S SMBV-K113
  If "PDSCH Scheduling > Auto/DCI and Auto Sequence", combination of FDD and TDD is supported
- Option: R&S SMBV-K119
  If "PDSCH Scheduling > Auto/DCI and Auto Sequence", SCells can work in LAA mode.
  LAA cells use FDD duplexing.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DUPLexing` on page 585

TDD UL/DL Configuration ← Component Carrier Table
Option: R&S SMBV-K112

In TDD duplexing mode, sets the uplink-downlink configuration number. That is, defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

In "PDSCH Scheduling > Auto/DCI and Auto Sequence" mode, the individual carriers can use different "UL/DL Configuration". The frame configuration of the selected carries and the used duplexing are also displayed. Alternatively, use the SC-FDMA Time Plan to visualize them.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:UDConf` on page 585

TDD Special Subframe Config ← Component Carrier Table
Option: R&S SMBV-K112

In TDD duplexing mode, sets the special subframe configuration number.

Together with the parameter Cyclic Prefix, this parameter defines the lengths of the DwPTS, the guard period and the UpPTS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SPSConf` on page 586

CIF Present ← Component Carrier Table
Defines whether the Carrier Indicator Field (CIF) is included in the PDCCH DCI formats transmitted from the corresponding SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF` on page 584

sched. Cell Index ← Component Carrier Table
Defines the component carrier/cell that signals the UL and DL grants for the selected SCell. The signaling cell is determined by its Cell Index.

According to the LTE-A specification, cross-carrier scheduling has to be enabled per user and per component carrier.

To enable signaling for one particular SCell on the PCell, i.e. cross-carrier scheduling, set the "schedCell Index" to 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex` on page 587

PDSCH Start ← Component Carrier Table
Sets the starting symbol of the PDSCH for the corresponding SCell, i.e. determines the "Control Region for PDCCH".

Note: All subframes use the same "Control region for PDCCH" as defined here, regardless of the settings of the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart` on page 587

Power / dB ← Component Carrier Table
Sets the RS EPRE (reference signal energy per resource element) of the SCell relative to the RS EPRE of the PCell.

The absolute power of the RS of a cell is calculated according to the following formula:

$Absolute_RS_EPRE_{Cell_X}$ = RS Power per RE relative to Level Display + "Level Display" + $CA_Power_{Cell_X}$

Example:

Set "EUTRA/LTE > Set to Default"

Set Activate Carrier Aggregation > On

For the SCell1, set $CA_Power_{Cell_1}$ = Power / dB = -5 dB

Enable SCell1, i.e. set State > On

The value of the parameter "General DL Settings" > RS Power per RE relative to Level Display" is -30.736 dB

The power displayed in the status bar of the instrument is "Level = -30 dBm"

$Absolute_RS_EPRE_{Cell_1}$ = (-30.736 dB) + (-30.00 dBm) + (-5 dB) = -65.736 dBm

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset` on page 586

Delay / ns ← Component Carrier Table
Sets the time delay of the SCell relative to the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay` on page 587

State ← Component Carrier Table
Activates/deactivates the component carrier/SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe` on page 588

4.2.3 MBSFN Settings

Configuration of the "MBSFN Settings" requires the additional software option R&S SMBV-K84.

The "MBSFN Settings" section comprises the parameters necessary to configure an MBSFN transmission. Refer to Chapter 3.1.4, "LTE MBMS Concepts", on page 44 for background information.

According to the MBMS LTE concept, one eNodeB may serve more than one MBSFN areas. In this implementation, the simulated cell belongs to only one MBSFN area. Hence, all radio resources reserved for MBSFN subframes are assigned to one MBSFN area.

In an LTE network, the MBSFN information is transmitted only during the specially reserved MBSFN subframes. Almost all MBMS control information is carried by a special control channel, the MCCH. There is one MCCH per MBSFN area. In this implementation, the MCCH is always mapped to the first active MBSFN subframe within one MCCH repetition period (see figure in Example "MBSFN Resource Allocation" on page 80).

A configurable "MCCH repetition period" determines how frequent the control information is transmitted within a defined "MCCH modification period" (see Figure 4-1).

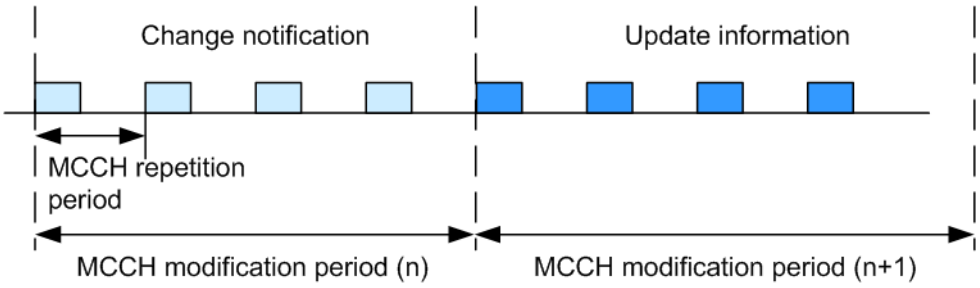


Figure 4-1: Change of MCCH information

The MCCH carries a single message, the *MBSFNAreaConfiguration* message, which provides information on the ongoing MBMS sessions and the corresponding radio resources, i.e. the mapping of the PMCHs. The BCCH also carries some of the MBMS control information by the special System Information Blocks SIB Type 13 and SIB Type 2.

For exact definition of control elements and messages such as *MBSFNAreaConfiguration*, refer to TS 36.331.

The following table provides an overview of the steps an UE performs to acquire the information about the resource configuration of reserved MBSFN subframes, the position of the MCCH within the MBSFN subframes as well as information necessary to demodulate the MCCH and to retrieve the information about the PMCH scheduling.

Table 4-2: Acquiring MBSFN information

Step	Information provided by	Description	User Interface
1	BCCH > SIB#2 • *MBSFN-SubframeConfiguration*	The SIB#2 contains common radio configuration information and among other things a list (*mbsfn_SubframeConfigList*) with scheduling information for up to 8 MBSFN allocations (*MBSFN-SubframeConfiguration*). Hence, after receiving the SIB#2 each UE, also the MBSFN incapable UEs, are informed about the subframes that are reserved for MBSFN in the downlink.	Subframe Config (SIB Type 2)
2	BCCH > SIB#13 • *MBSFN-AreaInfoList* • *MBMS-NotificationConfiguration*	The SIB#13 carries the information necessary to acquire the MBMS control information for up to 8 MBSFN areas (*MBSFN-AreaInfoList*), as well as the common MBMS notification scheduling information (*MBMS-NotificationConfiguration*). After receiving the SIB#13 the MBSFN capable UE is able to find the MBSFN reference signals (*mbsfn-AreaID*) and to detect and demodulate the MCCH (*mcch-Config* and *MBMS-NotificationConfiguration*).	MBSFN-AreaInfoList Parameters MBSFN-Notification-Config Parameters
3	MCCH > *MBSFNAreaConfiguration* • *PMCH-InfoList* • *CommonSF-Allocation-PatternList*	The MCCH carries the single message *MBSFNAreaConfiguration* that determines which of the reserved MBSFN subframes (compare SIB#2) belong to which MBSFN area and provides a list with configuration information for up to 15 PMCHs (*PMCH-InfoList*) per an MBSFN area. **Note:** The *MBSFN-SubframeConfiguration* is equivalent to the summary of all *CommonSF-AllocationPatternList*. In this implementation, all MBSFN subframes are assigned to one MBSFN area. Hence, *MBSFN-SubframeConfiguration* equates the *CommonSF-AllocationPatternList* and configuration of the later one is done with the parameters of SIB#2. The *PMCH-InfoList* specifies the individual PMCHs, including MBMS sessions, used MCS, allocated subframes (*sf-AllocEnd*), and the periodicity for providing MCH scheduling information on MAC layer (*mch-SchedulingPeriod*).	Common Subframe Allocation Period PMCH-InfoList Parameters
4	PMCH	The UE receives the PMCHs.	

The illustrations on Figure 4-2 and Figure 4-3 show the signaling of MBSFN information during the acquisition steps.

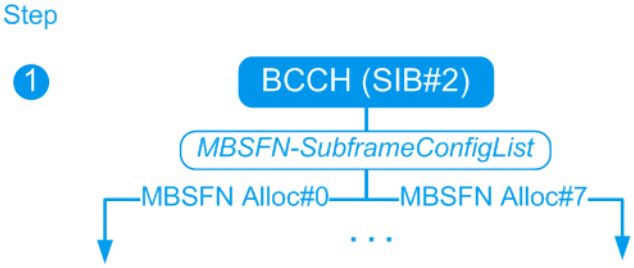


Figure 4-2: MBSFN Signaling (step 1)

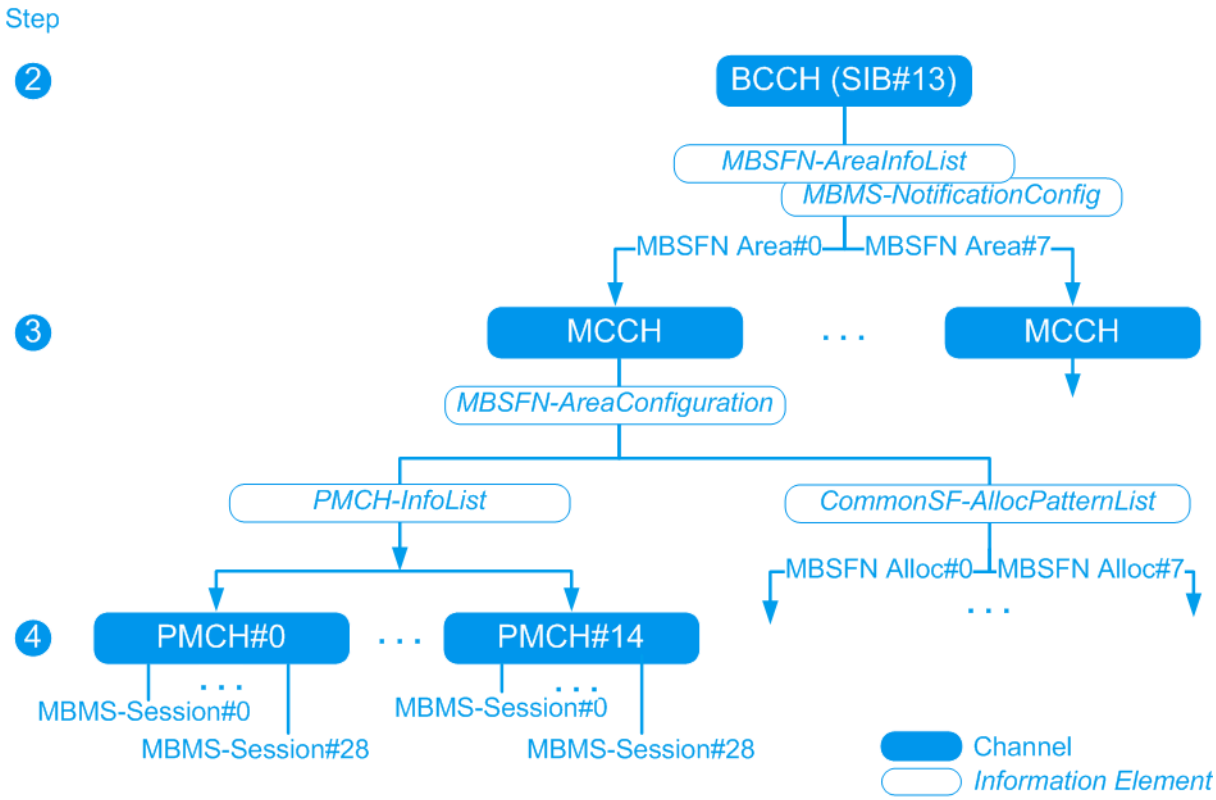


Figure 4-3: MBSFN Signaling (steps 2 to 4)

Example: MBSFN Resource Allocation

This example shows the MBSFN resource allocation for the settings listed in the following table. Use the default values for the other parameters.

ARB Sequence Length

The generation of a signal with cyclically repeating MBSFN pattern requires an "ARB sequence length" equal to the "MCCH repetition period" or to the "MCCH modification period".

The maximum value of the ARB sequence length depends on the selected channel bandwidth and on the memory size option of the generator.

Parameter	Value
EUTRA/LTE > Duplexing	FDD
EUTRA/LTE > Sequence Length	512 Frames
General DL Settings > Channel Bandwidth	1.4 MHz
General DL Settings > MBSFN Mode	Mixed
Radio Frame Allocation Period	8 Frames
Radio Frame Allocation Offset	2 Frames

Parameter	Value
Subframe Allocation Mode	4 Frames
Allocation value (HEX)	AAAAAA
MCCH State	On
MCCH Repetition Period	128 Frames
MCCH Modification Period	512 frames
Notification Repetition Coefficient	2 Frames
Notification Subframe Index	4, i.e. the MCCH change notification on PDCCH is transmitted on subframe#6
Common Subframe Allocation Period	64 Frames, i.e. the PMCH scheduling is repeated after 64 frames
Number of PMCHs	3
PMCH#0: SF Alloc Start/SF Alloc EndSF Alloc End	5
PMCH#0: MCH Scheduling Period	8
PMCH#1: SF Alloc End	7
PMCH#1: MCH Sched. Period	8
PMCH#2: SF Alloc End	95 (automatically calculated)
PMCH#2: MCH Sched. Period	8

See Figure 4-4 for an illustration of the resource allocation.

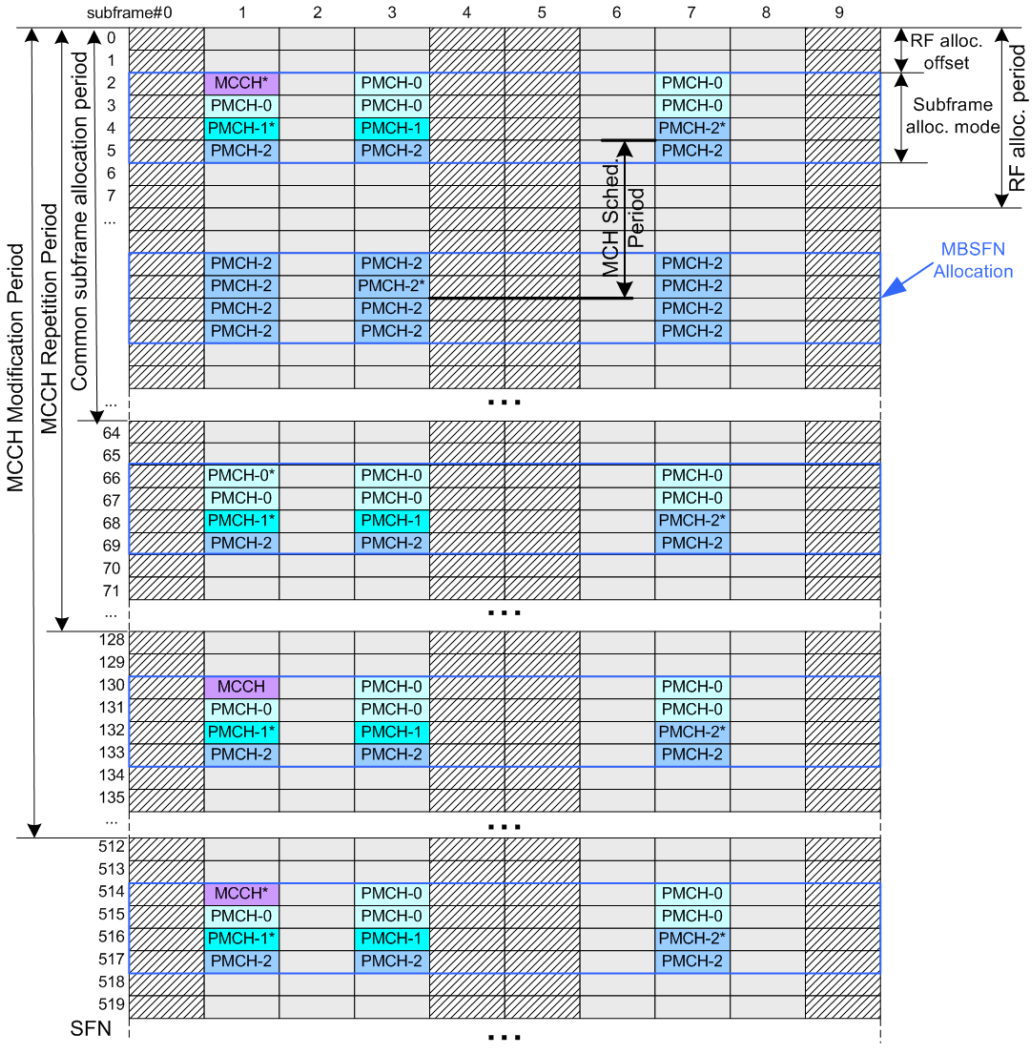


Figure 4-4: Example of MBSFN resource allocation

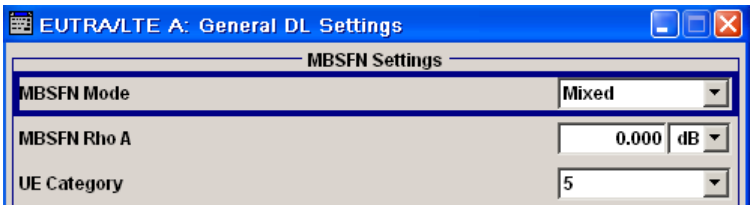
SFN	= System Frame Number
Pattern subframes	= Subframes not allowed to be scheduled as MBSFN subframes
Grey subframes	= MBSFN subframes not used for MBMS transmission, i.e. regular LTE subframes that can be used for allocation of DL signal
MCCH*	= First MCCH in a new MCCH modification period
PMCH-0*/PMCH-1*/ PMCH-2*	= First PMCH of one MCH scheduling period.

By default, the SFN (System Frame Number) starts with 0. Use the parameter SFN Offset to adjust the start value.

If PRS and MBSFN are configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely (see Example "Overlapping PDSCH, PRS and MBSFN" on page 103).

To access the MBSFN dialog:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > MBSFN".
3. Select "MBSFN Mode > Mixed".



This dialog comprises the parameters necessary to configure an MBSFN transmission:

MBSFN Mode....84
MBSFN Rho A....84
UE Category....84
Subframe Config (SIB Type 2)....84
- Radio Frame Allocation Period....85
- Radio Frame Allocation Offset....85
- Subframe Allocation Mode....85
- Allocation value (HEX)....85

Area Info (SIB Type 13)....85
- MBSFN-AreaInfoList Parameters....86
  - Area ID (N_ID_MBSFN)....86
  - Non-MBSFN Region Length....86
  - Notification Indicator....86
  - MCCH State....87
  - MCCH Repetition Period....87
  - MCCH Offset....87
  - MCCH Modification Period....87
  - Allocation Value (HEX)....87
  - MCCH MCS....87
  - MCCH Modulation....87
  - MCCH Transport Block Size....88
  - MCCH Data Source....88
- MBSFN-NotificationConfig Parameters....88
  - Notification Repetition Coefficient....88
  - Notification Offset....88
  - Notification Subframe Index....88
  - Notification Pattern....89

PMCH Structure....89
- Common Subframe Allocation Period....89
- PMCH-InfoList Parameters....89
  - Number of PMCHs....89
  - SF Alloc Start/SF Alloc End....89
  - Use Table 2....90
  - MCS....90

└ Modulation 91
└ MCH Scheduling Period 91
└ Data Source 91
└ State 91

MBSFN Mode
Enables the MBSFN transmission and selects a mixed MBSFN Mode, i.e. the available subframes are shared between MBSFN and regular LTE operation.

Note: Dedicated MBSFN Mode (i.e. all subframes are used for MBSFN solely) will be supported in a later version.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE` on page 578

MBSFN Rho A
Defines the power of the MBSFN channels relative to the common Reference Signals.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA` on page 581

UE Category
Defines the UE category as defined in TS 36.306.

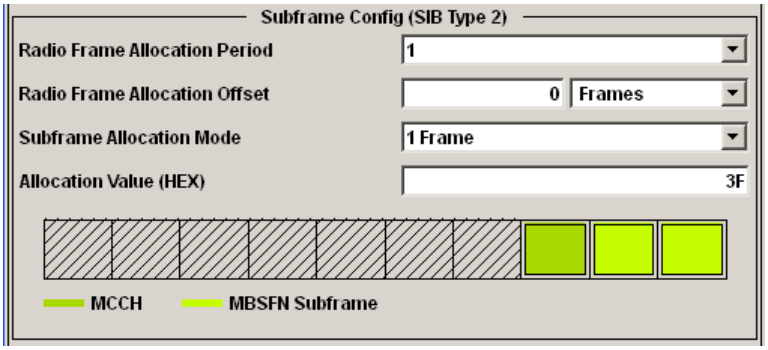
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC` on page 583

Subframe Config (SIB Type 2)
This section comprises settings for configuration of the general MBSFN structure, i.e. it defines which subframes are used for MBSFN transmission. In the “real” system, these values are transmitted via the System Information Block (SIB) Type 2.

The parameters in this section correspond to the MBMS information element *MBSFN-SubframeConfig*, as defined in TS 36.331.

The graph in this section displays the currently reserved MBSFN subframes. To select a subframe as MBSFN subframe, click on this subframe.

Note: The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.
Also, the content of the MCCH is not generated automatically, but has to be set manually, by selecting the data source.



Radio Frame Allocation Period ← Subframe Config (SIB Type 2)
Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

```
SFN mod radioFrameAllocationPeriod = radioFrameAllocationOffset
```

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER` on page 582

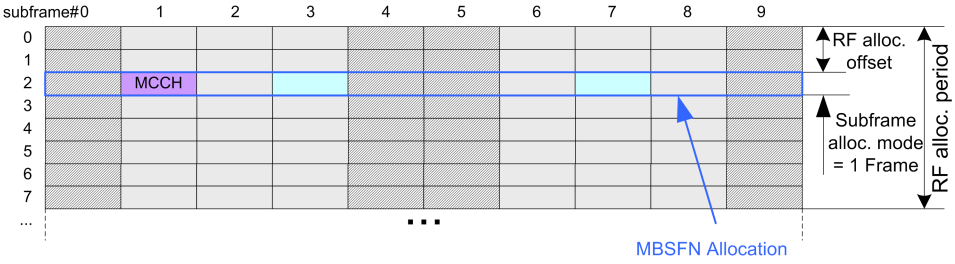
Radio Frame Allocation Offset ← Subframe Config (SIB Type 2)
Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

```
SFN mod radioFrameAllocationPeriod = radioFrameAllocationOffset
```

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset` on page 582

Subframe Allocation Mode ← Subframe Config (SIB Type 2)
Defines whether MBSFN periodic scheduling is 1 or 4 frames.

The figure in Example "MBSFN Resource Allocation" on page 80 shows an MBSFN allocation composed of 4 frames. The following figure displays an MBSFN allocation with "Subframe allocation mode" set to 1 frame.



Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe` on page 582

Allocation value (HEX) ← Subframe Config (SIB Type 2)
Defines which MBSFN subframes are allocated.

This parameter is identical to the bitmap defined by the field *subframeAllocation* of the MBMS information element *MBSFN-SubframeConfig*.

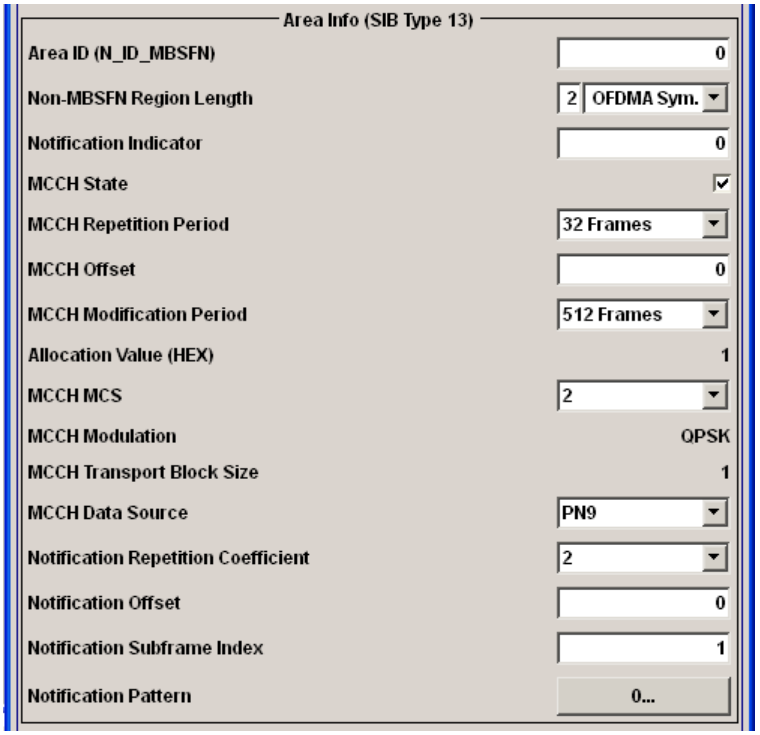
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL` on page 583

Area Info (SIB Type 13)
This section comprises settings for configuration of the general MBSFN area info, i.e. it defines where to find the MCCH. In the “real” system, these values are transmitted via the System Information Block (SIB) Type 13.

The parameters in this section correspond to the MBMS information elements *MBSFN-AreaInfoList* and *MBSFN-NotificationConfig*, as defined in TS 36.331.

Note: The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.

Also the content of the MCCH is not generated automatically, but has to be set manually, by selecting of a data source.



MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
This section comprises the parameters of the MBMS information element *MBSFN-AreaInfoList*.

Area ID (N_ID_MBSFN) ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines the MBSFN area ID, parameter N_{id}^{MBSFN}.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID` on page 573

Non-MBSFN Region Length ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL` on page 578

Notification Indicator ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area. Value 0 corresponds to the least significant bit as defined for the DCI Format 1C.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND` on page 577

MCCH State ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Enables/disables the MCCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe on page 577

MCCH Repetition Period ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines the interval between transmissions of MCCH information in radio frames.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER on page 577

MCCH Offset ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Indicates, together with the "MCCH repetition period", the radio frames in which MCCH is scheduled. MCCH is scheduled in radio frames for which:

SFN mod "MCCH repetition period" = "MCCH offset"

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS on page 576

MCCH Modification Period ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines periodically appearing boundaries, i.e. radio frames for which the following equation is fulfilled:

SFN mod "MCCH modification period" = 0

The contents of different transmissions of MCCH information can only be different if there is at least one such boundary in-between them.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER on page 575

Allocation Value (HEX) ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

Note: In the current implementation, the MCCH is always mapped to the first active MBSFN subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL? on page 573

MCCH MCS ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS on page 574

MCCH Modulation ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Displays the values as determined by the "MCCH MCS".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation? on page 574

MCCH Transport Block Size ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Displays the values as determined by the "MCCH MCS".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize? on page 577

MCCH Data Source ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)
Sets the data source used for the MCCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA on page 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt on page 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern on page 576

MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)
This section comprises the parameters of the MBMS information element *MBSFN-NotificationConfig*.

Notification Repetition Coefficient ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)
Selects the current change notification repetition period common for all MCCHs that are configured. The notification repetition period is calculated as follows:

change notification repetition period = shortest modification period/ "Notification repetition coefficient"

Where the *shortest modification period* corresponds with the value of the selected "MCCH modification period".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC on page 575

Notification Offset ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)
Defines, together with the "Notification Repetition Coefficient", the radio frames in which the MCCH information change notification is scheduled, i.e. the MCCH information change notification is scheduled in radio frames for which:

SFN mod notification repetition period = "Notification offset"

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset on page 575

Notification Subframe Index ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)
Defines the subframe used to transmit MCCH change notifications on PDCCH.

In FDD: Value 1, 2, 3, 4, 5 and 6 correspond with subframe #1, #2, #3, #6, #7 and #8 respectively

In TDD: Value 1, 2, 3, 4 and 5 correspond with subframe #3, #4, #7, #8 and #9respectively

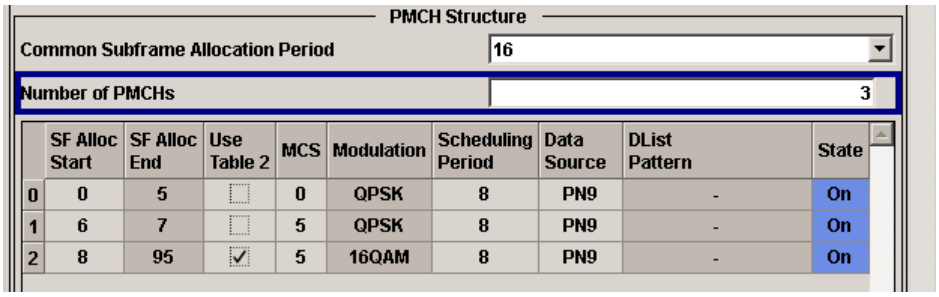
Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI on page 576

Notification Pattern ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)
Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern on page 575

PMCH Structure
This section comprises settings for configuration of the PMCH structure, i.e. where to find a PMCH carrying a certain MTCH. In the “real” system, these values are transmitted via the MCCH (*MBSFNAreaConfiguration*).

The parameters in this section correspond to the MBMS information elements *MBSFNAreaConfiguration* and *PMCH-InfoList*, as defined in TS 36.331.



Common Subframe Allocation Period ← PMCH Structure
Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCHs that are configured for this MBSFN area.

The subframe allocation patterns, as defined by *commonSF-Alloc*, repeat continuously during this period.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP on page 578

PMCH-InfoList Parameters ← PMCH Structure
Comprises the parameters of the *PMCH-InfoList*.

Number of PMCHs ← PMCH-InfoList Parameters ← PMCH Structure
Defines the number of PMCHs in this MBSFN area.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs on page 579

SF Alloc Start/SF Alloc End ← PMCH-InfoList Parameters ← PMCH Structure
Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

The subframes allocated to (P)MCH corresponding with the n^{th} entry in *pmch-InfoList* are the subsequent subframes starting from either the subframe identified by "SF Alloc End" of the $(-1)^{th}$ listed (P)MCH or, for n=1, the first subframe, through the subframe identified by "SF Alloc End" of the n^{th} listed (P)MCH. Value 0 corresponds with the first subframe defined by field *commonSF-Alloc*.

Note: Configuring the MCHs ("SF Allocation Start" values) from bottom to top. Although the 3GPP specification defines the "SF Alloc End" parameter as the only one required, in this implementation it is mandatory to define the "SF Alloc Start" instead. The implemented algorithm uses the selected "SF Alloc Start" and calculates automatically the "SF Alloc End" of the corresponding MCH. The algorithm applies the internal rule, that there is no gap between two consequent MCHs.

It is therefore recommended to configure the MCHs, i.e. define the "SF Alloc Start" values, from bottom to the top. This workaround prevents the configuration of overlapping MCHs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart` on page 581
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd` on page 581

Use Table 2 ← PMCH-InfoList Parameters ← PMCH Structure
(requires option R&S SMBV-K113)

Defines which of the two tables defined in TS 36.213 is used to specify the used modulation and coding scheme (see MCS and Modulation):

- "Use Table 2 > Off": Table 7.1.7.1-1 is used
- "Use Table 2 > On": Table 7.1.7.1-1A is used.

Example:

For "MCS = 5" and "Use Table 2 > Off", the used modulation is "Modulation > QPSK".

If "Use Table 2 > On", the used modulation changes to "Modulation > 16QAM".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCSTwo` on page 580

MCS ← PMCH-InfoList Parameters ← PMCH Structure
Defines the value for parameter according to TS 36.213 Table 7.1.7.1-1 or Table 7.1.7.1-1A, which defines the Modulation and Coding Scheme (MCS) applicable for the subframes of this (P)MCH as indicated by the field *commonSF-Alloc*. The MCS does however neither apply to the subframes that may carry MCCH, i.e. the subframes indicated by the field *sf-AllocInfo* within System Information Block Type 13, nor for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by the MAC).

To select which one of the two tables Table 7.1.7.1-1 or Table 7.1.7.1-1A is used, use the parameter Use Table 2. Using Table 7.1.7.1-1A requires option R&S SMBV-K113.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS` on page 580

Modulation ← PMCH-InfoList Parameters ← PMCH Structure
Indicates the used modulation, as defined with:

- Use Table 2
- MCS

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MOD?` on page 581

MCH Scheduling Period ← PMCH-InfoList Parameters ← PMCH Structure
Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

Note: The first subframe of the scheduling period may contain the MAC control element and therefore uses MCS of MCCH (however, the data source from PMCH is still used).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod` on page 581

Data Source ← PMCH-InfoList Parameters ← PMCH Structure
Sets the data source for this PMCH/MTCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA` on page 579
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt` on page 579
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern` on page 580

State ← PMCH-InfoList Parameters ← PMCH Structure
Enables/disables the selected PMCH/MTCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:STATe` on page 579

4.2.4 Physical Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Physical".

   In this dialog, the channel bandwidth respectively the number of resource blocks per slot is selected. The other parameters are fixed and read-only.

Channel Bandwidth....92
Number of Resource Blocks Per Slot....92
FFT Size....93
Number of eMTC Narrorbands....93
Physical Resource Block Bandwidth....93
Occupied Bandwidth....93

Sampling Rate....93
Number Of Occupied Subcarriers....94
Number Of Left/Right Guard Subcarriers....94

Channel Bandwidth
Sets the channel bandwidth of the EUTRA/LTE system.

The 3GPP specification defines bandwidth agonistic layer 1 where the channel bandwidth is determined by specifying the desired number of resource blocks. However, the current EUTRA standardization focuses on six bandwidths.

- "1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz"
  Select a predefined channel bandwidth.
  The parameter "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".
  The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If necessary, adjust the "FFT Size".
  See also Table 3-1 for an overview of the cross-reference between the parameters.
  If "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected, the "1.4 MHz" bandwidth is supported by LTE and eMTC; the NB-IoT-specific settings are not available for configuration.
- "200 kHz"
  Option: R&S SMBV-K115
  This channel bandwidth is **dedicated to NB-IoT**. It is available, if "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected.
  If channel bandwidth of 200 kHz is used, the LTE or eMTC-specific settings are not available for configuration. Available is only one NB-IoT carrier which works in standalone mode (Mode = "Standalone").
- "User"
  Option: R&S SMBV-K55
  Provided for backward compatibility with previous version of this software, this parameter allows you to select a user-defined bandwidth as number of resource blocks.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:BW` on page 543

Number of Resource Blocks Per Slot
Indicates the number of used resource blocks for the selected "Channel Bandwidth".

"Channel Bandwidth"	"Number of Resource Blocks Per Slot (UL)"
"1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz"	Read-only value, set automatically as function of the "Channel Bandwidth" and "Physical Resource Block Bandwidth"
"User"	"Channel Bandwidth" depends on the "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth"

The sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If necessary, adjust the value of "FFT Size".

See also Table 3-1.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NORB on page 543

FFT Size
Sets the FFT (Fast Fourier Transformation) size.

You can change the FFT size for all bandwidth definitions if the following conditions are met:

- For a specific bandwidth, all FFT sizes are applicable as long as the size is greater than the number of occupied subcarriers.
  By default, the smallest available FFT size is selected.
- To decrease the number of unused guard subcarriers and the resulting sampling rate, for channel bandwidth of 15 MHz an FFT size of 1536 is provided, too.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:FFT on page 544

Number of eMTC Narrorbands
Option: R&S SMBV-K115

This parameter is **dedicated to eMTC** and available if "Mode > eMTC/NB-IoT or LTE/ eMTC/NB-IoT" is selected.

It indicates the number of eMTC narrowbands N_{RB}^{DL} available within the selected channel bandwidth.

The value is calculated as follows:

"Number of Narrorbands" = "Number of Resource Blocks" / 6

For more information, see "Narrowbands" on page 310.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NNBands? on page 781

Physical Resource Block Bandwidth
Displays the bandwidth of one physical resource block. The value is fixed to 12 x 15 kHz.

Remote command:
n.a.

Occupied Bandwidth
Displays the occupied bandwidth, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth? on page 544

Sampling Rate
Displays the sampling rate, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:SRATe? on page 543

Number Of Occupied Subcarriers
Displays the number of occupied subcarriers, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?` on page 544

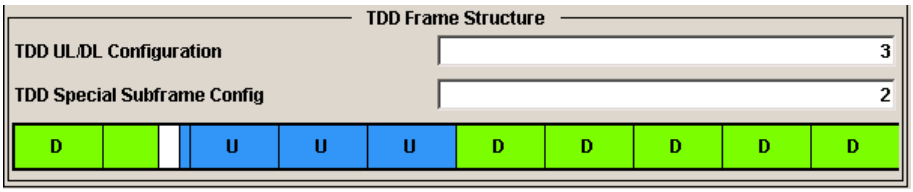
Number Of Left/Right Guard Subcarriers
Displays the number of left/right guard subcarriers, calculated form the parameter "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LGS?` on page 544
`[:SOURce<hw>]:BB:EUTRa:DL:RGS?` on page 545

4.2.5 TDD Frame Structure Settings

Access:

► Select "EUTRA/LTE > Duplexing > TDD".



The TDD frame is configured by adjusting the UL/DL configuration and the special subframe configuration (see also Chapter 3.1.1.1, "OFDMA Parameterization", on page 19).

TDD UL/DL Configuration
Sets the UL/DL configuration number and defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:UDConf` on page 537

TDD Special Subframe Config
Sets the special subframe configuration number and together with the parameter "Cyclic Prefix" defines the lengths of the DwPTS, the guard period (GP) and the UpPTS.

The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf` on page 537

Number of UpPTS Symbols
Option: R&S SMBV-K119 (if "Mode = LTE")

For TDD Special Subframe Config = 10, sets the number of UpPTS symbols.

In all other configurations, the number of UpPTS symbols is set automatically depending on:
- "TDD UL/DL Configuration" on page 94
- "TDD Special Subframe Config" on page 94.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:UPTS` on page 537

4.2.6 Cell-Specific Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Cell".

   The "Cell-Specific Settings" section comprises the physical layer cell identity settings and the DL power control settings.

Cell ID 95
Physical Cell ID Group 96
Physical Layer ID 96
Cyclic Prefix (General DL Settings) 96
UL/DL Cyclic Prefix 96
PDSCH P_B 96
PDSCH/PDCCH/PBCH Ratio rho_B/rho_A 97
PHICH Duration 97
PHICH N_g 97
RA_RNTI 98

Cell ID
Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID

There is a cross-reference between the values of these three parameters and changing of one of them results in adjustment in the values of the others.

The Cell ID determinates:
- The downlink reference signal pseudo-random sequence
- The frequency shifts of the reference signal
- The S-SYNC sequence
- The cyclic shifts for PCFICH, PHICH and PDCCH mapping
- The pseudo-random sequence used for scrambling

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CID on page 545

Physical Cell ID Group
Sets the physical cell identity group.

To configure these identities within a cell ID group, set the parameter Physical Layer ID.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CIDGroup on page 545

Physical Layer ID
Sets the identity of the physical layer within the selected physical cell identity group, set with parameter Physical Cell ID Group .

The physical layer ID determinates the Zadoff-Chu orthogonal sequence carried by the PSS (P-SYNC) and used for cell search.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:PLID on page 546

Cyclic Prefix (General DL Settings)
Sets the cyclic prefix length for all subframes.

The number of the OFDM symbols is set automatically.

"Normal"	Normal cyclic prefix, i.e. the DL slot contains seven OFDM symbols.
"Extended"	Extended cyclic prefix, i.e. the DL slot contains six OFDM symbols. The extended cyclic prefix is defined to cover large cell scenarios with higher delay spread and MBMS transmission. NB-IoT allocations cannot be activated.
"User Defined"	To set the cyclic prefix length per subframe, use the parameter "DL Frame Configuration" > "Cyclic Prefix".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CPC on page 546

UL/DL Cyclic Prefix
In "Duplexing > TDD", determines the cyclic prefix for the appropriate opposite direction.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:DLCPc on page 555
[:SOURce<hw>]:BB:EUTRa:DL:ULCPc on page 546

PDSCH P_B
Defines the cell-specific ratio rho_B/rho_A according to TS 36.213 (Table 5.2-1).

The following table gives an overview of the resulting values of the parameter "PDSCH Ratio rho_B/rho_A" as function of the values for the parameter [PDSCH P_B] and the number of configured antennas.

PDSCH P_B	1 Tx antenna	2 or 4 Tx antennas
0	0.000 dB	0.969 dB
1	-0.969 dB	0.000 dB
2	-2.218 dB	-1.249 dB
3	-3.979 dB	- 3.010 dB

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB on page 547

PDSCH/PDCCH/PBCH Ratio rho_B/rho_A
Displays or sets the transmit energy ratio among the resource elements allocated for PDSCH/PDCCH/PBCH in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

The PDSCH value is calculated form the parameter PDSCH P_B. It also depends on the number of configured antennas.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa on page 547
[:SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa on page 547
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa on page 547

PHICH Duration
Sets the PHICH duration, i.e. the allocation of the PHICH resource element groups over the OFDM symbols.

The value selected puts the lower limit of the size of the PCFICH Settings that is signaled by the PCFICH.

If Activate Carrier Aggregation > "On", you can define the PHICH duration per component carrier.

"Normal" All resources element groups of PHICH (see Number of PHICH Groups) are allocated on the first OFDM symbol (OFDM Symbol 0).

"Extended" The resources element groups of PHICH are distributed over three OFDM symbols for a normal subframe or over two symbols within a special one.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:DURation on page 587

PHICH N_g
Sets the parameter N_g according to TS 36.211, section 6.9.

If Activate Carrier Aggregation > "On", you can define the PHICH duration per component carrier.

"1/6, 1/2, 1, 2" The used Number of PHICH Groups for the different subframes is calculated according to the following formula:

$$N_{PHICH}^{group} = \begin{cases} \lceil N_g (N_{RB}^{DL}/8) \rceil & \text{for normal cyclic prefix} \\ \lceil 2 \cdot N_g (N_{RB}^{DL}/8) \rceil & \text{for extended cyclic prefix} \end{cases}$$

In FDD mode, the calculated value corresponds directly to the parameter "Number of PHICH Groups".
In TDD mode, the number of PHICH groups is calculated as the product of the N^{group}_{PHICH} value multiplied with a coefficient selected from the following table.

UL/DL Configuration	Subframe number									
	0	1	2	3	4	5	6	7	8	9
0	2	1	-	-	-	2	1	-	-	-
1	0	1	-	-	1	0	1	-	-	1
2	0	0	-	1	0	0	0	-	1	0
3	1	0	-	-	-	0	0	0	1	1
4	0	0	-	-	0	0	0	0	1	1
5	0	0	-	0	0	0	0	0	1	0
6	1	1	-	-	-	1	1	-	-	1

The parameter Number of PHICH Groups is read-only.

"Custom" (for Activate Carrier Aggregation > "Off")
The parameter Number of PHICH Groups is configurable.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:NGParameter` on page 588

RA_RNTI
Sets the random-access response identity RA-RNTI for the users.

The value selected here determined the value of the parameter UE_ID/n_RNTI in case a RA_RNTI "User" is selected.

See UE_ID/n_RNTI.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNti` on page 546

4.2.7 Downlink Signals Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".

2. Select "General DL Settings > Signals".

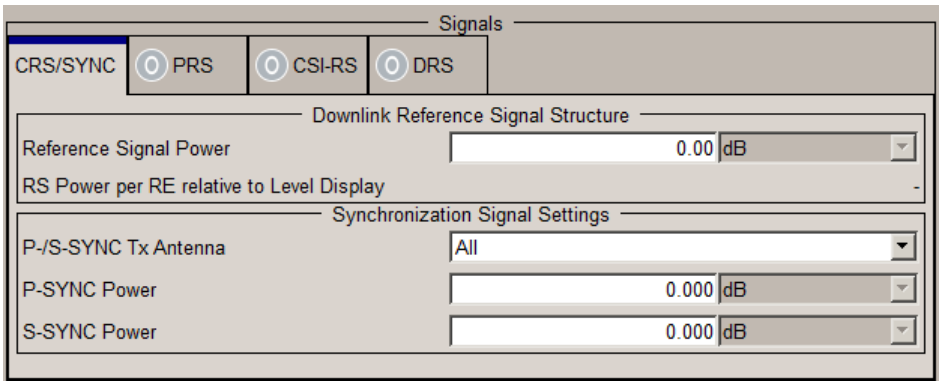
   The "Signals" dialog comprises the settings of all DL signals.

- Synchronization and Cell-specific Reference Signals (CRS/SYNC) Settings.....99
- NB-IoT Synchronization and Cell-specific Reference Signals (NRS/N-SYNC) Settings.....100
- Positioning Reference Signal (PRS) Settings.....101
- CSI-RS Settings.....106
- Discovery Reference Signals (DRS) Settings.....113

4.2.7.1 Synchronization and Cell-specific Reference Signals (CRS/SYNC) Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Signals > CRS/SYNC".



The dialog comprises the "Downlink Reference Signal Structure" and the "Synchronization Signal Settings" sections. Use these settings to set the power level of the reference signals and the P-/S-SYNC and to enable/disable the P-/S-SYNC.

Downlink Reference Signal Structure
Comprises the downlink reference signal settings, like the power of the reference signals.

For an overview of the provided power settings and detailed information on how to adjust them, refer to Chapter 8.2, "Adjusting the Signal Power", on page 501.

Reference Signal Power ← Downlink Reference Signal Structure
Sets the power of the reference signal (PRS relative).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer` on page 541

RS Power per RE relative to Level Display ← Downlink Reference Signal Structure
If "EUTRA/LTE > State = On", displays the power of the reference signal (RS) per resource element (RE) relative to the power value, displayed in the status bar ("Level").

If a MIMO configuration is enabled, the value of this parameter is equal for all antennas; this applies also for the antenna configured in the path B.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE?` on page 541

Synchronization Signal Settings
In the "Synchronization Signal Settings" section, the power of the P-SYNC/S-SYNC is set.

P-/S-SYNC Tx Antenna ← Synchronization Signal Settings
Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna` on page 542

P-SYNC Power ← Synchronization Signal Settings
Sets the power of the P-SYNC allocations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer` on page 542

S-SYNC Power ← Synchronization Signal Settings
Sets the power of the S-SYNC allocations.

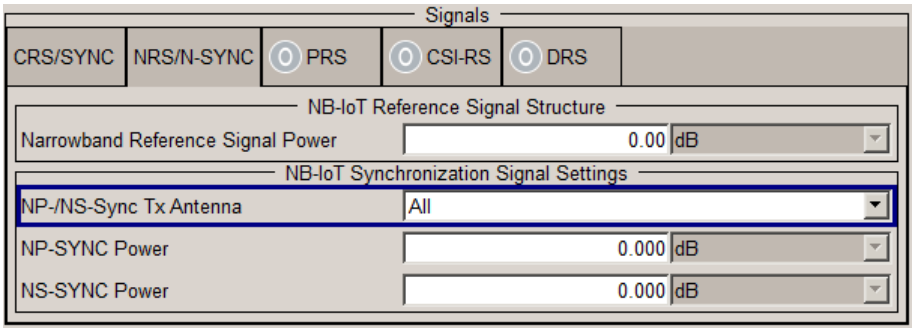
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer` on page 542

4.2.7.2 NB-IoT Synchronization and Cell-specific Reference Signals (NRS/N-SYNC) Settings

Option: R&S SMBV-K115

Access:

1. Select "Mode > LTE/eMTC/NB-IoT"
2. Select "General > Link Direction > Downlink (OFDMA)".
3. Select "General DL Settings > Physical > Channel Bandwidth ≥ 1.4 MHz"
4. Select "General DL Settings > Signals > NRS/N-SYNC".



NRS/N-SYNC (NPSS/NSSS)
Option:R&S SMBV-K115

Access: "General DL Settings > Physical > Channel Bandwidth ≥ 3 MHz" and "Signals > NRS/N-SYNC".

Comprises the NB-IoT Signals NRS and NPSS/NSSS settings.

Narrowband Reference Signal Power ← NRS/N-SYNC (NPSS/NSSS)
Sets the power of the narrowband reference signal (NRS).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:REFSig:NIOT:POWer` on page 781

NP-/NS-Sync Tx Antenna ← NRS/N-SYNC (NPSS/NSSS)
Defines on which antenna port the NPSS/NSSS are transmitted.

The available values depend on the number of configured antennas, see NB-IoT MIMO Configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:TXANtenna` on page 782

NP-SYNC Power/NS-SYNC Power ← NRS/N-SYNC (NPSS/NSSS)
Sets the power of the NPSS/NSSS allocations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NPPWr` on page 782
`[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NSPWr` on page 782

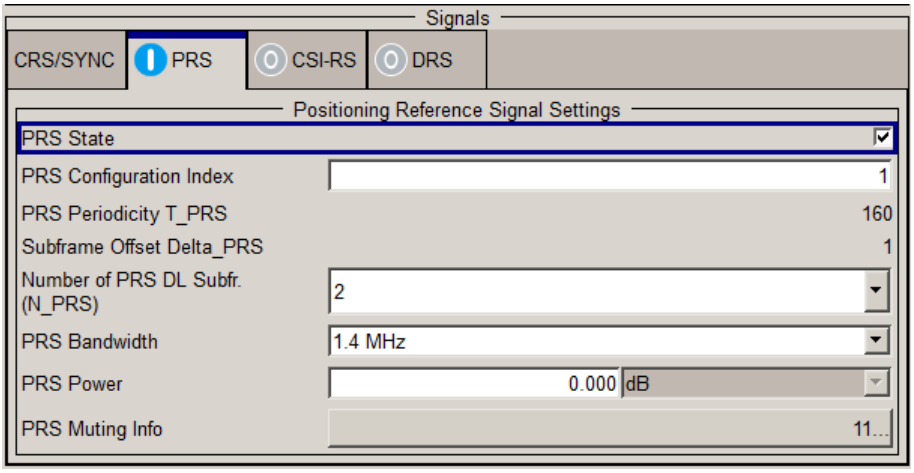
4.2.7.3 Positioning Reference Signal (PRS) Settings

Option: R&S SMBV-K84.

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".

2. Select "General DL Settings > Positioning Reference Signal Settings".



This section comprises the setting necessary to configure the positioning reference signals (PRS). See also "Positioning Reference Signals" on page 30.

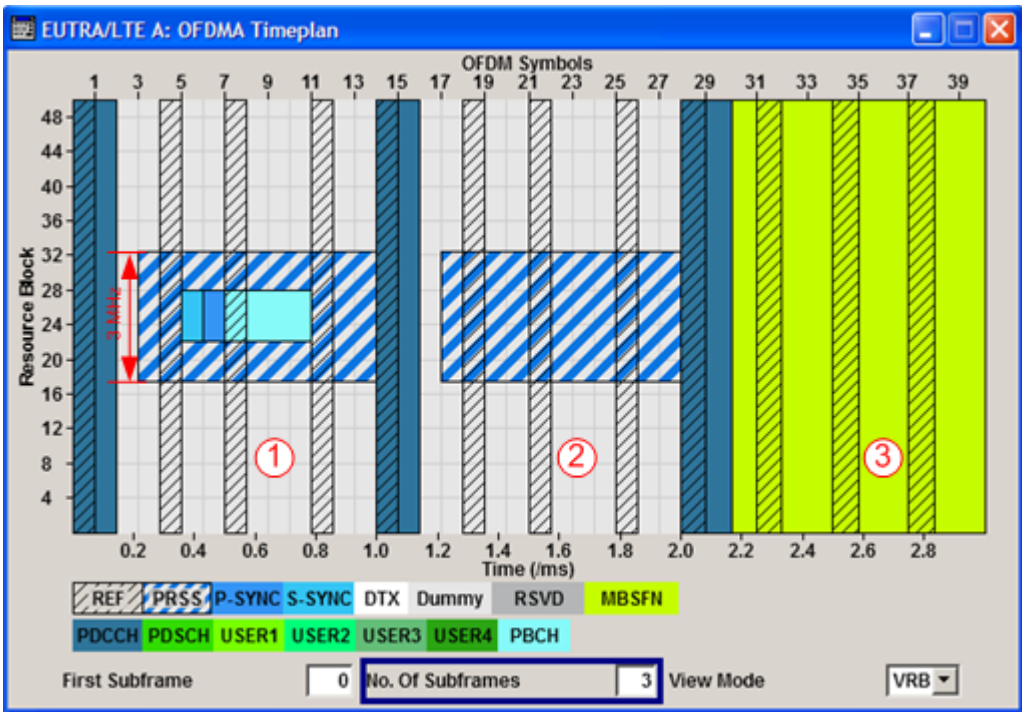
If PRS and MBSFN are configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks is skipped then.

Example: Overlapping PDSCH, PRS and MBSFN

Perform the following settings:

- PRS State = ON
- PRS Configuration Index = 0
- Number of PRS DL Subframes (N_PRS) = 2
- PRS Bandwidth = 3 MHz
- MBSFN Mode = Mixed
- Use the OFDMA Time Plan to visualize the allocation of the PRSs.



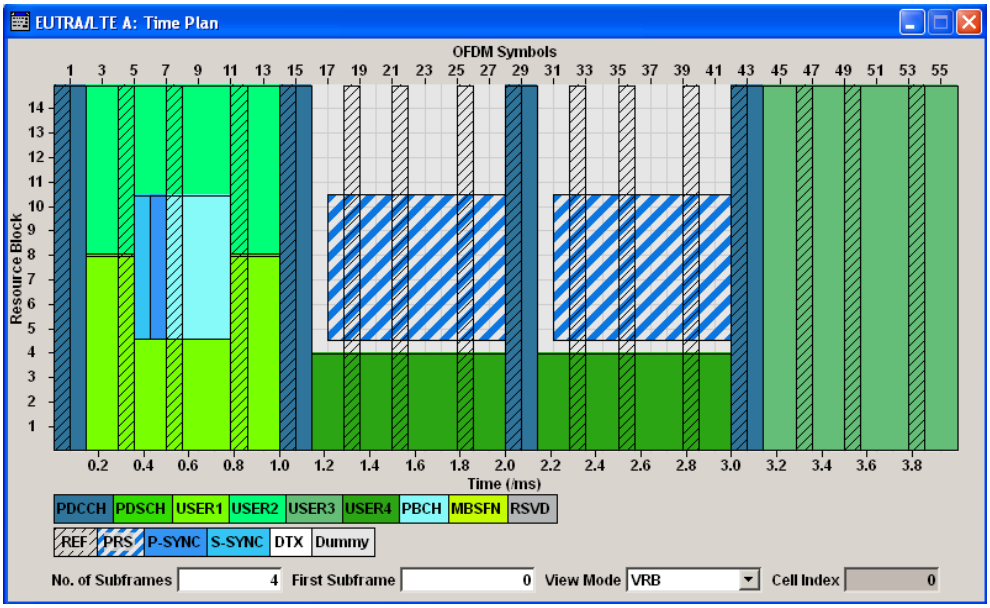
1 = PDSCH and PRS are overlapping in the subframe#0
2 = MBSFN is ignored in subframe#1
1+2 = two consequent PRS subframes with 3 MHz Bandwidth, i.e. one PRS occasion
3 = first MBSFN subframe

Example: How to visualize the effect of muting and omitting PRS transmission

Perform the following settings:

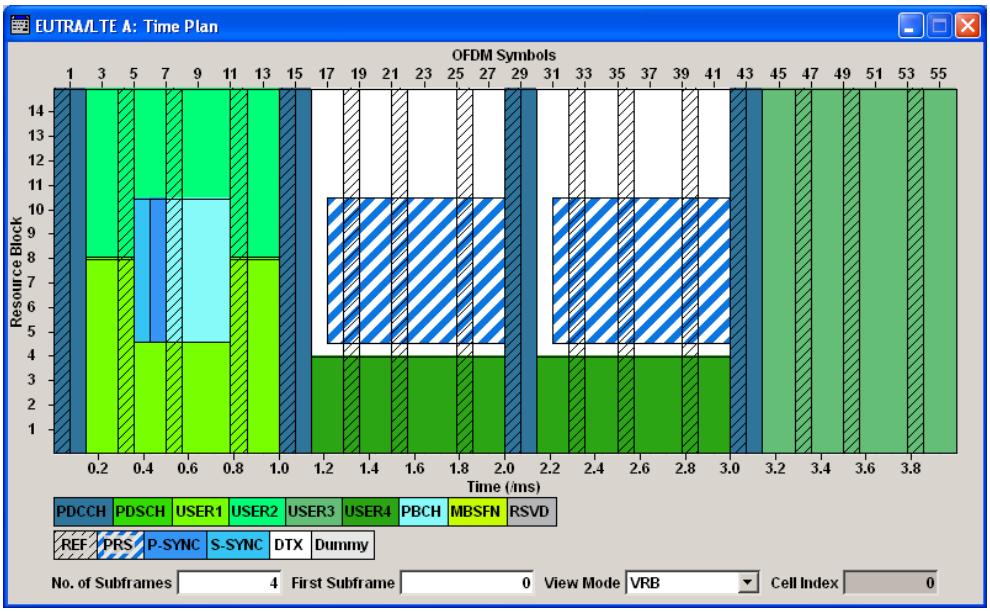
- Select "EUTRA/LTE > General DL Settings > Physical > Channel Bandwidth = 3 MHz"
- Select "EUTRA/LTE > DL Frame Configuration > Subframe Config" and configure the subframes.
- Select "EUTRA/LTE > General DL Settings > Signals > PRS", use the default settings, and enable the following:
  - "PRS Configuration Index = 1"
  - "Number of PRS DL Subframes (N_PRS) = 2"
  - "PRS State > On"

- Select "EUTRA/LTE > DL Frame Configuration" and open the OFDMA Time Plan to visualize the configured allocations.



The time plan confirms the transmission of one PRS occasion, consisting of two consequent PRS subframes with 1.4 MHz bandwidth, transmitted in subframe#1 and subframe#2.

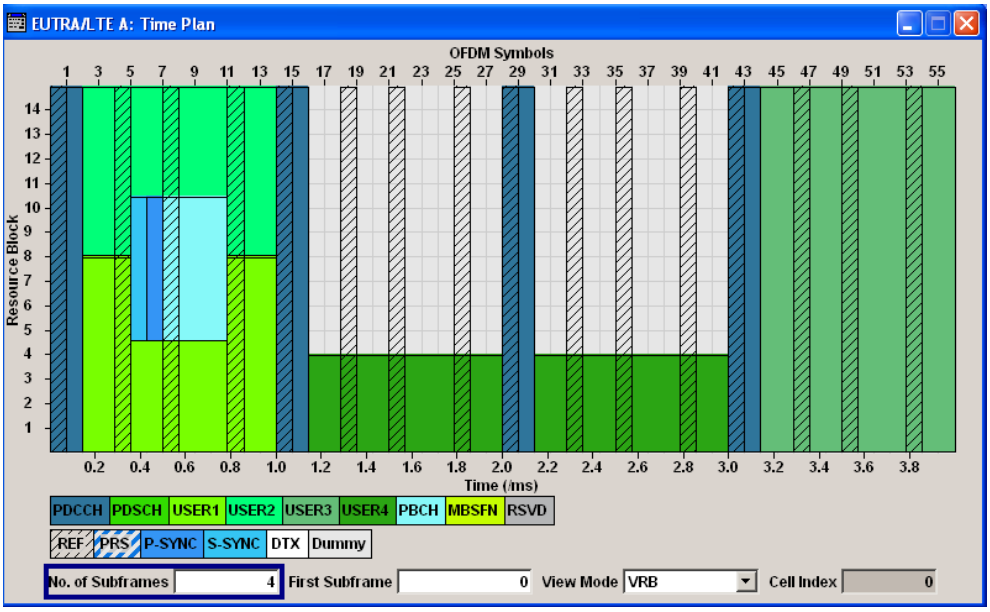
- Select "EUTRA/LTE > DL Frame Configuration > Behavior in Unsch. RE (OCGN) > Dummy Data"
- Select "EUTRA/LTE > DL Frame Configuration > Dummy Data Configuration > Omit PRS Subframes"
- Observe the allocations displayed on the time plan.



The time plan confirms that the PRS subframes are *not* filled in with DTX.

- Select "EUTRA/LTE > General DL Settings > PRS" and set "PRS Muting Info = 01"

- Observe the allocations displayed on the time plan.



The time plan confirms that the PRS is muted; there is no transmission of PRS in the subframe#1 and subframe#2. The muted PRS subframes are not omitted; the allocation-free resource blocks in these subframes are filled with DTX.

PRS State 105
PRS Configuration Index 105
PRS Periodicity T_PRS 105
PRS Subframe offset Delta_PRS 106
Number of PRS DL Subframes (N_PRS) 106
PRS Bandwidth 106
PRS Power 106
PRS Muting Info 106

PRS State
Enables the generation of the PRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe` on page 549

PRS Configuration Index
Sets the PRS Configuration Index I_{PRS} as defined in TS 36.211 (table 6.10.4.3-1).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI` on page 548

PRS Periodicity T_PRS
Displays the periodicity of the PRS generation (T_{PRS}) as defined in TS 36.211 (table 6.10.4.3-1).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?` on page 549

PRS Subframe offset Delta_PRS
Displays the subframe offset of the PRS generation ($Delta_{PRS}$) as defined in TS 36.211 (table 6.10.4.3-1).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?` on page 548

Number of PRS DL Subframes (N_PRS)
Defines the number of consecutive DL subframes in that PRS are transmitted. Several consecutive DL subframes build one PRS occasion.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS` on page 548

PRS Bandwidth
Defines the RBs in which the PRS is transmitted.

Note: The PRS Bandwidth must not be bigger than channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW` on page 547

PRS Power
Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW` on page 549

PRS Muting Info
Specifies a bit pattern that defines the muted and not muted PRS. The bit pattern can be 2, 4, 8 or 16 bit long, where each bit defines the PRS state of one PRS occasion. The parameter Number of PRS DL Subframes (N_PRS) defines the length of the PRS occasions.

See Example "How to visualize the effect of muting and omitting PRS transmission" on page 103

"0" PRS is muted in the corresponding PRS occasion.

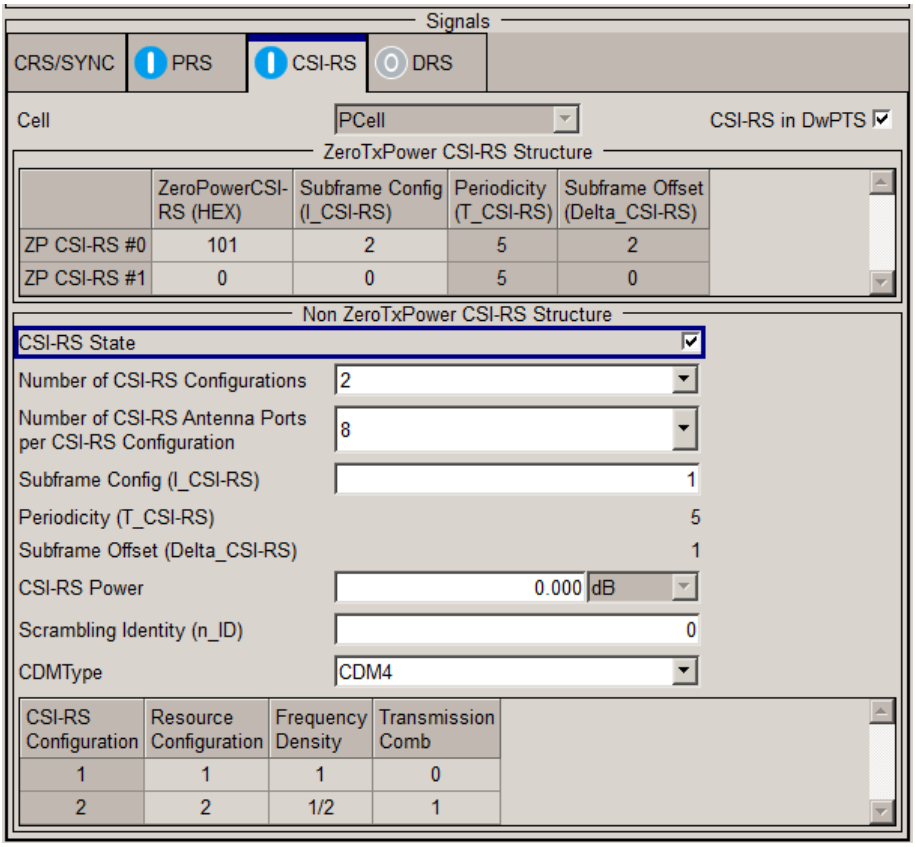
"1" PRS is not muted, i.e. PRS is transmitted in the corresponding PRS occasion.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PRSS:MIPattern` on page 550

4.2.7.4 CSI-RS Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Signals > CSI".



This dialog comprises the settings for configuring the channel-state information reference signal (CSI-RS) structure. For detailed information, see "CSI Reference Signals" on page 31.

The TS 36.211 specifies the occurrence of the CSI reference signal in the subframes as function of the subframe configuration period T_{CSI-RS} and the subframe offset $Delta_{CSI-RS}$. The available value ranges are listed in Table 4-3 [TS 36.211]. The parameter I_{CSI-RS} can be configured separately for the zero (ZeroTxPower CSI-RS Structure) and non-zero transmission power ("NonZeroTxPower CSI-RS Structure" on page 110) cases.

Table 4-3: CSI reference signal structure configuration

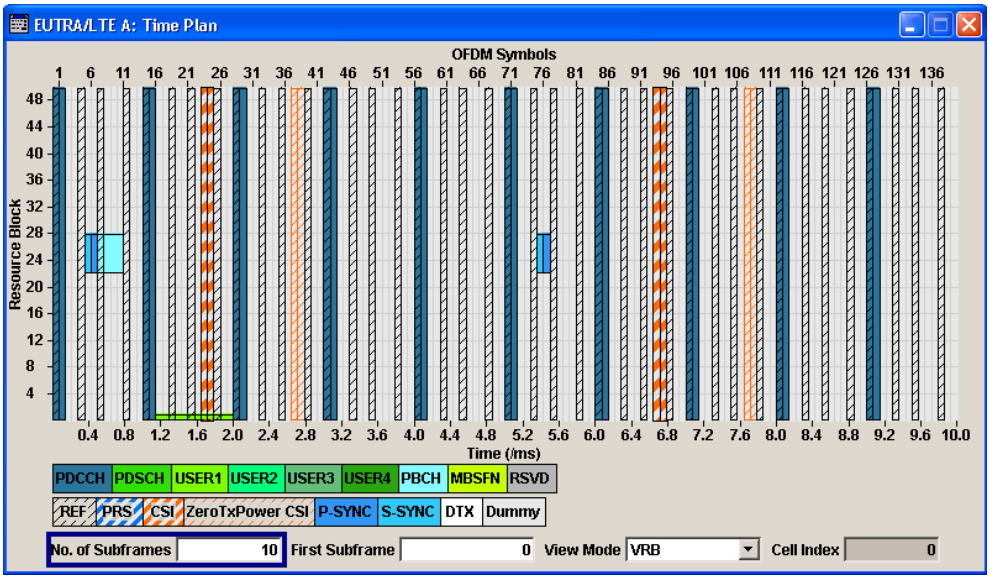
CSI-RS subframe configuration I_{CSI-RS}	**CSI-RS periodicity T_{CSI-RS} (subframes)**	**CSI-RS subframe offset $Delta_{CSI-RS}$ (subframes)**
0 to 4	5	I_{CSI-RS}
5 to 14	10	I_{CSI-RS} - 5
15 to 34	20	I_{CSI-RS} - 15
35 to 74	40	I_{CSI-RS} - 35
75 to 154	80	I_{CSI-RS} - 75

How to enable and visualize a CSI-RS transmission

1. Select "EUTRA/LTE > Set to Default".
2. Select "EUTRA/LTE > Link Direction > Downlink (OFDMA)".
3. Select "EUTRA/LTE > State > On".
4. Select "EUTRA/LTE > General Downlink Settings".
5. Select "General Downlink Settings > Signals > CSI-RS".
   Configure the settings as required.
   For example, enable the settings displayed in the figure above.
6. Enable "Cell-specific CSI-RS Structure > Subframe Config (I_CSI-RS) = 1".
7. Select "Cell-specific CSI-RS Structure > CSI-RS State > On".
   Close the dialog.
8. Select "EUTRA/LTE > Frame Configuration".
9. LAA is disabled in this example. If LAA is configured and thus "Scheduling > PDSCH Scheduling = Auto/DCI" is used, the "Subframe" setting are automatically configured. To observe the allocation of the physical resources, open the time plan (see step 10). Otherwise proceed as follows:
   Configure the subframe selected for the CSI-RS transmission:
   a) Select "Frame Configuration > Subframe = 1" to configure the subframe selected for the CSI-RS transmission.
   b) Set "No. of Used Allocations = 2".
      The allocation table displays the activated PDSCH allocation with the corresponding number of used "Phys. Bits".
   c) In the allocation table, for this PDSCH allocation, select "Ench. Settings > Config".
   d) In the "Enhanced Settings" dialog, select "CSI-RS > Awareness > On".
   e) In the allocation table, select the PDSCH allocation. Compare the number of used "Phys. Bits".

   The displayed information confirms, that less physical bits are allocated for the PDSCH, because some resources are reserved for the CSI-RS transmission.

   Tip: Use the parameter CSI Awareness State to inform an UE that a CSI-RS transmission is used.
10. Select "Frame Configuration > Time Plan".
    Set "No of Subframes = 10".



Cell 109
CSI-RS in DwPTS 110
ZeroTxPower CSI-RS Structure 110
- ZeroPowerCSI-RS (HEX) 110
- Subframe Config (I_CSI-RS) 110
- Periodicity (T_CSI-RS) 110
- Subframe Offset (Delta_CSI-RS) 110

NonZeroTxPower CSI-RS Structure 110
- CSI-RS State 110
- Number of CSI-RS Configurations 111
- Number of AP per CSI-RS Configuration 111
- Subframe Config (I_CSI-RS) 111
- Periodicity (T_CSI-RS) 111
- Subframe Offset (Delta_CSI-RS) 111
- CSI-RS Power 111
- Scrambling Identity (n_ID) 112
- CDMType 112
- CSI-RS Configurations 112
  - CSI-RS Configuration # 112
  - Resource Configuration 112
  - Frequency Density 113
  - Transmission Comb 113

Cell

With enabled "General DL Settings > CA > Activate Carrier Aggregation > On" state, indicates to which cell (i.e. component carrier) the settings apply.

Remote command:
n.a

CSI-RS in DwPTS
Enables transmission of the CSI-RS in the Downlink Pilot Time Slot (DwPTS) parts of the TDD frame.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:DWPTs` on page 593

ZeroTxPower CSI-RS Structure
Option: R&S SMBV-K113

From LTE Rel. 12 on, eNBs support one (ZP CSI-RS #0) primary and one additional (ZP CSI-RS #1) zero-power CSI reference signal for each cell.

ZeroPowerCSI-RS (HEX) ← ZeroTxPower CSI-RS Structure
Sets the used CSI-RS configurations in the zero transmission power subframes. Required is a 16-bit-long hexadecimal value (bitmap). The UE assumes a zero transmission power for each bit set to one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZP` on page 591

Subframe Config (I_CSI-RS) ← ZeroTxPower CSI-RS Structure
Sets the parameter $I_{CSI\text{-}RS}$ for CSI-RS with zero transmission power, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPI` on page 592

Periodicity (T_CSI-RS) ← ZeroTxPower CSI-RS Structure
Sets the parameter subframe configuration period $T_{CSI\text{-}RS}$ for CSI-RS with zero transmission power, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPT?` on page 593

Subframe Offset (Delta_CSI-RS) ← ZeroTxPower CSI-RS Structure
Sets the parameter subframe offset $Delta_{CSI\text{-}RS}$ for CSI-RS with zero transmission power, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPDelta?` on page 592

NonZeroTxPower CSI-RS Structure
Comprises the following cell-specific parameters:

CSI-RS State ← NonZeroTxPower CSI-RS Structure
Enables the transmission of a CSI-RS, see also "How to enable and visualize a CSI-RS transmission" on page 108.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:STATe` on page 591

Number of CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K119

Enables using multiple CSI-RS configurations and sets the value of the parameter N_{res}^{CSI}.

To define the individual configurations, use the parameters Resource Configuration, Frequency Density and Transmission Comb.

See also Chapter 3.1.8.4, "Full Dimension MIMO (FD-MIMO)", on page 57.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG` on page 593

Number of AP per CSI-RS Configuration ← NonZeroTxPower CSI-RS Structure
Defines (or indicates) the number of antenna ports (one, two, four or eight) the CSI-RS are transmitted on.

Option: R&S SMBV-K119

- This field is configured automatically, if Number of CSI-RS Configurations≥ 2 is selected.
  The value indicates the number of antenna ports per CSI-RS configuration N_{ports}^{CSI} and is selected to comply with the aggregation rule, given in Table 3-8.
- The value displayed in the "DRS" > "CSI-RS" on page 116 dialog resembles the value set in the "CSI-RS" dialog.

Use the Cell-Specific Antenna Port Mapping and configure the cell-specific antenna port mapping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NAP` on page 590

Subframe Config (I_CSI-RS) ← NonZeroTxPower CSI-RS Structure
Sets the parameter $I_{CSI\text{-}RS}$ for cell-specific CSI-RS, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFI` on page 590

Periodicity (T_CSI-RS) ← NonZeroTxPower CSI-RS Structure
Indicates the parameter subframe configuration period $T_{CSI\text{-}RS}$ for cell-specific CSI-RS, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFT?` on page 591

Subframe Offset (Delta_CSI-RS) ← NonZeroTxPower CSI-RS Structure
Indicates the parameter subframe offset $Delta_{CSI\text{-}RS}$ for cell-specific CSI-RS, see Table 4-3.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFDelta?` on page 590

CSI-RS Power ← NonZeroTxPower CSI-RS Structure
Boosts the CSI-RS power compared to the cell-specific reference signals.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:POW on page 590

Scrambling Identity (n_ID) ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K112

Sets the additional scrambling identity n_ID used to generate the NonZeroTxPower CSI-RS, as specified in LTE Rel. 11.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SCID on page 594

CDMType ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K119

Sets the higher-level parameter `CDMType` that influence the antenna port mapping of the CSI-RS.

CDM8 type is available if the product of Number of CSI-RS Configurations * Number of AP per CSI-RS Configuration = {24 or 32}

See also Chapter 3.1.8.4, "Full Dimension MIMO (FD-MIMO)", on page 57.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CDMType on page 594

CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Table with several rows, where the number of rows depends on the Number of CSI-RS Configurations.

CSI-RS Configuration # ← CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K119

Indicates the configuration number, where the number of configurations is set with Number of CSI-RS Configurations.

Resource Configuration ← CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Defines the CSI-RS configuration used for the current cell and for which the UE assumes non-zero transmission power. The zero transmission power subframes are determined by the ZeroPowerCSI-RS (HEX).

Option: R&S SMBV-K119

From LTE Rel. 13 on, cells can use multiple CSI-RS configurations. Select Number of CSI-RS Configurations ≥ 2 to enable this feature and be able to select an individual CSI-RS configuration value for each of the enabled configurations.

The Number of AP per CSI-RS Configuration and the CDMType are set automatically. All other CSI-RS configuration settings are common for all CSI-RS configurations.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CONFig[<st>]
on page 589

Frequency Density ← CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K119

Sets the parameter `NZP-FrequencyDensity` and thus defines the CSI-RS mapping to resource elemets according to TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:FRDensity[<st>]`
on page 595

Transmission Comb ← CSI-RS Configurations ← NonZeroTxPower CSI-RS Structure
Option: R&S SMBV-K119

Sets the parameter `NZP-TransmissionComb` and thus defines the CSI-RS mapping to resource elemets according to TS 36.211.

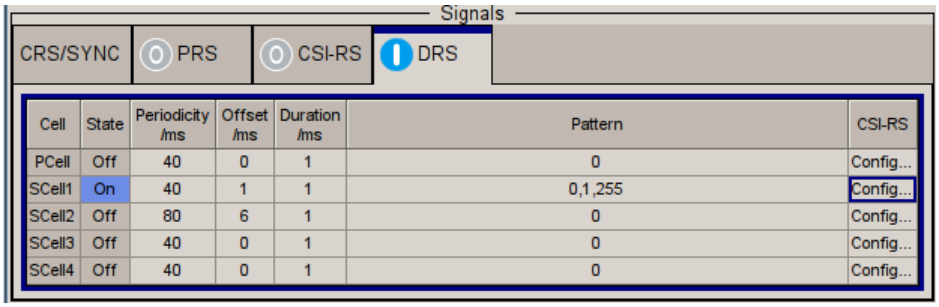
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:TRANscomb[<st>]`
on page 595

4.2.7.5 Discovery Reference Signals (DRS) Settings

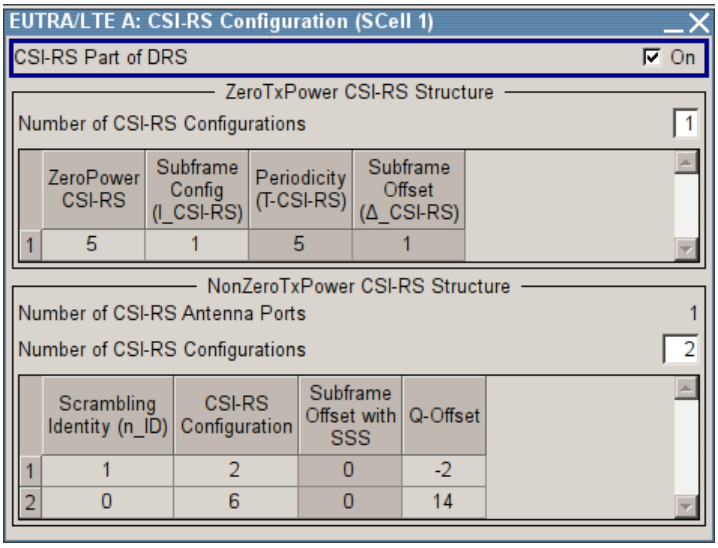
Option: R&S SMBV-K119

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Scheduling > PDSCH Scheduling" > **"Auto/DCI or Auto Sequence"**.
3. Select "General DL Settings > CA > State > On".
4. Select "General DL Settings > CA" > **"SCell"** > "Duplexing" > **"LAA"**.
5. Select "General DL Settings > Signals > DRS".



6. To access the CSI-RS settings, select "CSI-RS > Config".



7. During a discovery signal occasion, the eNB can configure up to 5 zero-power CSI reference signals (CSI-RS) and up to 96 non-zero-power CSI reference signals within the DRS period.
   To configure the CSI-RS:

   a) Set "CSI-RS Part of DRS = On"
   b) Set "ZeroTxPower/NonZeroTxPower > Number of CSI-RS Configurations ≥ 1"
   c) Configure the CSI-RS structures as required.

   This dialog comprises settings, necessary to configure the discovery reference signals occasions for the LAA cells.
   For configuration of the LAA burst, see Chapter 4.3.6, "LAA Settings", on page 137.
   See also "Discovery reference signal (DRS)" on page 56.

How to set the ARB sequence length for signals composed of DRSs with different periodicity

Per default, the R&S SMBV uses an ARB sequence length of 1 frame. Thus the generated signal is 10 ms long and comprises the first LAA frame. This frame is then repeated cyclically.

If DRS signals with different periodicity are configured, you have to adjust the length of the generated signal so that it contains the whole DRS periodicity of all DRSs.

1. Select "LTE > Filter/Clipping/ARB/TDW/Power Settings > ARB" to observe the current signal length.

2. Calculate the required ARB sequence length as follows:
   "ARB Sequence Length" = k*LCM("Periodicity"$_{PCell}$, "Periodicity"$_{SCell\#1}$, ... "Periodicity"$_{SCell\#4}$)/10

   Where:
   - k is a multiplier and k≥ 1
   - LCM is the standard least common multiple mathematical function

- "Periodicity"$_{PCell/SCell\#n}$ is the DRS periodicity in milliseconds of each of the active cell with enabled DRS signals.

3. Set "ARB > ARB Sequence Length" to the calculated value.

Settings:

Cell 115
State 115
Periodicity 115
Offset 115
Duration 116
Pattern 116
CSI-RS 116
└ CSI-RS Part of DRS 117
└ ZeroTxPower/NonZeroTxPower CSI-RS Structure>Number of CSI-RS Configurations 117
└ ZeroPower CSI-RS 117
└ Subframe Config (I_CSI-RS) 117
└ Periodicity (T_CSI-RS) 117
└ Subframe Offset (Delta_CSI-RS) 117
└ Number of AP per CSI-RS Configuration 117
└ Scrambling Identity (n_ID) 118
└ CSI-RS Configuration 118
└ Subframe Offset with SSS 118
└ Q-Offset 118

Cell
Indicates the cell (PCell or SCell) the displayed settings belong to.

Remote command:
n.a.

State
For LAA SCells, enables the selected discovery reference signal occasion configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:STATe` on page 597

Periodicity
Defines how often the DRS measurement timing configuration (DMTC) occasion appears.

A DMTC occasion lasts 6 ms and can appear each 40 ms, 80 ms or 160 ms.

See also "Discovery reference signal (DRS)" on page 56.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PERiodicity` on page 598

Offset
Offsets the DRS within the periodical DRS occasion, see Figure 3-35.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:OFFSet on page 598

Duration
Sets or indicates the DRS duration.

- For LAA SCells, "Duration = 1 ms"
- In FDD mode, "Duration = 2 to 5 ms"

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:DURation on page 598

Pattern
A DRS is 1ms long (see Duration) and is transmitted **zero times or at most once** in any subframe during the DMTC occasion.

For LAA SCells, this parameter defines the DRS subframes for 20 DMTC occasions.

The values are set as a sequence of up to 20 values within the range -1 to 5 and indicate the following situations:

- -1: no DRS transmission
- 0, 1, 2, 3, 4, 5: DRS transmitted in the first/second/third/fourth/sixth subframe of the DMTC occasion

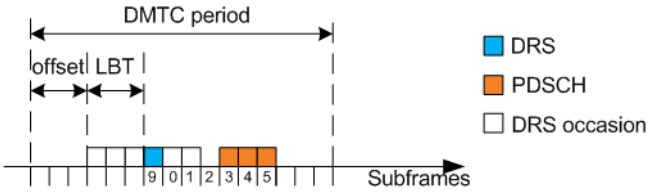


Figure 4-5: DRS allocation

DRS = Discovery reference signal
LBT = Listen-before-talk
DMTC = DRS measurement timing configuration
DRS occasion = Subframes during the DMTC period where DRS can occur
PDSCH = Physical DL shared channel

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PATTern on page 598

CSI-RS
During a discovery signal occasion, the eNB can configure up to 5 zero-power CSI reference signals (CSI-RS) and up to 96 non-zero-power CSI reference signals within the DRS period.

To configure the CSI-RS:

- Set "CSI-RS Part of DRS = On"
- Set "ZeroTxPower/NonZeroTxPower > Number of CSI-RS Configurations ≥ 1"
- Configure the CSI-RS structures as required.
- In the "Signals > CSI-RS" dialog, define the parameter Number of AP per CSI-RS Configuration for the LAA "Cell".

CSI-RS that is part of the DRS uses the same antenna ports (APs) as the CSI-RS, see "Mapping table" on page 163.

Provided are the following ZeroTxPower and NonZeroTxPower parameters:

CSI-RS Part of DRS ← CSI-RS
Enables defining the CSI-RS part of the DRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CDSTate` on page 599

ZeroTxPower/NonZeroTxPower CSI-RS Structure>Number of CSI-RS Configurations ← CSI-RS
Enables up to 5 ZeroTxPower CSI-RS and up to 96 NonZeroTxPower CSI-RS within the DRS period.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum` on page 599
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum` on page 599

ZeroPower CSI-RS ← CSI-RS
Sets the used CSI-RS configurations in the zero transmission power subframes. Required is a 16-bit-long hexadecimal value (bitmap). The UE assumes a zero transmission power for each bit set to one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZP` on page 599

Subframe Config (I_CSI-RS) ← CSI-RS
Sets the parameter I_{CSI-RS} for CSI-RS with zero transmission power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPI` on page 600

Periodicity (T_CSI-RS) ← CSI-RS
Indicates the parameter subframe configuration period T_{CSI-RS} for CSI-RS with zero transmission power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPT?` on page 600

Subframe Offset (Delta_CSI-RS) ← CSI-RS
Indicates the parameter subframe offset Δ_{CSI-RS} for CSI-RS with zero transmission power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPDelta?` on page 601

Number of AP per CSI-RS Configuration ← CSI-RS
Defines (or indicates) the number of antenna ports (one, two, four or eight) the CSI-RS are transmitted on.

Option: R&S SMBV-K119

- This field is configured automatically, if Number of CSI-RS Configurations≥ 2 is selected.

The value indicates the number of antenna ports per CSI-RS configuration N_{ports}^{CSI} and is selected to comply with the aggregation rule, given in Table 3-8.

- The value displayed in the "DRS" > "CSI-RS" on page 116 dialog resembles the value set in the "CSI-RS" dialog.

Use the Cell-Specific Antenna Port Mapping and configure the cell-specific antenna port mapping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NAP` on page 590

Scrambling Identity (n_ID) ← CSI-RS
From LTE Rel. 12 on, eNBs can generate the individual NonZeroTxPower CSI-RS with separate scrambling identity n_{ID} (`scramblingIdentity`) [TS 36.331].

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSCid`
on page 601

CSI-RS Configuration ← CSI-RS
Defines the CSI-RS configuration used for the current cell and for which the UE assumes non-zero transmission power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZConfig`
on page 602

Subframe Offset with SSS ← CSI-RS
Indicates the parameter subframe offset (`subframeOffset`) between the secondary synchronization signal (SSS) and the CSI-RS resource in a discovery signal occasion [TS 36.331].

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSFoffset`
on page 602

Q-Offset ← CSI-RS
Sets the parameter Q-offset for cell-specific CSI-RS [TS 36.331].

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZQoffset`
on page 602

4.2.8 MIMO

In the MIMO section, the MIMO configuration and the simulated antennas are defined.

Provided are the following settings:

Global MIMO Configuration
Determines the number of transmit antennas of the simulated EUTRA/LTE system.

The Downlink Reference Signal Structure is set accordingly (see also Figure 3-9).

Note: One baseband simulates one antenna.

"1 TxAntenna" Enables single antenna port transmission.

"2 TxAntennas/4 TxAntennas"
Enables a multiple antenna transmission. The transmission mode, transmit diversity or spatial multiplexing, is determined per allocation with the parameter Precoding Scheme.

"SISO + BF" This mode combines the 1 transmit antenna Single Input Single Output (SISO) transmission with beamforming (BF).
Beamforming is a method to increase the SNR of the signal received by the UE. In this mode, beamforming is implemented as a single layer PDSCH which is mapped to the different antennas with individual phase offsets. To simplify the configuration and to fulfill the requirements as specified in TS 36.101, Annex A, the same precoding vector as in a MIMO case can be used.

Note: While generating signal in this mode, the antennas simulated by path A and Path B are **not** MIMO antennas. The signal at the output of both paths is the same SISO signal with the same **cell-specific reference signals**.
To enable the instrument to generate a **transmission using antenna port 5** signal (transmission corresponding to the UE-specific reference signal) as defined in the 3GPP specification, set the parameter Precoding Scheme to "Beamforming (UE-spec.RS)".

In this case, the generated signal carries a combination of common signal part (PBCH, PDCCH, cell-specific RS,...), which is identical on all antennas, and UE-specific PDSCH, which is different on the antennas due to the applied precoding.

Note that, although the generation of a beamformed signal requires more than one antenna, for the UE it appears as a SISO signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration` on page 539

Simulated Antenna
Defines the antenna to be simulated.

The configuration of the Downlink Reference Signal structure is set accordingly (see Figure 3-9).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna` on page 539

Simulated Antenna Path A
Determines the simulated antenna for path A. The configuration of the Downlink Reference Signal Structure is set accordingly (see also Figure 3-9).

The possible values of this parameter depend on the setting of the parameter Global MIMO Configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna` on page 539

NB-IoT MIMO Configuration
Option: R&S SMBV-K115

For "Channel Bandwidth = 200 kHz or ≥ 3 MHz", sets the number of transmit antennas used for the simulated NB-IoT system.

The NRS structure is set automatically.

To use Tx diversity:
- Select "NB-IoT MIMO Configuration = 2 Tx Antennas"
- In the mapping table, define the antenna port: select AP2000 or AP20001

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:NIOT:CONFig` on page 783

Antenna Port Mapping
(enabled for instruments equipped with R&S SMBV-K84)

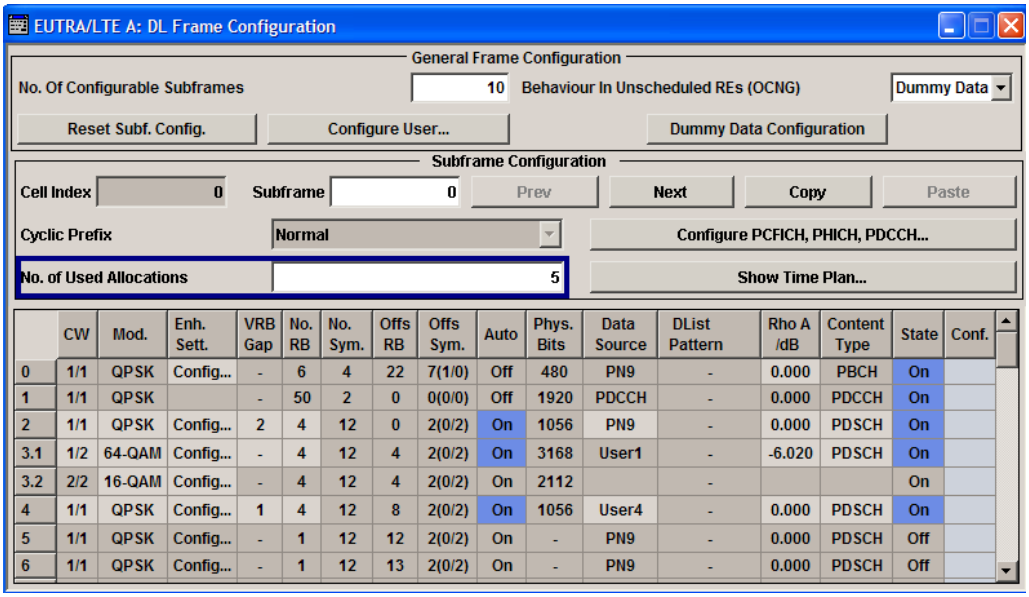
Accesses the Cell-Specific Antenna Port Mapping settings for defining the mapping of the logical antenna ports to the available physical Tx antennas.

4.3 DL Frame Configuration Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Scheduling > Manual".
3. Select "General > Frame Configuration".

   The "DL Frame Configuration" dialog allows you to configure the subframes and the OFDMA resource allocations. The dialog consists of several tabs.
   The "DL Frame Configuration" dialog consists of three sections, "General Frame Configuration", "Subframe Configuration", and the "Allocation Table".



- General Frame Configuration Settings....121
- Dummy Data Configuration Settings....122
- Auto Sequence Configuration....124
- EPDCCH Configuration Settings....132
- Scrambling Configuration Settings....136
- LAA Settings....137
- Subframe Configuration Settings....140
- DL Resource Allocation Table....142

4.3.1 General Frame Configuration Settings

Provided are the following settings:

No Of Configurable (DL) Subframes....121
Reset All Subframes....122
Configure User....122
Behavior In Unscheduled REs (OCNG)....122
Dummy Data Configuration....122

No Of Configurable (DL) Subframes
Sets the number of configurable subframes. Only the downlink and the special subframes are enabled for configuration if TDD mode is selected.

All downlink/special subframes are filled periodically with the configured subframes except for the P-SYNC/S-SYNC. The last are set globally in the "General DL Settings" dialog. The PBCH can only be configured in subframe 0.

For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see Chapter B.3, "Four Configurable Frames in Uplink and Downlink Direction", on page 896.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes` on page 563

Reset All Subframes
Resets settings of all subframes including cyclic prefix and number of used allocations to the default values.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame` on page 564

Configure User
Calls the "Configure User" menu for configuring allocations for different users.

The menu is described in Chapter 4.7, "User Configuration Settings", on page 195.

Remote command:
n.a.

Behavior In Unscheduled REs (OCNG)
Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

This function can be used as an OFDMA Channel Noise Generator (OCNG) according to TS 36.101.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:BUR` on page 563

Dummy Data Configuration
(Available for dummy data)

Access the "Dummy Data Configuration" dialog for setting the modulation, power, and data source for the dummy data.

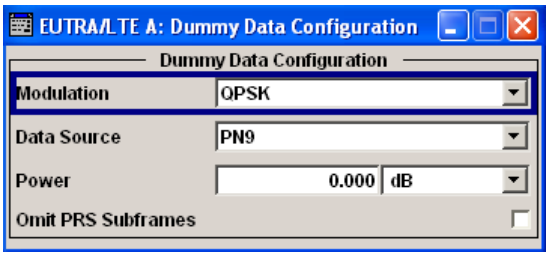
The menu is described in Chapter 4.3.2, "Dummy Data Configuration Settings", on page 122.

Remote command:
n.a.

4.3.2 Dummy Data Configuration Settings

Access:

► Select "Frame Configuration > Behavior in Unsch. REs (OCNG) > Dummy Data ".



In this section, the dummy data for filling the unscheduled resource blocks and subframes are configured.

Modulation....123
Data Source....123
Power (Dummy Data)....123
Omit PRS Subframes....123

Modulation
Selects the modulation of the dummy data.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation` on page 701

Data Source
Selects the data source for the dummy data configuration.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA` on page 702
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern` on page 703
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect` on page 702

Power (Dummy Data)
Sets the power of the subcarriers allocated with dummy data.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer` on page 702

Omit PRS Subframes
(requires R&S SMBV-K84)

If the OCNG (OFDM Channel Noise Generator) is used, you can disable (omit) the OCNG transmission in the non-muted PRS subframes, as required for RSTD Performance Tests (TS 36.133, section A.9.8.1).

Tip: Use the OFDMA Time Plan to visualize the allocated resources.

See also Example "How to visualize the effect of muting and omitting PRS transmission" on page 103.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:OPSubframes` on page 703

4.3.3 Auto Sequence Configuration

The "Auto Sequence" mode requires the additional software option R&S SMBV-K112. This mode supports you to generate EUTRA/LTE signals from a sequence perspective.

In "Auto Sequence" mode, you configure the sequence-related settings once per active User; all related parameters are calculated automatically.

Impact of the "Auto Sequence" mode on the configuration of DCIs

The following applies for each active user (State > On) and for every active cell:

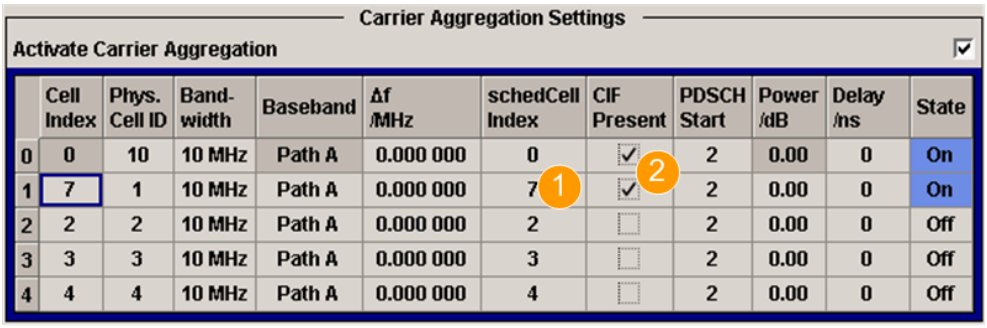
- There is one DL DCI and one UL DCI for the user and the cell in the PDCCH DCI table. Comprehend these DCIs as template DCIs. The DCIs which are used for the generated subframes are derived from them, with modifications according to the auto sequence DCI tables.
- Suitable DCI formats are selected automatically, according to the Tx Modes.
- If Activate Carrier Aggregation is enabled, the Cell Index for the DL-DCI and UL-DCI is set to the selected sched. Cell Index
- Several parameters of the DCI formats are automatically varied throughout the subframes (see DCI Format Configuration).

  For example:
  - The modulation and coding scheme (MCS) and HARQ-related parameters are indicated as "Auto"
  - If CIF Present is enabled, the CIF parameter in the DL-DCI and UL-DCI is set to the selected Cell Index

4.3.3.1 How to Enable and Use the Auto Sequence Mode

This example focuses on the "Auto Sequence" settings and their impact. For step-by-step instruction on how to enable the required configuration, see Chapter 4.2.2.2, "How to Enable Carrier Aggregation and Cross-Carrier Scheduling", on page 73.

1. Select "Baseband > EUTRA/LTE > General DL Setting > CA".
   Enable for example the following settings:



	Cell Index	Phys. Cell ID	Band-width	Baseband	Δf /MHz	schedCell Index	CIF Present	PDSCH Start	Power /dB	Delay /ns	State
0	0	10	10 MHz	Path A	0.000 000	0	☑	2	0.00	0	On
1	7	1	10 MHz	Path A	0.000 000	7	☑	2	0.00	0	On
2	2	2	10 MHz	Path A	0.000 000	2	☐	2	0.00	0	Off
3	3	3	10 MHz	Path A	0.000 000	3	☐	2	0.00	0	Off
4	4	4	10 MHz	Path A	0.000 000	4	☐	2	0.00	0	Off

1 = Cross-carrier scheduling is disabled (SCell#1 uses "schedCellIndex = 7")
2 = "CIF Preset > On"

2. Select "General DL Setting > Scheduling > PDSCH Scheduling > Auto Sequence".
3. Select "EUTRA/LTE > DL Frame Configuration > General".
   Enable "User > User 1/User 2 > State > On".

   The subframe-related settings are not displayed. Compare these settings to the settings described in Chapter 4.3, "DL Frame Configuration Settings", on page 120.

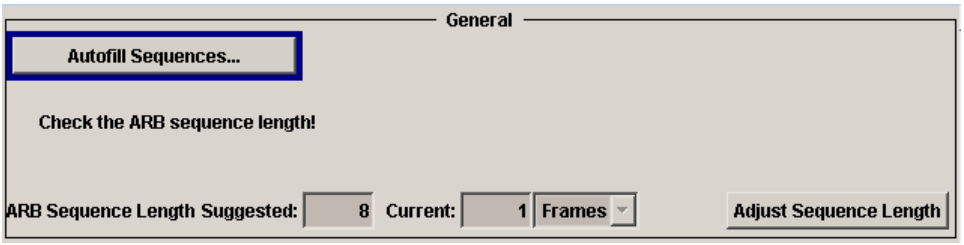
	User 1	User 2	User 3	User 4
State	☑	☑	☐	☐
Activate CA	☐	☐	☐	☐
Tx Modes	Mode 9	Mode 7	Mode 2	Mode 2
Auto Sequence	Config...	Config...	Config...	Config...
UE Category	User	User	User	User
Antenna Mapping	Config...	Config...	Config...	Config...
Scrambling	☑	☑	☑	☑
Channel Coding	☑	☑	☑	☑
UE ID	0	0	0	0
Data Source	PN9	PN9	PN9	PN9
DList/Pattern	-	-	-	-
P_A	0 dB	0 dB	0 dB	0 dB
SPS	Config...	Config...	Config...	Config...
Aperiodic SRS	☐	☐	☐	☐
CSI Awareness	☐	☐	☐	☐

4. Select "DL Frame Configuration > PDCCH > DCI Table".
   Observe the settings.

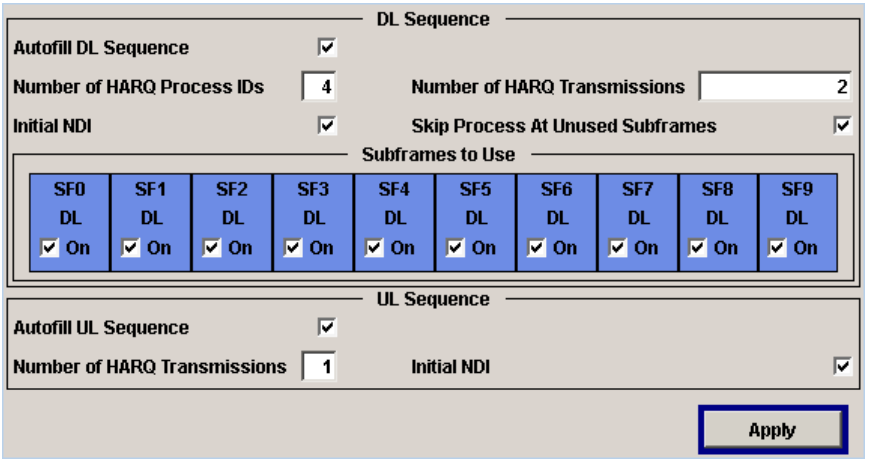
   There are two active users, "User1" and "User2" and two active cells with "sched-Cell Index = 0 and 7". The DCI format "DCI format = 0 and 1A" is automatically selected, see "Impact of the "Auto Sequence" mode on the configuration of DCIs" on page 124.
5. In "DCI Table", select "User1 > DCI Format 1A > Content > Config" for the DCI with "Cell Index = 7".

   The "DCI Format Configuration" confirms the configuration: "CIF = 7", MCS and HARQ-related settings are set to "Auto".
6. To configure the HARQ transmission:

a) Open the "DL Frame Configuration > General > User Configuration > User1 > Auto Sequence > Config" dialog.

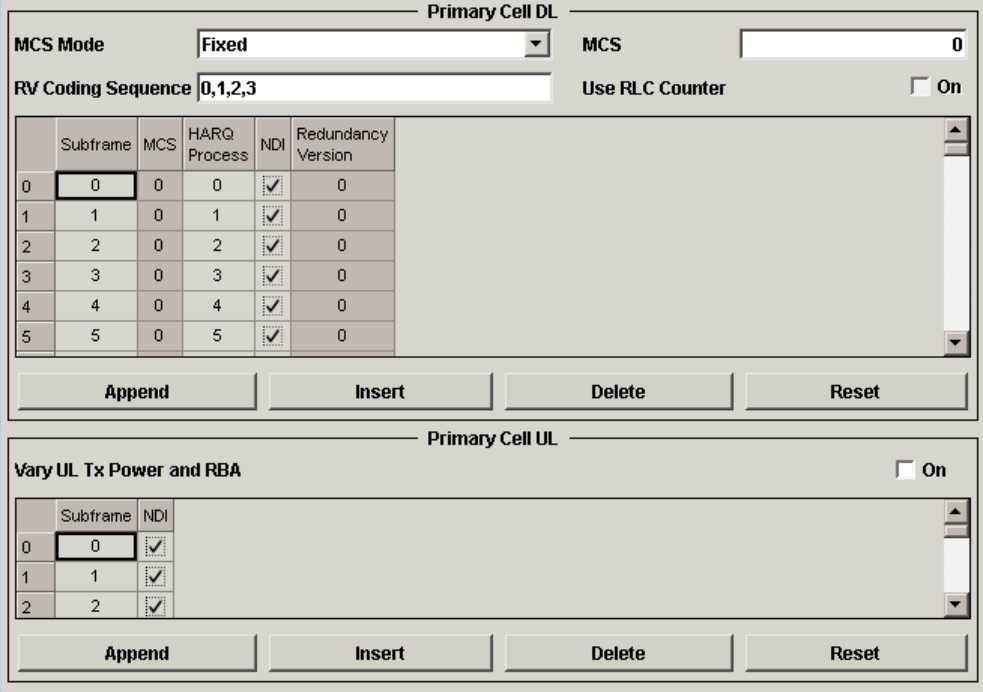


b) Select "Auto Sequence > Autofill Sequences".
Configure the HARQ transmission. Select "Apply".



c) If the current ARB sequence length deviates form the suggested one, select "Adjust Sequence Length".

Observe the resulting settings in the "Auto Sequence > Primary Cell DL/UL" sections.



4.3.3.2 Auto Sequence Settings

To access this dialog:

1. Select "EUTRA/LTE > General DL Setting > Scheduling > PDSCH Scheduling > Auto Sequence".
2. Select "DL Frame Configuration > General > User Configuration > User1 > Auto Sequence > Config."

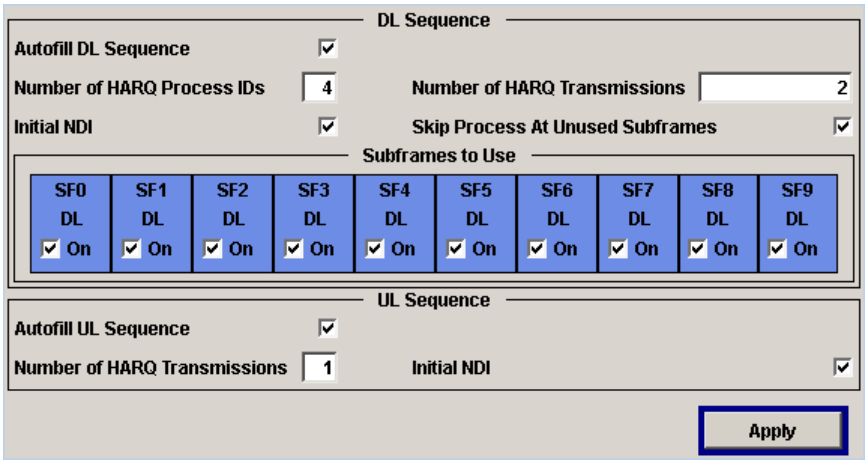
   The "Auto Sequence" dialog opens.

   For instruction on how to use these settings, see Chapter 4.3.3.1, "How to Enable and Use the Auto Sequence Mode", on page 124.

Autofill Sequences... 128
└ Autofill DL/UL Sequence 128
└ Number of HARQ Process IDs 128
└ Number of HARQ Transmissions 128
└ Initial NDI 128
└ Skip Process at Unused Subframes 129
└ Subframes to Use: 129
└ Apply 129
ARB Sequence Length > Suggested, Adjust Length 129
DL DCI Sequence 129
└ MCS Mode 129
└ MCS 130
└ Target Code Rate, Target Modulation 130

└ RV coding Sequence 130
└ Use RLC Counter 130
└ DL DCI Sequence Table 130
UL DCI Sequence 131
└ Vary UL TX Power and RBA 131
└ UL DCI Sequence Table 131
Append, Insert, Delete, Reset 132

Autofill Sequences...
Access a dialog with settings to configure the DL and UL DCIs.



To configure the Auto Sequence DCI tables of the user automatically, enable the "Autofill DL/UL Sequence" parameters, adjust the settings, and confirm with "Apply".

Autofill DL/UL Sequence ← Autofill Sequences...
Automatically fill the auto sequence DCI tables of the user in a meaningful and standard-compliant way.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:AFSeq` on page 652
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:AFSeq` on page 652

Number of HARQ Process IDs ← Autofill Sequences...
Sets the number of HARQ process IDs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHIDs` on page 652

Number of HARQ Transmissions ← Autofill Sequences...
Sets the number of HARQ transmissions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHTRans` on page 652
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:NHTRans` on page 652

Initial NDI ← Autofill Sequences...
Defines whether the "New Data Indicator" flag is set at the beginning of the sequence or cleared.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:INDI on page 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:INDI on page 653

Skip Process at Unused Subframes ← Autofill Sequences...
Defines how the HARQ processes are distributed throughout the used subframes.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:SKPRocess on page 653

Subframes to Use: ← Autofill Sequences...
Sets the downlink subframes to be used for the HARQ transmission as a pattern of "0" and "1", where 1 enables a subframe.

Do not set the uplink subframes; in FDD duplexing mode, used are all subframes and in TDD mode, all downlink and special subframes that are allowed to schedule uplink transmissions.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL[:CELL<ccidx>]:
USUBframe<dir0> on page 653

Apply ← Autofill Sequences...
Applies the settings

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:APPLy on page 653

ARB Sequence Length > Suggested, Adjust Length
Displays the suggested and currently used ARB sequence length.

If the current ARB sequence length deviates form the suggested one, select "Adjust Sequence Length". The ARB sequence length is set automatically.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ARBLen? on page 651
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ASLength on page 652

DL DCI Sequence
The DL DCIs are defined in table form that can be filled in manually, by adding rows and configuring them, or automatically, with the Autofill Sequences... settings.

MCS Mode ← DL DCI Sequence
Sets how the Modulation and Coding Scheme is configured.

"Manual" Enter the MCS value in the corresponding column

"Fixed" The MCS value is fixed and configured with the parameter MCS

"Target Code Rate"
The required MCS value is calculated based on the selected "Target Code Rate" and "Target Modulation".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:MCSMode
on page 654

MCS ← DL DCI Sequence
In "MCS Mode > Fixed", sets the MCS value.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:FMCS
on page 654

Target Code Rate, Target Modulation ← DL DCI Sequence
In "MCS Mode > Target Code Rate", sets the target code rate and modulation (QPSK, 16QAM, 64QAM).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TCR on page 654
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TMOD
on page 654

RV coding Sequence ← DL DCI Sequence
Sets the redundancy version sequence to be used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RVCSequence
on page 655

Use RLC Counter ← DL DCI Sequence
Enables/disables the use of radio link control (RLC) counter.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:URLCounter
on page 658

DL DCI Sequence Table ← DL DCI Sequence
The DCIs are configured in table form. If the Autofill Sequences... function is used, several parameters are preconfigured.

In TDD mode, the DCI table lists only the DL and special subframes.

A conflict indicates an erroneous situation, like for example if the selected "Target Code Rate" cannot be achieved.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SLENgth?
on page 656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:SUBFrame on page 656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:TB1:MCS on page 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:HARQ on page 655
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:TB1:NDI on page 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:TB1:RV on page 658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:
SEQelem<dir0>:TB1:RLCCounter on page 657

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:PDRE on page 655
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:CONFlict? on page 658

UL DCI Sequence
The UL DCIs are defined in table form, that can be filled in manually, by adding rows and configuring them, or automatically, with the Autofill Sequences... settings.

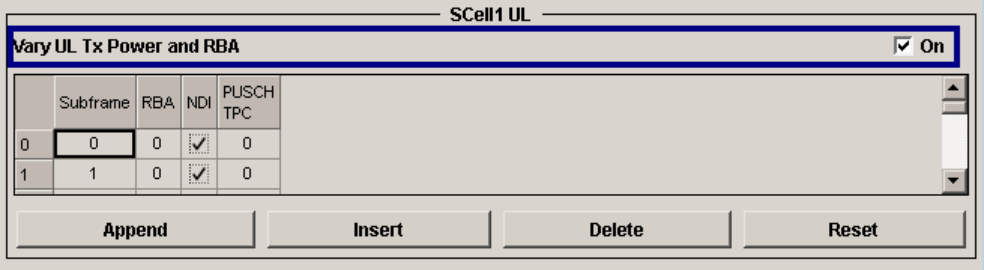


Figure 4-6: UL DCI Sequence settings in TDD mode ("UL/DL Configuration = 0")

Vary UL TX Power and RBA ← UL DCI Sequence
Enables the "PUSCH TPC" column in the table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:VULTxpow on page 659

UL DCI Sequence Table ← UL DCI Sequence
The DCIs are configured in table form. If the Autofill Sequences... function is used, several parameters are preconfigured.

In TDD mode, the DCI table lists only the DL and special subframes. The "UL Index" parameter is displayed if a TDD UL/DL Configuration = 0 is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SLENgth? on page 656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:SUBFrame on page 656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:RBA on page 658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:NDI on page 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:PTPC on page 659
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:ULINdex on page 659
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:CONFlict? on page 658

Append, Insert, Delete, Reset
Standard functions for handling of table elements.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:APPend
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:INSert
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:DELete
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RESet
on page 661
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SELement
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:APPend
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:INSert
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:DELete
on page 660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:RESet
on page 661

4.3.4 EPDCCH Configuration Settings

Option: R&S SMBV-K112/K115

Access:

1. Select "General > Link Direction > Downlink (OFDMA)"
2. Select "General DL Settings > Scheduling" > **"Auto/DCI"**
   EPDCCH cannot be activated in manual mode ("Scheduling > Manual")
3. Select "Frame Configuration > General > General > Configure User"
4. Select "User# > EPDCCH > Config"
5. Set "Activate EPDCCH > On".
   You can enable and configure the EPDCCH parameters for the selected user and, if DL carrier aggregation is used, also per component carrier.
6. Select "Frame Configuration > E(DPCCH)".
7. In the "DCI Table", select "User 1 > (E)EPDCCH > EPDCCH Set 1".
8. Select "Frame Configuration > Subframe > Subrame#0 > Allocation Table" to observe the EPDCCH allocation.

The parameters of the EPDCCH#1 allocation and the most of the available parameters are set automatically.

9. Select "EPDCCH > Enhanced Settings > Config" to observe the percoding information, i.e. the used antenna ports.
10. Select "Frame Configuration > Timeplan" to observe the EPDCCH configuration.

    The display confirms that the EPDCCH is transmitted in the data region of the frame and it does not span the full system bandwidth. The EPDCCH is transmitted over a set of four narrow non-contiguous physical resource blocks (PRB).

    The number of displayed EPDCCH pairs per UE depends on the following:
    - Number of PRB pairs per EPDCCH set.
    - Number of active EPDCCH sets.
      The two EPDCCH sets of one UE are indicated with the same color.
    - If and which EPDCCH set is allocated ("Frame Configuration > E(DPCCH) > User x > (E)EPDCCH > EPDCCH Set x")
      At least one DCI must be assigned to an EPDCCH.
    - EPDCCH transmission type
    - Resource block allocation per EPDCCH set.
      EPDCCH may partly overlap.
    - Amount of DCI information (assigned ECCEs) carried in an EPDCCH with two PRB pairs and localized transmission.
      If the DCI information is not sufficient to fill all available EPDCCH PRBs, the unallocated PRBs can be used for PDSCH transmission.

Settings:

Activate EPDCCH 133
Set 1/2 State 134
Transmission Type 134
Number of PRB Pairs 134
Resource Block Assignment 134
N^EPDCCH_ID 134
Relative EPDCCH Power 135
Hopping 135
Starting NB 135
Max. Repetitions MPDCCH (Rmax) 135
Search Space Start Subframe 135

Activate EPDCCH
If "General DL Settings > Scheduling" > **"Auto/DCI"**, enables the EPDCCH transmission for the select user and component carrier.

EPDCCH cannot be activated in manual mode ("Scheduling > Manual").

Option: R&S SMBV-K115

The EPDCCH and EPDCCH set 1 are always active.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:STATe`
on page 699

Set 1/2 State
Enables the EPDCCH set.

To allocate an EPDCCH set, select "Frame Configuration > E(DPCCH) > User x > (E)EPDCCH > EPDCCH Set 1/2".

Option: R&S SMBV-K115

The EPDCCH and EPDCCH set 1 are always active.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STATe` on page 699

Transmission Type
Select whether localized or distributed EPDCCH transmission is used.

"Localized" Subsequent EREGs are allocated within the same PRB as long as there are physical resources available.
Localization transmission is useful if the channel conditions are known, so that the scheduling and MIMO precoding can be optimized.

"Distributed" EREGs are allocated in the separate (subsequent) PRBs.
This transmission type applies frequency diversity and distributed the REGs among the available channel bandwidth. Distributed transmission is used if the channel conditions are unknown.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:TTYP` on page 699

Number of PRB Pairs
Sets the number of physical resource block (PRB) pairs.

Per PRB pair, there are 16 enhanced resource element groups (EREG), that are numbered from 0 to 15.

Observe the OFDMA Time Plan

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:PRBS` on page 700

Resource Block Assignment
Shifts the EPDCCH allocations in the frequency domain and defines the resource blocks used for the EPDCCH transmission.

The EPDCCH PRBs are distributed among the available resource blocks according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:RBA` on page 700

N^EPDCCH_ID
Unlike the PDCCH that is a cell-specific control channel, the EPDCCH is a user-specific control channel.

This parameter sets the user-specific identifier $n^{EPDCCH}_{ID,m}$ used to initialize the DMRS scrambling sequences of the EPDCCH sets.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:NID` on page 700

Relative EPDCCH Power
Sets the power of the EPDCCH allocations.

The value is applied relative to the value of the parameter Reference Signal Power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:POWer` on page 701

Hopping
Option: R&S SMBV-K115

Enables MPDCCH hopping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:HOPPing` on page 842

Starting NB
Option: R&S SMBV-K115

Sets the first narrowbands in which MPDCCH is allocated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STNB` on page 843

Max. Repetitions MPDCCH (Rmax)
Option: R&S SMBV-K115

Sets the maximum number the MPDCCH is repeated.

The actual number of repetitions is calculated as function ofhte repetition level, as described in "MPDCCH repetition number" on page 316.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:REPMpdcch` on page 843

Search Space Start Subframe
Option: R&S SMBV-K115

Sets the first subframe of the search space.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STSF` on page 843

4.3.5 Scrambling Configuration Settings

(requires R&S SMBV-K112)

Access:

1. Select "General > Link Direction > Downlink (OFDMA)"
2. Select "Frame Configuration > General > General > Configure User"
3. Select "User# > Tx Modes > Mode 10"
4. Select "User# > Scrambling > Config"

   With option R&S SMBV-K112, you can enable and configure the scrambling parameters for the selected user.
   If DL carrier aggregation is used, the scrambling parameters are configured per component carrier. The scrambling state, however, applies to all component carriers.

Settings:

Scrambling State....136
Use DMRS Scrambling Identities....136
DMRS Scrambling Identity 1/2....136

Scrambling State
Enables/disables scrambling for all allocations belonging to the selected user.

The parameter "Scrambling State" determines the "Enhanced Settings > Scrambling State" of all allocations for which you select the Data Source = "User x".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe` on page 696

Use DMRS Scrambling Identities
Sets if one or two scrambling identities are used for the demodulation reference signals (DMRS).

See "Coordinated multi-point operation for LTE (CoMP)" on page 50.

To set the n_{CSID}, use the parameters DCI Format 2/2A/2B/2C/2D and Scrambling Identity n_SCID.

"Off" The DRMS sequence is generated with the variable $n_{ID} = N_{ID}^{cell}$, where N_{ID}^{cell} is the physical cell identity (PCI).

"On" $n_{ID} = n_{ID}^{DMRS,i}$, i.e. two DRMS scrambling identities are used.
Set the values with the parameters DMRS Scrambling Identity 1/2.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:USE` on page 696

DMRS Scrambling Identity 1/2
Sets the DMRS scrambling identities $n_{ID}^{DMRS,i}$.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID1
on page 697
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID2
on page 697

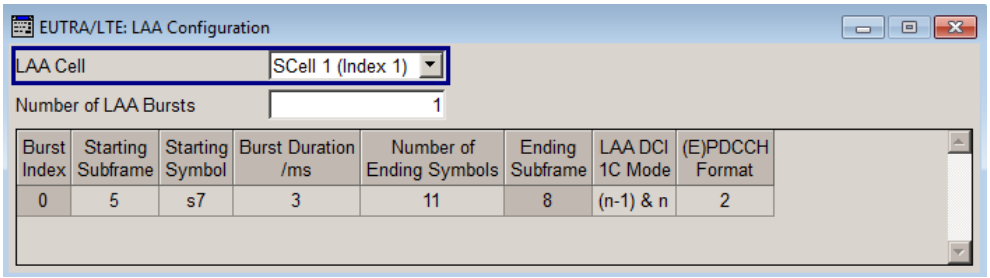
4.3.6 LAA Settings

Option: R&S SMBV-K119

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > Scheduling PDSCH Scheduling" > **"Auto/DCI or Auto Sequence"**.
3. Enable at least on LAA SCell, for example select "General DL Settings > CA > SCell#1 > Duplexing" > **"LAA"**.
4. To configure the discovery reference signals:
   a) Select "General DL Settings > Signals > DRS"
   b) For example set, "SCell#1 > State = On", "Periodicity = 40", "Duration = 1", "Offset = 1" and "Pattern = 0".

   The DMTC occasion has a periodicity of 40 s. The DRS is 1 ms long and allocated in the subframe#1 of the DMTC occasion, because "Pattern = 0" but "Offset = 1".
   For more information, see "Discovery reference signal (DRS)" on page 56.
   See also Chapter 4.2.7.5, "Discovery Reference Signals (DRS) Settings", on page 113.
5. Select "General > DL Frame Configuration" > **"LAA"**.
6. Select "LAA Cell = SCell 1 (Index 1)", i.e. one of the SCell configured as LAA cells in the DL carrier aggregation "CA" dialog.
7. Enable at least one LAA burst, e.g. set "Number of LAA Burst = 1".
8. Configure the LAA burst in terms of start and end subframe, burst duration and DCI mode.



9. Observe the LAA SCell allocation on the "Time Plan".

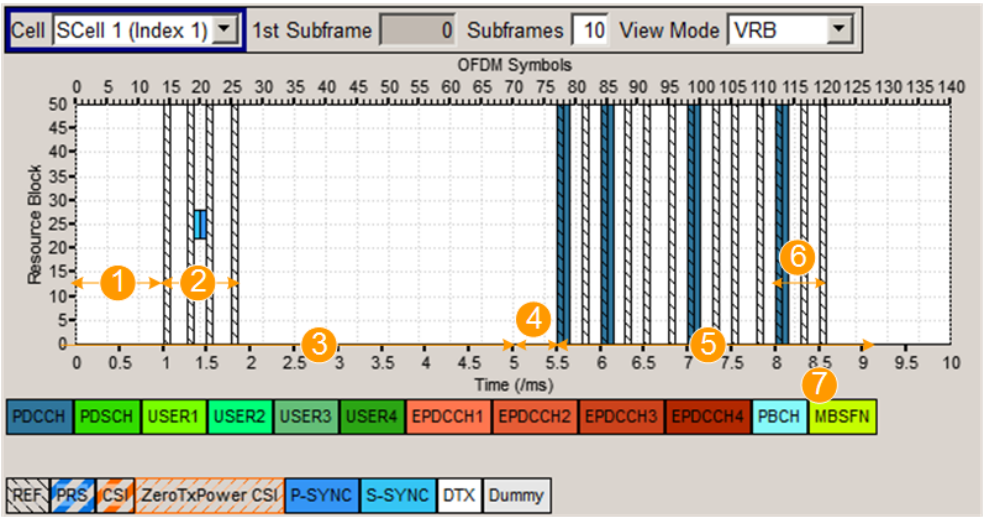


Figure 4-7: LAA burst in the Time Plan: understanding the displayed information

1 = "DRS Offset = 1"
2 = "DRS Duration = 1 ms"
3 = LAA burst "Starting Subrame = 5", i.e. LAA burst start at subframe#5 of each frame
4 = "Starting Symbol = s7", i.e. the LAA partial subframe starts at the boundary of the second symbol within the LAA starting subframe
5 = "Burst Duration = 3 ms", where the starting LAA subframe is a partial subframe and the last (ending) subframe contains 11 ending OFDM symbols
6 = "Number of Ending Symbols = 11" (not all symbols are used)
7 = "Ending Subframe = Starting Subframe + Burst Duration = 8"
Subframes = 10

10. To configure the DCI format 1C:
    a) Select "General > DL Frame Configuration > LAA > LAA DCI 1C Mode = e.g. (n-1)&n"
    b) Select "(E)PDCCH > User = CC-RNTI"
    c) For "DCI Format > 1C", select "Content > Config".
    d) Set the field "Subframe Configuration for LAA".
11. Adjust the "ARB Sequence Length" according to "How to set the ARB sequence length for signals composed of DRSs with different periodicity" on page 114.

    For background details, see Chapter 3.1.8, "LTE Release 13/14 Introduction", on page 53
    The remote commands required to define these settings are described in Chapter 9.14, "LAA and DRS", on page 595.

Settings:

LAA Cell 139
Number of LAA Bursts 139
Burst Index 139
Starting Subframe 139
Starting Symbol 139
Burst Duration (ms) 139
Number of Ending Symbols 139

Ending Subframe..... 140
LAA DCI 1C Mode.....140
(E)PDCCH Format..... 140

LAA Cell
Selects the LAA SCell for that the LAA is configured.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LAA:CEINdex` on page 603

Number of LAA Bursts
You can configure up to 10 LAA bursts per LAA SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:NUMBursts` on page 603

Burst Index
Consecutive number indicating the LAA bursts.

Starting Subframe
Sets the first subframe of the LAA bust.

See:
- Figure 4-7
- Chapter 3.1.8.1, "Frame Structure Type 3 (LAA) and Partial Subframes", on page 54.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSFrame`
on page 603

Starting Symbol
Defines the time point the LAA burst started:
- "s0": LAA burst starts at the LTE subframe boundary (`subframeStartPositon`), i.e. at the **first slot** of a subframe
- "s7": LAA burst starts at the boundary of the **second slot** of a subframe (`secondSlotStartingPositon`

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSLot`
on page 604

Burst Duration (ms)
Sets the duration of the LAA burst.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:DURation`
on page 604

Number of Ending Symbols
Sets the number of OFDM symbols in the last subframe of the LAA burst.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:LSFSymbols
on page 605

Ending Subframe
Indicates the number of the last subframe of the LAA burst. The value is calculated as follows:

Indicates the number of the last subframe of the LAA burst. The value is calculated as follows:

- For "Starting Symbol = s0"
  "Ending Subframe" = "Starting Subframe" + "Burst Duration" - 1
- For "Starting Symbol = s7"
  "Ending Subframe" = "Starting Subframe" + "Burst Duration"

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:ENSFrame?
on page 604

LAA DCI 1C Mode
Defines how the DCI format 1C is sent.

Assuming `n` is the last subframe, DCI format 1C can be sent in the following ways:

- "(n-1)"
  DCI is present in the **next-to-last subframe** (`n-1`).
- "n"
  DCI is present in the **last subframe** `n`.
  If "Subframe Configuration for LAA < 14", no other physical channels are sent in subframe `n`
- "(n-1)&n"
  DCI present in both **`n` and `n-1`** subframes
  Both subframe have to use identical subframe configuration.
- "Manual"

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:C1Mode
on page 605

(E)PDCCH Format
For "LAA DCI 1C Mode" different than "Manual", sets the (E)PDCCH format and defines how many (E)CCEs are used for the transmission of the (E)PDCCH.

See also "(E)PDCCH Format (Variable)" on page 181.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:EPDCch
on page 605

4.3.7 Subframe Configuration Settings

Provided are the following settings:

Cell....141
Subframe Selection....141
Cyclic Prefix....141
No. Of Used Allocations....141
Copy/Paste....141
Next/Prev....141
Show Time Plan....142
Configure PCFICH, PHICH, PDCCH....142

Cell
With enabled "General DL Settings > CA > Activate Carrier Aggregation > On" state, indicates to which cell (i.e. component carrier) the settings apply.

Remote command:
n.a

Subframe Selection
Sets the subframe to be configured in the frame configuration table.

Remote command:
n.a

Cyclic Prefix
Configuration of the cyclic prefix per subframe is only enabled, if the parameter Cyclic Prefix is set to User Defined.

The number of the OFDM symbols per subframe is set automatically.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix` on page 564

No. Of Used Allocations
Sets the number of scheduled allocations in the selected subframe.

The number of available allocations depends on the allocation's content type for a subframe and the general channel bandwidth setting.

The default value depends on the existence of a PBCH channel in a subframe. In this case, the default value is set to 2, otherwise to 1. The second or the first allocation is reserved for the PDCCH, regardless whether this allocation is enabled or not.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount` on page 564

Copy/Paste
Copies/pastes the settings of the selected subframe. P-SYNC/S-SYNC/PBCH settings are not considered.

For more detailed information, see Chapter B.1, "Copy/Paste Subframe", on page 895.

Remote command:
n.a.

Next/Prev
Navigates through the subframes.

Remote command:
n.a.

Show Time Plan
Opens the time plan for the OFDMA resource allocation.

The menu is described in detail in Chapter 6.1, "OFDMA Time Plan", on page 448.

Remote command:
n.a.

Configure PCFICH, PHICH, PDCCH
Opens the dialog for configuring the PCFICH, PHICH and PDCCH.

The dialog is described in detail in Chapter 4.6, "Enhanced PCFICH, PHICH and PDCCH Channel Configuration", on page 166.

Remote command:
n.a.

4.3.8 DL Resource Allocation Table

The resource allocation table is located in the lower part of the "DL Frame Configuration" menu. The resource allocation table is where the individual allocation parameters for a subframe are set.

Allocation number 142
Codeword 142
Modulation 143
Enhanced Settings 143
VRB Gap 143
No. RB (Resource Blocks) 145
No. Sym 146
Offset RB 146
Offset Sym 147
Auto 147
Phys. Bits 147
Data Source 148
Rho A 148
Content Type 149
State 149
Conflict 149

Allocation number
Displays the consecutive number of the allocation.

Remote command:
n.a.

Codeword
Determines whether one or two codewords use the same physical resource, and whether codeword 1/2 or 1/2 is configured with this allocation table entry

In case the data source for an allocation is set to User, changing this parameter sets also the parameter "Codeword" of all allocations, belonging to the same User in the subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords`
on page 565

Modulation
Selects the modulation scheme for the allocation.

In case the data source for an allocation is set to User, changing this parameter sets also the parameter "Modulation" of all allocations, belonging to the same User in the subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation` on page 565

Enhanced Settings
Opens the "Enhanced Settings" dialog for configuration of precoding and channel coding (see Chapter 4.4, "Enhanced PBCH, PDSCH and PMCH Settings", on page 149).

Remote command:
n.a.

VRB Gap
Enables the utilization of virtual resource blocks (VRB) of distributed type and determines whether the first or the second gap is applied. That is, it determines the distribution and the mapping of the VRB pairs to the physical resource blocks (PRB) pairs.

The VRB-to-PRB mapping and the calculation of the VRB gap values are performed according to TS 36.211. The specification defines two types of VRBs, a localized distribution with a direct mapping and distributed VRBs for better frequency diversity. The distribution of the VRBs is performed in such a way, that consecutive VRBs are not mapped to frequency-consecutive PRBs. The VRBs are spread over the frequencies instead. Each single VRB pair is split into two parts and a frequency gap between these two VRB parts is introduced. That is, a frequency hopping on a slot basis is applied. For wider channel bandwidths (more than 50 RBs), a second VRB gap with smaller size may be applied.

Tip: Use the "DL Time Plan" to visualize the PDSCH mapping.

The information whether localized or distributed VBRs are applied is carried by the PDCCH. The DCI Formats 1A/1B/1D provide the special 1-bit flag "Localized/Distributed VBR Assignment" for this purpose. The selection whether the first or the second gap is applied, is determined by the additional bit "Gap Value".

Note: In case a "General DL Settings > Scheduling > PDSCH Scheduling > Auto/DCI" mode is used, the "VRB Gap" value is read-only and is set according to the configuration of the corresponding DCI format.

Example:

"DL Channel Bandwidth = 10 MHz" (50 RBs)

Three subframes are configured:

- Subframe#0
  - PDSCH allocation#2 (User2): "VRB Gap = 0"
  - PDSCH allocation#3 (User4): "VRB Gap = 0"

	CW	Mod.	Enh. Sett.	VRB Gap	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Rho A /dB	Content Type	State	Conf.
0	1/1	QPSK	Config...	-	6	4	22	7(1/0)	Off	480	MIB	-	0.000	PBCH	On	
1	1/1	QPSK		-	50	2	0	0(0/0)	Off	1920	PDCCH	-	0.000	PDCCH	On	
2	1/1	QPSK	Config...	-	2	12	0	2(0/2)	On	552	User2	-	0.000	PDSCH	On	
3	1/1	QPSK	Config...	-	2	12	2	2(0/2)	On	552	User4	-	0.000	PDSCH	On	

- Subframe#1
  - PDSCH allocation#2 (User2): "VRB Gap = 1"
  - PDSCH allocation#3 (User4): "VRB Gap = 1"
  - Both allocations use distributed VRBs; the first VRB gap is applied.

  According to TS 36.211, the first VRB gap for 10 MHz channel bandwidth is **27 RBs**
- Subframe#2
  - PDSCH allocation#2 (User2): "VRB Gap = 1"
  - PDSCH allocation#3 (User4): "VRB Gap = 2"
  - Both allocations use distributed VRBs. The first VRB gap is applied for PDSCH allocation#2 (User2) and the second VRB gap for the allocation#3 (User4) .

  According to TS 36.211, the second VRB gap for 10 MHz channel bandwidth is **9 RBs**

Use the "DL Time Plan" to visualize the PDSCH mapping.

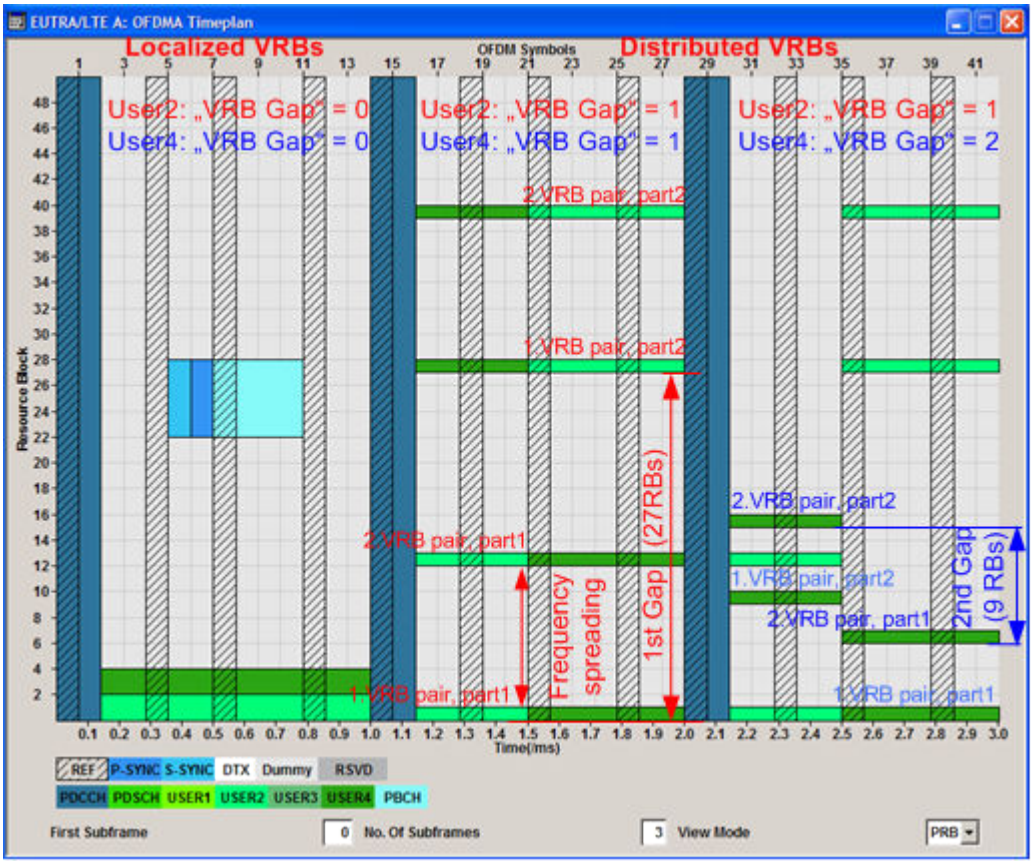


Figure 4-8: DL Time Plan

Subframe#0 = Localized VRB, direct mapping VRB-to-PRB
Subframe#1 = Distributed VRB: First Gap=27 RBs applied for User2 and User4
Subframe#2 = Distributed VRB: First Gap=27 RBs applied for User2, second Gap=9RBs applied for User4

"0" A **localized distribution** is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.

"1" Enables a **distributed** resource block allocation. The first VRB gap is used.

"2" Enabled for "Channel Bandwidths" greater than 50 RBs.
The mapping is based on the second (smaller) VRB gap.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP`
on page 565

No. RB (Resource Blocks)
Defines the bandwidth of selected allocation in terms of resource blocks per slot.

In case two codewords are configured, the defined bandwidth of the allocation with the second codeword is determinate by the selected bandwidth of the first one.

"Auto" indicates automatically calculated value depending on other settings, like the "Content type".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount on page 566

No. Sym.
Sets the size of the selected allocation in OFDM symbols.

For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.

Example:

For Cyclic Prefix with normal length (14 OFDMA Symbols) and Symbol Offset = 2 the resulting "No. Of Symbols" is 12.

In case two codewords are configured, the size of the allocation with the second codeword is determinate by the size of the first one.

While configuring a special subframe for TDD mode, the maximum size of the PDSCH allocation is determined by the selected TDD Frame Structure Settings and depends on the selected Cyclic Prefix.

The following table shows the cross-reference between the special subframe configuration and the maximum number of OFDM symbols available for PUSCH (DwPTS) in a special subframe for normal and extended CP.

Configuration of Special Subframe	DwPTS (Normal CP)	DwPTS (Extended CP)
0	3	3
1	9	8
2	10	9
3	11	10
4	12	3
5	3	8
6	9	9
7	10	5
8	11	-
9	6	-

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount on page 566

Offset RB
Sets the start resource block of the selected allocation.

The value is:
- **Read only:** if "Auto Offset Calculation > On"

- In case two codewords are configured, the start resource block of the allocation with the second codeword is determinate by the selected start resource block of the first one.
- **"Auto"**: if automatically calculated depending on other settings, like the "Content type".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset` on page 567

Offset Sym.
Sets the start OFDM symbol of the selected allocation.

Note: If the "Auto Offset Calculation" mode is activated, this value is read only.

For extended cyclic prefix, the maximum symbol offset is 13.

Note: According to TS 36.211, up to first three OFDM symbols of a subframe are reserved for control information (PDCCH). Therefore, for PDSCH allocations the maximum value is 3, regardless of the cyclic prefix length.

In case two codewords are configured, the start OFDM symbol of the allocation with the second codeword is determinate by the selected start OFDM symbol of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset` on page 567

Auto
Sets whether automatic offset calculation is used or not.

Note: If the "Auto Offset Calculation" mode is activated, the resource block offset and the start symbol offset are set automatically and cannot be changed.

By setting new allocations or changing the number of RBs of an existing allocation, the Auto mode tries to distribute the allocations with activated Auto mode in an optimal manner to the available resource blocks by adjusting the parameters "Offset RB". The resulting "No. of Bits" of a certain allocation can vary, due to overlapping control channels.

If it is not possible to distribute the changed configuration to the available resources blocks, a conflict is displayed.

Note: "Auto Offset Calculation" mode is only available for PDSCH. For PDCCH, this parameter is always off.

In case two codewords are configured, the state of the "Auto Offset Calculation" mode of the second codeword is set to the state of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC` on page 567

Phys. Bits
Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority.

See Chapter A, "Conflict Handling", on page 890.

"Auto" indicates automatically calculated value depending on other settings, like the "Content type".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits? on page 568

Data Source
Selects the data source for the selected allocation.

For PBCH allocation with enabled parameter MIB (including SFN), the "Data Source = MIB" is used.

If MBSFN is used, the data source of the allocations in the MBSFN subframes is set to MCCH or MTCH depending on the MBSFN configuration.

Use the User Configuration Settings dialog to configure the data sources for "User x".

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA on page 568
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect on page 569
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern on page 569

Rho A
Sets the power P_{PDSCH} (ρ A) respectively P_{PBCH} for the selected allocation.

The power of the PDCCH allocation P_{PDCCH} is read-only. The value is set in the "Enhanced Channel Configuration" dialog of the corresponding subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer on page 569

Content Type
Indicates the type of the selected allocation.

Note: There can be only one PBCH in subframe 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType?` on page 570

State
Sets the allocation to active or inactive state.

In case two codewords are configured, the state of the allocation with the second codeword is determinate by the state of the first one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe` on page 570

Conflict
Indicates a conflict between allocations.

For more information, see Chapter A, "Conflict Handling", on page 890.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict` on page 570

4.4 Enhanced PBCH, PDSCH and PMCH Settings

Access:

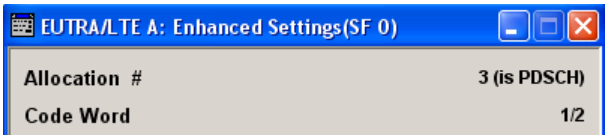
1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > Subframe Configuration > No of Used Allocations = 3".
3. Select "Allocation Table > Allocation#3 > Content Type".
4. Select one of the following "Content Type":
   a) "PBCH"
   b) "PDSCH"
   c) "PMCH"
5. Select "Enhanced Settings > Config..."

   In the "Enhanced Settings" dialog, you can define the precoding and the channel coding settings for the DL channels PBCH and PDSCH. The settings are configurable on a subframe basis.

Consider the following interdependencies:

- The "Precoding" settings are available for the first codeword and applied for both codewords.
- The available "Precoding" settings depend on:
  - The global MIMO configuration
  - The content of the allocation
  - The selected codeword
- For all allocations, where the "Data Source > User x":
  - The following parameters are read-only: "Scrambling State", "UE ID" and "Channel Coding State".
    To configure these parameters, open the User Configuration Settings dialog for the corresponding user.
  - You can access the "Enhanced Settings" of one particular "User 1..4" form any allocations belonging to this user.

4.4.1 Allocation Settings



Provided are the following settings:

Allocation #.....150
Codeword.....150

Allocation #
Displays the number of the allocation and the channel type the enhanced settings are configured for.

Remote command:
n.a.

Codeword
Displays the number of the codeword and the total number of codewords used for the selected allocation.

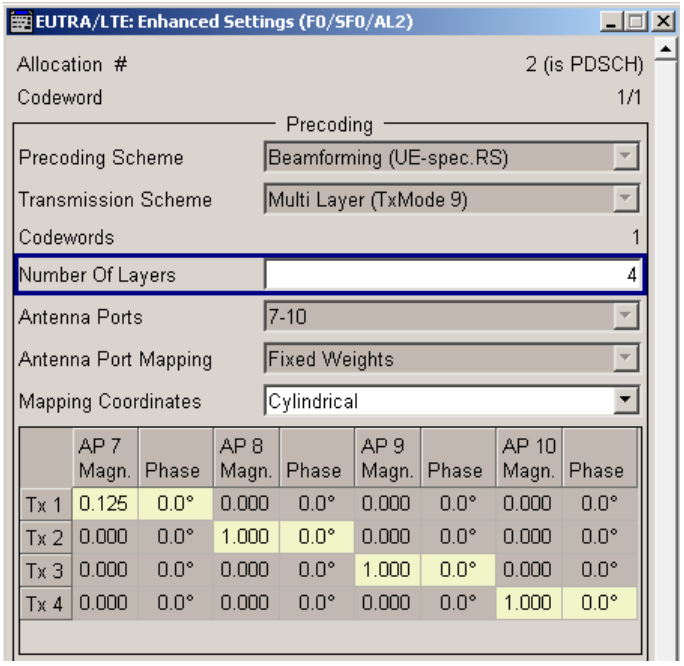
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords`
on page 565

4.4.2 Precoding Settings

Access:

1. Select "General DL Configuration > MIMO"

2. Select "Global MIMO Configuration > 2 TxAntennas"
3. Select "General > Frame Configuration > Subframe Configuration > No of Used Allocations = 3".
4. Select "Allocation Table > Allocation#3 > Content Type".
5. Select "Content Type > PDSCH"
6. Select "Enhanced Settings > Config..."



Consider the following interdependencies:

- The "Precoding" settings are available for the first codeword and applied for both codewords.
- The available "Precoding" settings depend on:
  - The global MIMO configuration
  - The content of the allocation
  - The selected codeword

Precoding Scheme....152
Transmission Scheme....152
Number of Layers....153
Scrambling Identity n_SCID....154
Antenna Ports....154
Antenna Port Mapping....154
Use Alternative Codebooks....154
Codebook Index/Codebook Index 2....155
Cyclic Delay Diversity....155
Mapping Coordinates....155
Mapping Table....156

Precoding Scheme
Selects the precoding scheme.

Note: The available precoding schemes depend on Content Type and the MIMO Configuration.

"None" Disables precoding.

"Spatial Multiplexing/Tx Diversity"
Precoding for spatial multiplexing or transmit diversity is performed according to TS 36.211 and the selected parameters.

"Beamforming (UE-spec.RS)"
Sets the PDSCH to transmission mode selected with the parameter Transmission Scheme.

"Antenna Port 4"
Option: R&S SMBV-K84
Default precoding scheme for the PMCH transmitted in MBFSN subframes.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme` on page 612

Transmission Scheme
Option: R&S SMBV-K84/K85/K112

Determines the transmission scheme (see also Table 3-6).

"Transmission Scheme"	Available for Global MIMO Configuration	Description
"Single Layer (TxMode 7)"	SISO+BF 2Tx/4Tx-Antennas	Option: R&S SMBV-K84 Sets the PDSCH to transmission mode 7, as described in TS 36.213, i.e. UE-specific RS (DM-RS) are added to the PDSCH. This special mode is defined for transmission using antenna port 5. In this implementation, antenna port 5 is simulated by all enabled antennas, depending on the selected Global MIMO Configuration. Note that for "SISO + BF" configuration mode, antenna port 5 is simulated by maximum two antennas. **Tip:** To enable the instrument to generate a **transmission using antenna port 5** signal, select "Global MIMO Configuration > SISO + BF" Antenna port 5 transmission is also known as transmission corresponding to the UE-specific reference signal. It is defined in the TS 36.101, chapter 8.3.
"Dual layer (TxMode 8)"	SISO+BF 2Tx/4Tx-Antennas	Option: R&S SMBV-K84 Sets the PDSCH to transmission mode 8, as described in TS 36.213, i.e. UE-specific RS are added to the PDSCH. In this mode, antenna ports 7 and 8 are used. In this implementation, antenna ports 7 and 8 are simulated by all enabled antennas, depending on the selected "Global MIMO Configuration". **Tip:** To enable the instrument to generate a transmission using antenna port 7 and 8, set the parameter "Global MIMO Configuration" to "SISO + BF", "2 Tx-antennas" or "4 Tx-antennas".
"Multi-layer (TxMode 9)"	SISO+BF 2Tx/4Tx-Antennas	Option: R&S SMBV-K85 Sets the PDSCH to transmission mode 9. Depending on the used layers, antenna ports 7 to 14 are used.
"Multi-layer, CoMP (TxMode 10)"	SISO+BF 2Tx/4Tx-Antennas	Option: R&S SMBV-K112 Sets the PDSCH to transmission mode 10, used for multi-layer transmissions combined with CoMP (coordinated multi-point operation). Depending on the used layers, antenna ports 7 to 14 are used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme` on page 613

Number of Layers
Sets/displays the number of layers for the selected allocation.

The number of available layers depends on selected Content Type and Precoding Scheme

The combination of number of codewords and number of layers determines the layer mapping for the selected precoding scheme, see also "Codewords and spatial layers" on page 41.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers` on page 612

Scrambling Identity n_SCID
Sets the scrambling identity according to TS 36.211.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID` on page 612

Antenna Ports
Option: R&S SMBV-K84

Displays and configures the antenna ports for the selected Transmission Scheme.

See also "Mapping table" on page 163.

If one of the multi-layer modes is configured to use one codeword (i.e. one layer), the mapping of the layer to the antenna ports (7 to 9) is configurable.

Tip: Use this setting to configure a dual-layer multi-user MIMO (MU-MIMO) scenario.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP` on page 609

Antenna Port Mapping
Option: R&S SMBV-K84/K85

Sets the way that the logical antenna ports are mapped to the physical TX antennas, see Chapter 4.5, "DL Antenna Port Mapping Settings", on page 160.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM` on page 610

Use Alternative Codebooks
Option: R&S SMBV-K113)

This parameter applies the enhanced 4 Tx codebook and is enabled if the following applies:

- Transmission Scheme > "Tx Mode 8/Tx Mode 9/Tx Mode 10" (dual- or multi-layer transmission) and
- Global MIMO Configuration = "4 TxAntennas"

The enhanced 4 Tx codebook is part of the further downlink MIMO enhancements feature proposed in LTE-A Rel. 12; see "Further DL MIMO enhancements (enhanced 4Tx codebook)" on page 53.

"Off" Applied is the normal codebook, as specified in TS 36.211.

"On" Applied is the enhanced 4Tx codebook, as specified in TS 36.213.
Tip: Toggle the parameter "Use Alternative Codebooks" and observe the effect on the values in the Mapping table.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBUA` on page 610

Codebook Index/Codebook Index 2
Enabled if:

- Precoding Scheme > "TX Diversity or Spatial Multiplexing"
- "Codeword = 1/2"
- "Antenna Port Mapping > Codebook"
- "User Specific Antenna Port Mapping" > Constant Codebook Index > "Off"
  If "Constant Codebook Index > On", the "Codebook Index/Codebook Index 2" is set automatically to the values set in the "User Specific Antenna Port Mapping" dialog.

Sets the codebook index for the selected allocation and selects the predefined pre-coder matrix.

The number of available codebook indices depends on the number of antenna ports with mapped user-specific reference symbols, the number of layers and number of Tx antennas per component carrier.

Figure 3-23 shows the range of the codebook index for downlink spatial multiplexing for LTE Rel. 8/9. The LTE Rel. 10 (R&S SMBV-K85) defines up to eight layers and uses the same principles.

The combination of codebook index and the selected Number of Layers determines the pre-coding matrix used for precoding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex[<dir>]` on page 610

Cyclic Delay Diversity
(Enabled for Precoding Scheme set to TX Diversity or Spatial Multiplexing and codeword 1/2 only)

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected Number of Layers determines the precoding parameters for spatial multiplexing.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD` on page 611

Mapping Coordinates
Switches between the "Cartesian" and "Cylindrical" coordinates representation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat` on page 611

Mapping Table
Option: R&S SMBV-K84

Defines the mapping of the antenna ports (AP) to the physical antennas, see "Mapping table" on page 166.

4.4.3 CSI-RS Settings

Access:

► Select "Enhanced Settings > CSI-RS".

In this dialog, the CSI awareness can be enabled/disabled.

CSI Awareness
Determines the way the PDSCH is processed.

"On" During the channel coding, the resource elements configured for the CSI-RS transmission are explicitly avoided and the PDSCH is mapped only on the available physical bits.

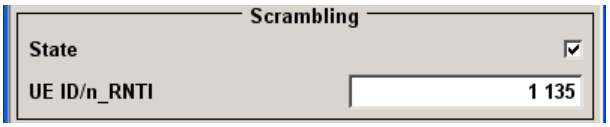
"Off" The channel coding is performed as if the CSI-RS is not transmitted. The PDSCH mapping is not modified to avoid the resource elements on that the CSI-RS can be transmitted.
The modulation symbols necessary for the transmission of the CSI-RS are subsequently substituted by the CSI-RS information; the CSI-RS are transmitted instead of the PDSCH symbols.
This process leads to increased bit error rate, but an UE receiving this PDSCH can still decode the information correctly.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW` on page 607

4.4.4 Scrambling Settings

Access:

► Select "Enhanced Settings > Scrambling".



This dialog comprises the settings needed for configuring the scrambling:

State Scrambling (DL)....157
UE ID/n_RNTI (PDSCH)....157

State Scrambling (DL)
Enables/disables the bit-level scrambling.

If a "User x" is selected as Data Source in the allocation table for the corresponding allocation, the "State Scrambling" is read only. Its value is displayed as set in the User Configuration Settings dialog for the corresponding user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe` on page 613

UE ID/n_RNTI (PDSCH)
Sets the user equipment identifier (n_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

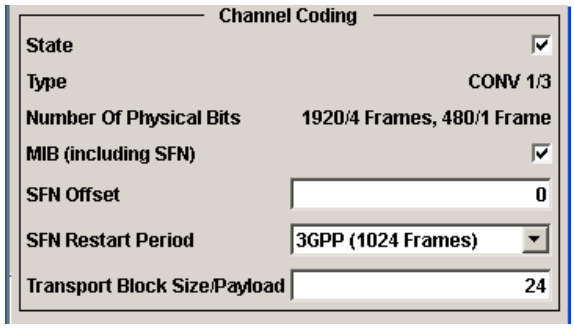
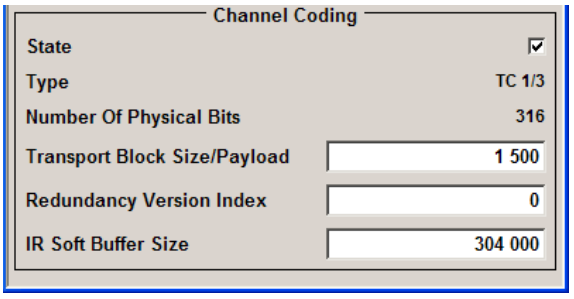
If a "User x" is selected as Data Source in the allocation table for the corresponding allocation, the "UE ID" is read only. Its value is displayed as set in the User Configuration Settings dialog for the corresponding user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID` on page 613

4.4.5 Channel Coding Settings

Access:

► Select "Enhanced Settings > Channel Coding".

PBCH channel coding settings	PDSCH channel coding settings
	

This dialog comprises the settings needed for configuring the channel coding. The settings vary according to the selected "Content Type"

State Channel Coding (DL) 158
Type Channel Coding (DL) 158
Number of Physical Bits (DL) 158
MIB (including SFN) 158
SFN Offset 159
MIB Spare Bits 159

Transport Block Size/Payload (DL)..... 159
Redundancy Version Index (PDSCH)..... 159
IR Soft Buffer Size (PDSCH).....159

State Channel Coding (DL)
Enables/disables channel coding for the selected allocation and codeword.

For any allocation with Data Source > "User x", the "Channel Coding State" is read only. The value is set in the User Configuration Settings dialog for the corresponding user.

A PBCH can be generated in one of the following modes:
- Without channel coding, i.e. this parameter is disabled.
  Dummy data or user-defined data lists are used.
- Channel coding with arbitrary transport block content
  Channel coding is activated and parameter MIB (including SFN) is disabled.
- Channel coding with real data (MIB) including SFN
  Channel coding and MIB are activated.

For the PBCH allocation with activated channel coding, one block of data (transport block size TBS of 24) is coded jointly and then spread over four frames. Set the ARB sequence length to a value that is a multiple of four.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe` on page 608

Type Channel Coding (DL)
Displays the used channel coding scheme and channel coding rate.

PBCH uses always tail biting convolution coding with code rate 1/3; PDSCH uses always turbo code with code rate 1/3.

Remote command:
n.a.

Number of Physical Bits (DL)
Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority (see Chapter A, "Conflict Handling", on page 890).

For Data Source > "User x", the value of the parameter "Number of Physical Bits" is the sum of the "Physical Bits" of all allocations of the same user in the selected sub-frame.

The size of the PBCH allocation is fixed to 1920/4 Frames, 480/1 Frame.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?` on page 568
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?`
on page 571

MIB (including SFN)
(for PBCH only)

Enables transmission of real MIB (master information block) data, calculated according to the values of the following "General DL Settings" parameters:

- Channel Bandwidth
- PHICH Duration
- PHICH N_g

The SFN (system frame number) is included as well.

If this parameter is enabled, the "Transport Block Size" is fixed to 24 and the Data Source for the PBCH allocation is set to "MIB".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 606

SFN Offset
(for PBCH only)

By default, the counting of the SFN (system frame number) starts with 0. Use this parameter to set a different start SFN value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset` on page 607

MIB Spare Bits
Sets the 10 spare bits in the PBCH transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MSPare` on page 607

Transport Block Size/Payload (DL)
Defines the size of the transport block/payload in bits.

- One transport block is generated and spread over all allocations. If "Data Source = User x", the parameters "Transport Block Size", "Redundancy Version Index" and "IR Soft Buffer Size" are related to all allocations of the same user in the subframe.
- In case a spatial multiplexing with two codewords is configured, individual transport blocks for the two code blocks are generated.
- For PBCH allocations with enabled parameter MIB (including SFN), the transport block size is fixed to 24.
  Set the transport block size to 24 if a generation compliant to the 3GPP specifications is required.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize` on page 609

Redundancy Version Index (PDSCH)
Sets the redundancy version index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex` on page 608

IR Soft Buffer Size (PDSCH)
Sets the size of the IR soft buffer for the selected transport block (N_IR from TS 36.212).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize` on page 608

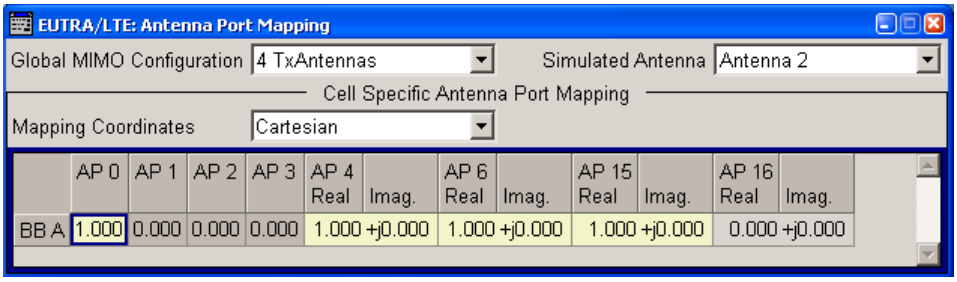
4.5 DL Antenna Port Mapping Settings

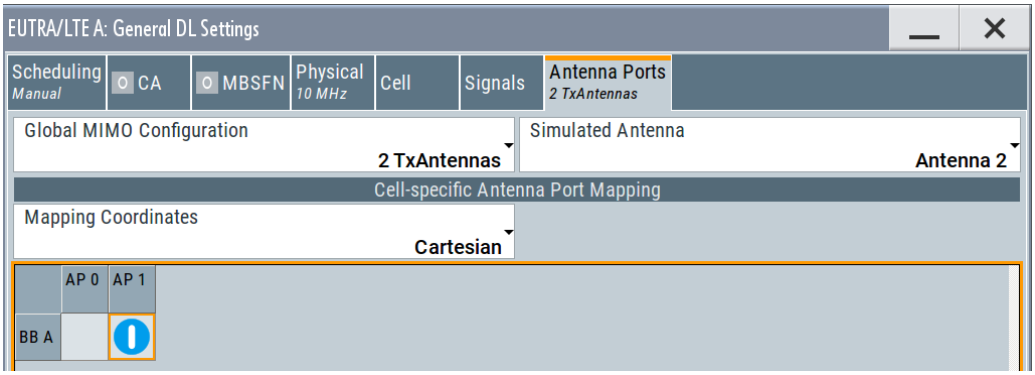
The 3GPP standard defines the different antenna ports for transmission in different transmission modes (TM, also "TxMode") and for the transmission of different reference signals. See Table 3-6 and Chapter 3.1.1.5, "Downlink Reference Signal Structure and Cell Search", on page 25.

The settings necessary to configure the reference signals and to enable the transmission modes are distributed among different dialogs, depending on their type (cell-specific, user-specific, etc.). The related antenna port mapping settings are distributed in these dialogs, too.

To set the cell-specific antenna port mapping settings

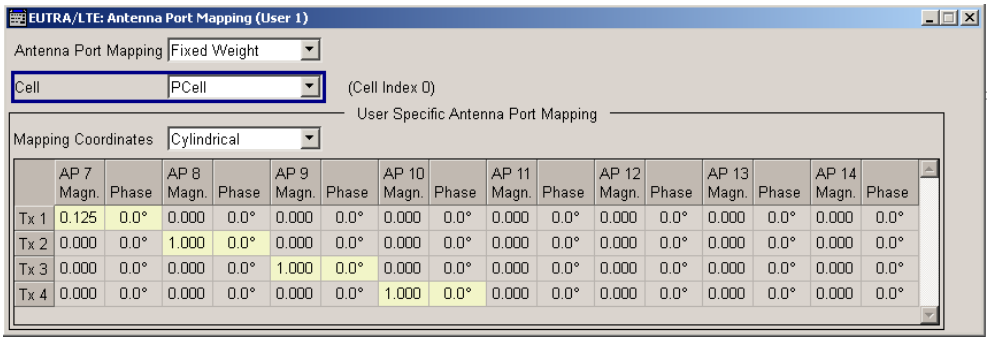
1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General DL Settings > MIMO > Antenna Port Mapping".





To set the user-specific antenna port settings

► Select "Frame Configuration > General > General > Configure User > Antenna Mapping > Config".

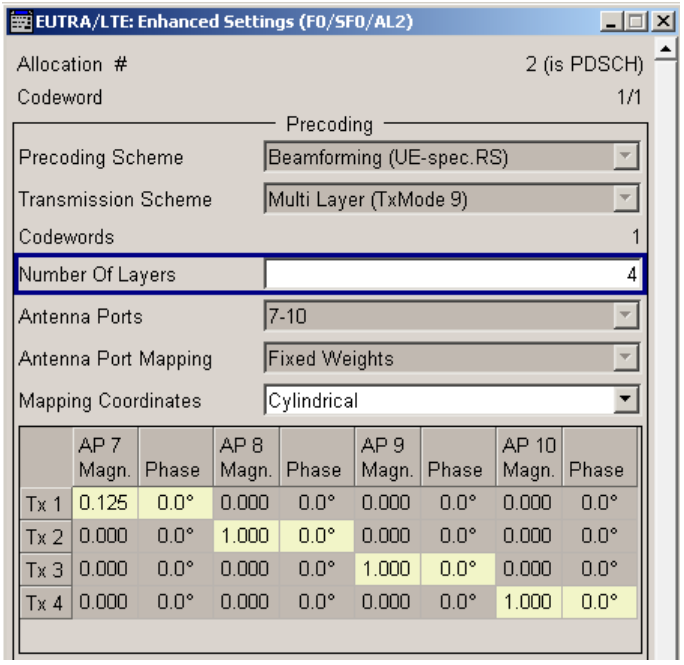


The available antenna ports and layers depend on the number of antennas and the transmission mode the UE is working in ("Frame Configuration > General > General > Configure User > Tx Mode")

To configure the PDSCH belonging to a particular user

1. Select "Frame Configuration > General > General > Configure User > User 1 > Tx Mode > e.g. Mode 9".
2. Select "Frame Configuration > Subframe > Subframe Selection#0 > No. of Used Allocation = 3".
3. Select "Frame Configuration > Subframe > Allocation Table > All#2 > Data Source > UE1".

4. Select "Frame Configuration > Subframe > Allocation Table > All#2 > Enh. PDSCH Settings > Precoding".



   Refer to Chapter 4.4.2, "Precoding Settings", on page 150 for description of the provided settings.

The dialogs shown in "To set the cell-specific antenna port mapping settings" on page 160, "To set the user-specific antenna port settings" on page 161 and "To configure the PDSCH belonging to a particular user" on page 161 comprise the settings necessary to configure the mapping of the logical antenna ports to the physical TX antennas (Basebands). The number of physical antennas is set with the parameter "General DL Settings" > Global MIMO Configuration.

The dialogs consist of two parts, a mapping table and a selection about the way the antenna mapping is performed. The yellow matrix elements in the mapping table indicate the default antenna port to physical antenna (TX antenna/baseband) mapping.

Mapping methods

The antenna mapping can be performed according to one of the following three methods:

- "Codebook"
  The used precoding weights are according to the TS 36.211, table 6.3.4.2.3-1 resp. 6.3.4.2.3-2. The selected element is defined by the selected codebook index and the number of layers.
- "Random codebook"
  The precoding weights are selected randomly from the tables defined for the codebook method.
- "Fixed weight"

A fixed precoding weight can be defined which is used for all allocations of the according “User” throughout the frame.

Depending on the selected mapping method, the mapping table is invisible ("Random codebook"), read-only ("Codebook") or full configurable ("Fixed weight").

Mapping table

The mapping table is a matrix with number of rows equal to the number of physical Tx antennas and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration.

- Antenna Ports AP0, AP1, AP2 and AP3 are always mapped to the four Tx antennas Tx1, Tx2, Tx3 and Tx4.
- Antenna Port AP4 is reserved for the MBSFN RS ("General DL Settings > MBSFN > State > Mixed") and per default mapped to "BB A".
- Antenna Port AP5 is reserved for the UE-specific RS (DM-RS) in TM7, AP7/AP8 are reserved for TM8
  ("Frame Configuration > General > User Configuration > Antenna Mapping > Config")
- Antenna Port AP6 is reserved for the PRS ("General DL Settings > PRS > State > On") and per default mapped to "BB A".
- Antenna Ports AP9 to AP14 are used by TM9
  ("Frame Configuration > General > General > Configure User > Antenna Mapping > Config")
- Antenna Ports AP15 to AP22 are reserved for CSI-RS (up to LTE Rel. 13)
  Option: R&S SMBV-K85
  ("General DL Settings > Signals > CSI-RS" > CSI-RS State > "On" and Number of AP per CSI-RS Configuration)
  The number of antenna ports corresponds to the maximum "Number of CSI-RS Antenna Ports", selected for any active cell with active CSI-RS or active DRS carrying CSI-RS.
- Option: R&S SMBV-K112
  Antenna Ports AP107 to AP110 are reserved for EPDCCH
  ("Frame Configuration > General > General > Configure User": "Tx Modex > TM10",
  EPDCCH > Config > "Activate EPDCCH > On" and "Antenna Mapping > Config")
- Option: R&S SMBV-K115
  Antenna Ports AP7 or AP8 are used for the transmission of eMTC PDSCH
  Antenna Ports AP107 to AP110 are reserved for MPDCCH
  Antenna Ports AP2000 and AP2001 are reserved for the NB-IoT reference signal NRS

Cell-Specific Antenna Port Mapping 164
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└ Antenna Port Mapping 164
└ Constant Codebook Index 164
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└ Mapping table 166

Cell-Specific Antenna Port Mapping
Option: R&S SMBV-K84/K85

Comprises the settings for defining the mapping of the logical APs to the available physical TX antennas.

Mapping Coordinates ← Cell-Specific Antenna Port Mapping
Switches representation between the "Cartesian (Real/Imag)" and "Cylindrical (Magn./Phase)" coordinates.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates` on page 540

Mapping table ← Cell-Specific Antenna Port Mapping
Defines the mapping of the antenna ports (AP) to the physical antennas, see "Mapping table" on page 163.

The default mapping is selected to fit the current configuration but it can be changed afterwards.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:REAL` on page 540
`[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:IMAGinary` on page 541

User-Specific Antenna Port Mapping
Comprises the settings for defining the mapping of the logical APs to the available physical TX antennas.

Antenna Port Mapping ← User-Specific Antenna Port Mapping
Defines the antenna port mapping method, see Mapping Methods.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE` on page 690

Constant Codebook Index ← User-Specific Antenna Port Mapping
For "Antenna Port Mapping > Codebook", defines whether the codebook index is set globally or per subframe.

Example:

Configure the settings as described in "To configure the PDSCH belonging to a particular user" on page 161.

- In the "User Specific Antenna Port Mapping" dialog:
  – Set "Antenna Port Mapping > Codebook"
  – Set **"Constant Codebook Index > On"**
  – Set the "Codebook Index/Codebook Index 2" values.

- Open the "Frame Configuration > Subframe > Allocation Table > All#2 > Enh. PDSCH Settings > Precoding" dialog.
  Observe the "Codebook Index/Codebook Index 2" values.
  The values are set automatically to the values set in the "Antenna Port Mapping" dialog.
- In the "User Specific Antenna Port Mapping" dialog, set **"Constant Codebook Index > Off"**.
- In the "Frame Configuration > Subframe > Allocation Table > All#2 > Enh. PDSCH Settings > Precoding" dialog, set the "Codebook Index/Codebook Index 2" values.

"On" Set the codebook index with the parameters Codebook Index/Codebook Index 2.
The values are constant and are used in all subframes for any PUSCH transmission of the particular user ("PUSCH Data Source > User x").

"Off" Set the codebook index with the parameters "Enhanced PDSCH Settings" > Codebook Index/Codebook Index 2
The values are set on a per subframe basis.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBCI` on page 689

Codebook Index/Codebook Index 2 ← User-Specific Antenna Port Mapping
For "Antenna Port Mapping > Codebook" and "Constant Codebook Index > On", sets the codebook index for codebook mapping method.

The codebook index values are constant are used in all subframes for any PUSCH transmission of the particular user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex[<dir>]` on page 689

Use Alternative Codebooks ← User-Specific Antenna Port Mapping
Option: R&S SMBV-K113

This parameter applies the enhanced four Tx codebook and is enabled if the following applies:

- Transmission Scheme > "Tx Mode 8/Tx Mode 9/Tx Mode 10" (dual- or multi-layer transmission) and
- Global MIMO Configuration = "4 TxAntennas"

The enhanced 4 Tx codebook is part of the further downlink MIMO enhancements feature proposed in LTE Rel. 12; see "Further DL MIMO enhancements (enhanced 4Tx codebook)" on page 53.

"Off" Applied is the normal codebook, as specified in TS 36.211.

"On" Applied is the enhanced 4Tx codebook, as specified in TS 36.213.
Tip: Toggle the parameter and observe the effect on the values in the Mapping table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBUA on page 689

Cell ← User-Specific Antenna Port Mapping
Indicates the cell to that the antenna port mapping is related, if a carrier aggregation is enabled (Activate Carrier Aggregation = On and Activate CA = On).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CELL on page 688

Mapping Coordinates ← User-Specific Antenna Port Mapping
Switches between the "Cartesian (Real/Imag)" and "Cylindrical (Magn./Phase)" coordinates representation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates on page 690

Mapping table ← User-Specific Antenna Port Mapping
Defines the mapping of the antenna ports (AP) to the physical antennas, see also "Mapping table" on page 163.

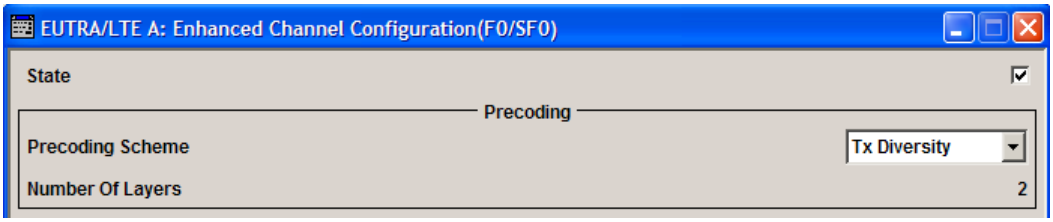
You can set the precoding matrix per layer and not only of the most upper one that corresponds to the selected number of layers, but also for the layers underneath. The number of used layers is always lower or equal to the number of Tx antennas. Different layers can be assigned per subframe, therefore it is possible that the antenna port mapping changes on a per subframe basis.

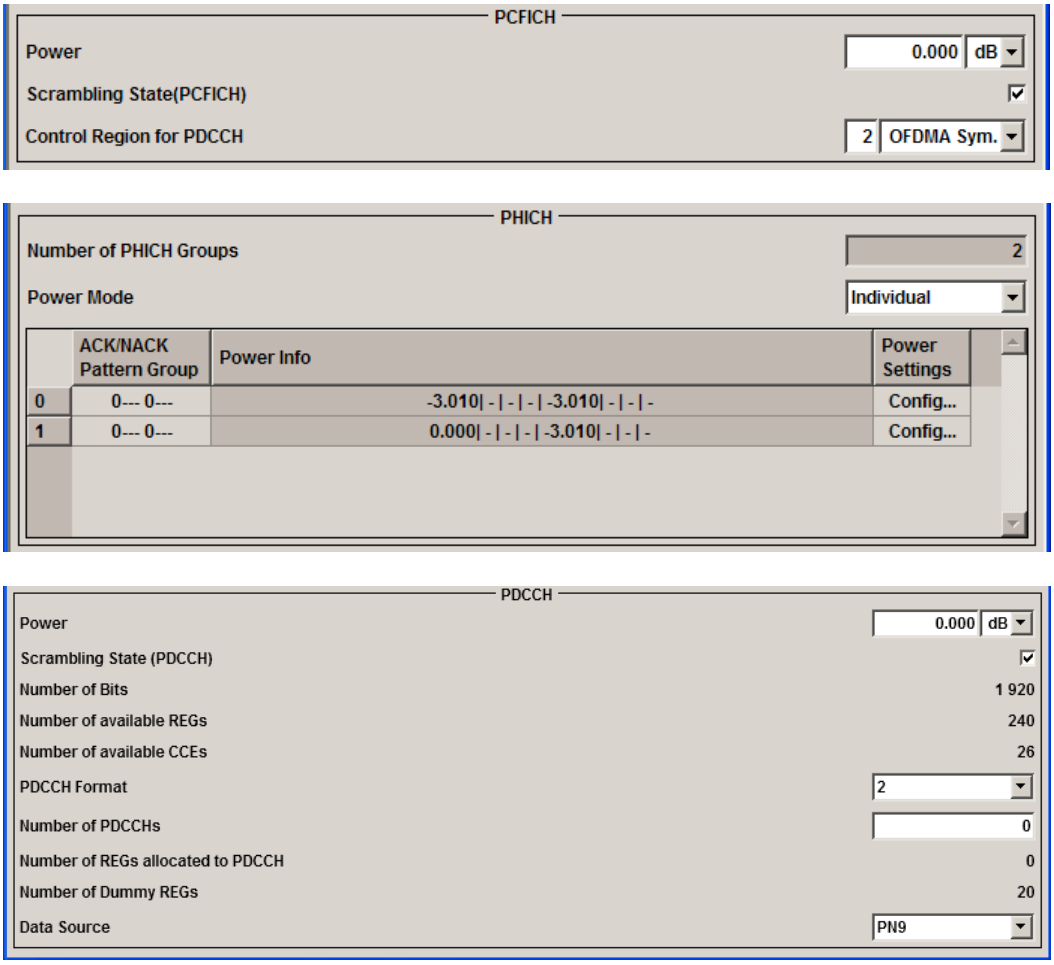
Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:REAL on page 690
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:IMAGinary on page 691

4.6 Enhanced PCFICH, PHICH and PDCCH Channel Configuration

The "Enhanced Channel Configuration" dialog allows you to define and configure the PCFICH, PHICH and PDCCH settings per subframe. The subframe for which the PCFICH, PHICH and PDCCH settings are currently configured is indicated in the window name.

The parameters available for configuration in section "Precoding" depend on the Global MIMO Configuration.





4.6.1 General PCFICH/PHICH/PDCCH Configuration and Precoding Settings

Comprises the settings common to all DL enhanced channels.

State
Enables/disables the PDCCH, PCFICH and PHICH allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe` on page 616

Precoding Scheme
Selects the precoding scheme for PDCCH, PCFICH and PHICH.

"None" Disables precoding.

"Tx Diversity" Precoding for transmit diversity will be performed according to TS 36.211 and the selected parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme` on page 617

Number of Layers (Enhanced Channels)
(Enabled for Precoding Scheme set to Tx Diversity)

Displays the number of layers for PDCCH, PCFICH and PHICH. This value is fixed to 1 for PDCCH, PCFICH and PHICH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?`
on page 617

Scrambling State
Enables/disables the scrambling of all DL enhanced channels.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:SCRambling:STATe`
on page 617

4.6.2 PCFICH Settings

Settings:

PCFICH Configuration..... 168
└ PCFICH Power..... 168
└ Control Region for PDCCH (PCell)..... 168

PCFICH Configuration
Comprises the PCFICH settings:

PCFICH Power ← PCFICH Configuration
Sets the power of the PCFICH (P_{PCFICH}).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer`
on page 618

Control Region for PDCCH (PCell) ← PCFICH Configuration
Sets the size of the control region, i.e. the number of OFDM Symbols that the region spans (see Table 4-4).

Table 4-4: Number of OFDM symbols in the control region for PDCCH

Channel Bandwidth	PHICH Duration	Duplex. Mode	OFDM Symbols in	The control region
			Normal Subframe	Special Subframe
No RB > 10	Normal	FDD	1, 2 ,3	-
	Normal	TDD	1, 2, 3	1, 2
	Extended	FDD	3	-
	Extended	TDD	3	2
No RB <=10	Normal	FDD	2, 3, 4	-
	Normal	TDD	2, 3, 4	2

Channel Bandwidth	PHICH Duration	Duplex. Mode	OFDM Symbols in	The control region
			Normal Subframe	Special Subframe
	Extended	FDD	3, 4	-
	Extended	TDD	3, 4	2

The size of the control region can vary per subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion`
on page 618

4.6.3 PHICH Settings

Provided are the following settings:

Cell 169
Number of PHICH Groups 169
Power Mode 170
PHICH Power 170
PHICHs Table 170
└ ACK/NACK Pattern Group x 170
└ Power Info 170
└ Power Settings Config 170

Cell
With enabled "General DL Settings > CA > Activate Carrier Aggregation > On" state, indicates to which cell (i.e. component carrier) the settings apply.

Remote command:
n.a

Number of PHICH Groups
Displays the number of available PHICH groups, depending on the value of the parameter PHICH N_g.

If "PHICH N_g > Custom", this parameter is enabled for configuration.

- For normal CP, one PHICH group consists of 8 ACK/NACK messages from several users.
- For extended CP, one PHICH group carries 4 ACK/NACK messages from several users.

Each PHICH group uses 3 resource element groups (REGs); hence the total number of REGs used for PHICH is 3 times the number of PHICH groups.

The number of the available OFDM symbols for the allocation of this total number of REGs depends on the selection made for the parameter PHICH Duration (normal or extended).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:NOGRoups`
on page 619

Power Mode
Determines whether all PHICHs in a PHICH group are sent with the same power or enables the adjustment of each P_{PHICH} individually.

The parameter Power Info displays the power values of the configured PHICHs.

"Constant" The power of a PHICH (P_{PHICH}) in a PHICH group is set with the parameter Power.

"Individual" The power of the individual PHICHs is set in the PHICH Power Config dialog.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODe` on page 618

PHICH Power
Sets the power of one PHICH (P_{PHICH}) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs within this group.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer` on page 619

PHICHs Table
Comprises the settings of the PHICHs.

ACK/NACK Pattern Group x ← PHICHs Table
Sets the ACK/NACK pattern for the corresponding PHICH group, where:

- "1" indicates an ACK
- "0" indicates a NACK
- "-" indicates DTX
  DTX means that the corresponding PHICH is not transmitted, i.e. the orthogonal sequence is not used.

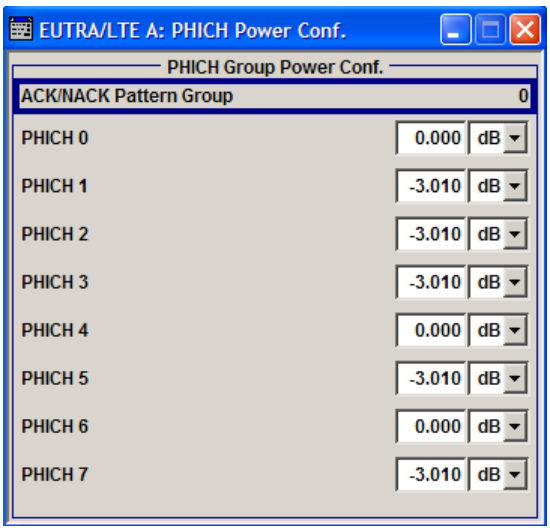
The number of ACK/NACK messages carried by a PHICH group depends on the Cyclic Prefix. Hence, a pattern group consists of 8 or 4 values for normal and extended CP respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:CELL<ch0>:ANPattern<gr0>` on page 619

Power Info ← PHICHs Table
Displays the power values of the configured PHICHs.

Remote command:
n.a.

Power Settings Config. ← PHICHs Table
Opens the "PHICH Power Config". dialog to configure the power of the PHICHs individual.



"ACK/NACK Pattern Group"
Displays the ACK/NACK pattern group the values are adjusted for.

"PHICH x" Sets the power of the individual PHICHs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:GROup<gr0>:ITEM<user0>:POW` on page 620

4.6.4 (E)PDCCH Settings

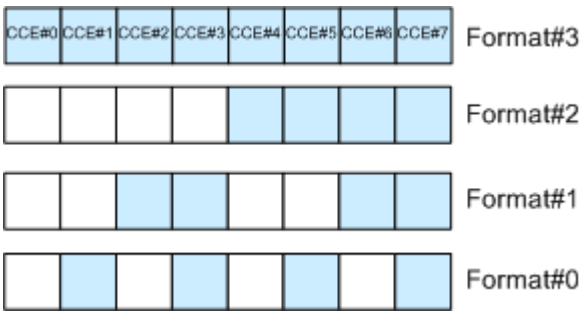
Settings:

PDCCH Format....171
Power....172
Number of PDCCH Bits / REGs / CCEs....172
Number of PDCCHs....173
Number of REGs allocated to PDCCH....174
Number of Dummy REGs....174
Data Source....174

PDCCH Format
Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) are used for the transmission of the PDCCH, i.e. determines how many PDCCHs (#PDCCH) can be transmitted.

The following figure shows the distribution of the PDCCH over the CCEs for the different formats.



"Variable" Select this mode to enable full flexibility by the configuration of the downlink control information (DCI) format and content (see Chapter 4.6.5, "(E)PDCCH Format Variable", on page 175).

"-1" Proprietary format for legacy support.

This format corresponds to the transmission of one PDCCH on all available REGs, i.e.

- Number of available REGs = #REGs allocated PDCCH,
- #PDCCH = 1,
- #DummyREGs = 0.

"0" One PDCCH is transmitted on one CCE, i.e. #REG=1.

"1" One PDCCH is transmitted on two CCEs, i.e. #REG=18.

"2" One PDCCH is transmitted on four CCEs, i.e. #REG=36.

"3" One PDCCH is transmitted on eight CCEs, i.e. #REG=72.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat` on page 622

Power
Sets the power of the PDCCH (P_{PDCCH}).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer` on page 620

Number of PDCCH Bits / REGs / CCEs
Displays the number of bits / REGs / CCEs allocated for PDCCH.

"Number of PDCCH Bits"

Indicates the number of bits available for PDCCH.

The number of bits available for PDCCH allocation depends on the selected:

- Channel Bandwidth
- Global MIMO Configuration
  Number of PHICH Groups
- PHICH Duration
- Control Region for PDCCH (PCell)

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS` on page 621

"Number of PDCCH REGs"

Indicates the number of the REGs that are available for the PDCCH allocation.
The number of REGs available for PDCCH allocation depends on the "Number of PDCCH Bits" ($\#Bits_{PDCCH}$) and is calculated as follows:
$\#REGs\ available_{PDCCH} = \#Bits_{PDCCH} / 8$

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS` on page 621

"Number of PDCCH CCEs"

Indicates the number of the control channel elements (CCEs) that are available for the PDCCH allocation.
The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several CCEs, where a CCE corresponds to 9 REGs, i.e. the number of the available CCEs is calculated as follows:
$\#CCEs\ available_{PDCCH}$ = "Number of PDCCH REGs"/ 9

Note: If Activate Carrier Aggregation > "On", the parameter "Number of available CCEs" displays information about the PCell.
Information related to the SCells is displayed by the corresponding parameter No. Dummy (E)CCEs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes`
on page 621

Number of PDCCHs
(for "PDCCH Format" different than "Variable")

Sets the number of PDCCHs to be transmitted.

The maximum number PDCCH that can be transmitted on the available REGs for PDCCH depends on the number of REGs (#REG) reserved for the transmission of one PDCCH, i.e. depends on the selected PDCCH Format and is calculated as follows:

#PDCCH = Number of PDCCH REGs / #REG.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs`
on page 622

Number of REGs allocated to PDCCH
(for "PDCCH Format" different than "Variable")

Defines the number of REGs that are allocated for PDCCH transmission (#REGs allocated$_{PDCCH}$) and is calculated as follows:

#REGs allocated$_{PDCCH}$ = #PDCCH * #REG

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs` on page 623

Number of Dummy REGs
(for "PDCCH Format" different than "Variable")

Displays the number of REGs that are available for the PDCCH allocation but are not allocated and is calculated as follows:

#DummyREGs = Number of PDCCH REGs - #REGs allocated PDCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs` on page 623

Data Source
(for "PDCCH Format" different than "Variable")

Selects the data source for PDCCH.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

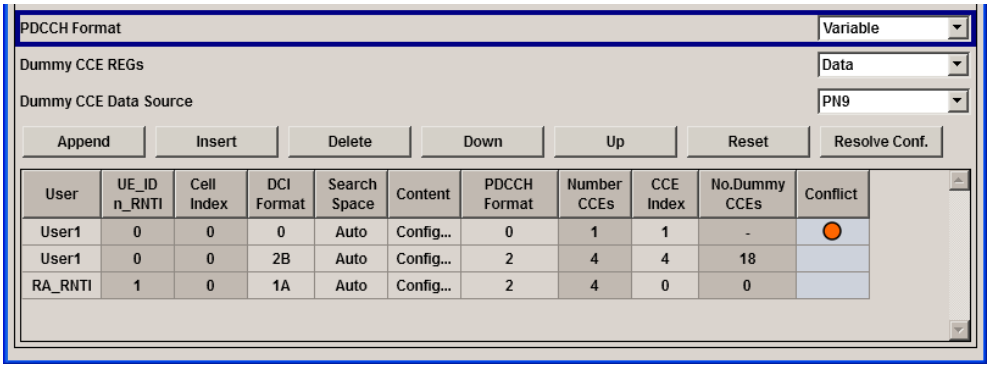
  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA` on page 623
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern` on page 624
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern` on page 624

4.6.5 (E)PDCCH Format Variable

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > (E)PDCCH".
3. Select PDCCH Format > "Variable".



Use these parameters and the DCI table to configure the multiple scheduling messages (DCIs) with the corresponding (E)PDCCHs.

Dummy CCE REGs....175
Dummy CCE Data Source....176
Standard configuration functions....176
Reset....177
Resolve Conflicts....177
DCI Table....177
- Number of Used (E)PDCCH Items....177
- User....178
- UE_ID/n_RNTI....178
- Cell Index....178
- Carrier Indicator Field (CIF)....179
- (E)PDCCH....179
- DCI Format....180
- Search Space....180
- Content Config/ Content Act./Rel....181
- (E)PDCCH Format (Variable)....181
- Number (E)CCEs....182
- (E)CCE Index....182
- No. Dummy (E)CCEs....182
- Conflict (DCI)....183

Dummy CCE REGs
Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource
on page 624

Dummy CCE Data Source
Selects the data source for the dummy CCE.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA
on page 625
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern
on page 625
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect
on page 625

Standard configuration functions
Standard configuration functions:

"Append" Adds a row at the end of the table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend
on page 626

"Insert" Insert a new row before the current one.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem
on page 626
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert
on page 626

"Delete" Deletes the selected row.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELete
on page 626

"Down/Up" Moves the selected row down or up.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN
on page 627
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP
on page 627

Reset
Resets the table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet
on page 628

Resolve Conflicts
The "Resolve Conf." is a built-in algorithm that reassigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values are not maintained. If the conflict cannot be resolved automatically, the values are left unchanged.

For more information on how to solve DCI conflicts, see Chapter A.3, "DCI Conflict Handling", on page 892.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe?
on page 628
To query the number of current conflicts:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:CONFlicts?
on page 627

DCI Table
Access:
- Select "General > Link Direction > Downlink (OFDMA)".
- Select "Frame Configuration > (E)PDCCH".
- Select PDCCH Format > "Variable".
- Select "DCI Table".

The "DCI Table" comprises the settings concerning the (E)PDCCH content.

Number of Used (E)PDCCH Items ← DCI Table
Displays the number of the (E)PDCCH items, i.e. the number of rows in the DCI table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UITems
on page 628

User ← DCI Table
Selects the user the DCI is dedicated to. The available DCI Format depend on the value of this parameter.

Note: If Activate Carrier Aggregation > "On", the Cell Index determines the component carrier the corresponding user is mapped to.
To enable one particular user in more than one component carrier, append several table rows and enable the same "User" in the different component carriers.

"User x" Selects one of the four users configured in the User Configuration Settings dialog.
The DCIs of an inactive user ("Configure User" > State > "Off") are not configurable and not considered by the calculation of "No. Dummy CCEs".

"P-RNTI/S-RNTI/RA-RNTI"
A group of users is selected.

"User x eIMTA"
Option: R&S SMBV-K113
Indicates that the user supports eIMTA. Use the DCI format 1C settings to define the UL/DL configuration numbers.
See "DCI Format 1C for eIMTA" on page 189.

"CC-RNTI" Option: R&S SMBV-K119
Sets that the DCI format 1C uses CRC scrambled with the CC-RNTI. Use the DCI format 1C settings to define the LAA subframe configuration.
See "DCI Format 1C for LAA" on page 190.

"User x SPS" Indicates an activated semi-persistent scheduling (SPS) for the corresponding user.

"None" Allows free definition of all settings

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER` on page 632

UE_ID/n_RNTI ← DCI Table
Displays the UE_ID or the n_RNTI for the selected PDCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID` on page 629

Cell Index ← DCI Table
Sets the component carrier on that the corresponding DCI is transmitted.

This parameter refers to the "DL Carrier Aggregation Configuration" > Cell Index. The "Cell Index" of the PCell (primary cell) is always set to 0.

Example:

If the following settings are enabled in the "DL Carrier Aggregation Configuration" dialog, the value range of the parameter "Cell Index" is 0, 1, 3, 5 and 7.

Component carrier	Cell index
PCell	0
SCell#1	1
SCell#2	3
SCell#3	7
SCell#4	5

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL` on page 630

Carrier Indicator Field (CIF) ← DCI Table
(Requires R&S SMBV-K85)

This field is enabled if:
- Activate Carrier Aggregation > "On" and
- For each User with "Configure User" > Activate CA.

The CIF is present in **each** DCI Format and identifies the component carrier that carries the PDSCH or PUSCH for the particular PDCCH in the cross-carrier approach (see Figure 3-27).

According to the LTE specification, cross-carrier scheduling is enabled by higher-level signaling. To simulate a cross-carrier scheduling in this implementation, enable the "DL Carrier Aggregation Configuration>CIF Present" per each component carrier/cell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634

(E)PDCCH ← DCI Table
Indicates if the DCI is carried by a PDCCH or by an EPDCCH set.

You can assign an EPDCCH set in the following cases:
- If the EPDCCH transmission and the particular set are activated for the selected user.
  See Chapter 4.3.4, "EPDCCH Configuration Settings", on page 132.
- EPDCCH is not allocated in a TDD special subframe in one of the situations listed in Table 4-5.

Table 4-5: Combinations of cyclic prefix and TDD special subframe configurations

"Cyclic Prefix"	TDD Special Subframe Config
Normal / Extended	0
Normal	5
Extended	4, 7, 8, 9

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PDCChtype on page 631

DCI Format ← DCI Table
Sets the DCI format for the selected PDCCH.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in both the UL and DL direction. It carries scheduling information as well as uplink power control commands.

The DCI is mapped on the PDCCH and depending on the DCI message size and usage are categorized into four different formats that are further subdivided (see Table 4-6).

Table 4-6: Overview DCI formats

DCI format	Purpose
DCI Format 0	PUSCH allocation information
DCI Format 1 DCI Format 1A DCI Format 1B DCI Format 1C DCI Format 1D	PDSCH information with one codeword
DCI Format 2/2A/2B/2C/2D	PDSCH information for MIMO configuration (two codewords)
DCI Format 3/3A	Uplink power control information

The fields of each DCI format are configurable parameters that can be adjusted in the corresponding dialog box. Select Content Config/ Content Act./Rel. to access this dialog box for the selected "DCI Format".

Not all DCI formats are always enabled for selection.

The following table gives an overview of the cross-reference between the available DCI formats and the value of the parameter User.

User	DCI format
P-RNTI/SI-RNTI/RA-RNTI	1A, 1C
User x	1, 1A, 1B, 1D, 2, 2A, 2B, 2C, 2D
None	All formats

See also TS 36.212, chapter 5.3.3.1.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt on page 629

Search Space ← DCI Table
Defines the search space for the selected DCI, i.e. determines the valid CCE indexes.

The search space determines the set of CCEs a UE monitors. The UE can decode only the control information on a PDCCH that is transmitted over CCEs within the search space this UE monitors.

Note: The 3GPP specification defines two kinds of search spaces, the common and the UE-specific search space.
Avoid the use of the "Auto" and "Off" values; these values are provided for backwards compatibility reasons only.

"Off" No search space is determined.
All CCEs are monitored.

"Auto" Provided for backward compatibility only.

An internal mapping to the common and UE-specific search space is applied depending on the value of the parameter "User":
- For "User x", "Auto" corresponds to "UE-spec"
- In all other cases, "Auto" corresponds to "Common"

"Common" The DCI is mapped to the common search space.
A common search space is used when all or a group of UEs is addressed. The combination "User 1" and common search space is enabled in PCell only.

"UE-spec" Non-common DCIs are mapped to the UE-specific search space. Each UE has multiple UE-specific search space, determined as a function of the UE_ID and the subframe. A UE-specific search space applies for the User set to "User x".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:SESPace` on page 632

Content Config/ Content Act./Rel. ← DCI Table
Opens the DCI Format Configuration dialog to configure the DCI fields of the selected DCI Format.

In the activation and release subframes of users that are semi-persistent scheduled (User > "User x SPS"), the function "Act./Rel." accesses the DCI Format Configuration dialog to configure the special fields for the SPS validation.

Remote command:
n.a.

(E)PDCCH Format (Variable) ← DCI Table
Sets the (E)PDCCH format.

The (E)PDCCH format determines how many (E)CCEs are used for the transmission of the (E)PDCCH.

Table 4-7: Supported PDCCH formats [TS 36.211]

PDCCH format	Number of CCEs	Number of REGs	Number of PDCCH bits
0	1	9	72
1	2	18	144

PDCCH format	Number of CCEs	Number of REGs	Number of PDCCH bits
2	4	36	288
3	8	72	576

Table 4-8: EPDCCH formats and number of ECCEs for one EPDCCH N^{EPDCCH}_{ECCE} [TS 36.211]

EPDCCH format	Case A	Case B
0	2	1
1	4	2
2	8	4
3	16	8
4	- / 32*	- / 16*

*) EPDCCH format 4 is supported if distributed transmission is used (see Transmission Type).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT` on page 630

Number (E)CCEs ← DCI Table
Defines the number of control channel elements used for the transmission of the (E)PDCCH.

The value depends on the selected (E)PDCCH format.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes?` on page 630

(E)CCE Index ← DCI Table
Sets the (E)CCE start index.

The available ECCEs depend on the selected (E)PDCCH format.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINDex` on page 631

No. Dummy (E)CCEs ← DCI Table
Defines the number of dummy (E)CCEs that are appended to the corresponding PDCCH.

Note: If Activate Carrier Aggregation > "On", the "Number of Dummy CCEs" is calculated per component carrier and depends on the selected Bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NDCCes?` on page 631

Conflict (DCI) ← DCI Table
Indicates a conflict between two DCI formats.

For more information on how to solve DCI conflicts, see Chapter A.3, "DCI Conflict Handling", on page 892.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?` on page 633
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:CONFlicts?` on page 627

4.6.6 DCI Format Configuration

For information on the provided settings, see also TS 36.212, chapter 5.3.3.1.

Carrier Indicator Field (CIF)..... 183
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Carrier Indicator Field (CIF)
(Requires R&S SMBV-K85)

This field is enabled if:
- Activate Carrier Aggregation > "On" and
- For each User with "Configure User" > Activate CA.

The CIF is present in **each** DCI Format and identifies the component carrier that carries the PDSCH or PUSCH for the particular PDCCH in the cross-carrier approach (see Figure 3-27).

According to the LTE specification, cross-carrier scheduling is enabled by higher-level signaling. To simulate a cross-carrier scheduling in this implementation, enable the "DL Carrier Aggregation Configuration>CIF Present" per each component carrier/cell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634

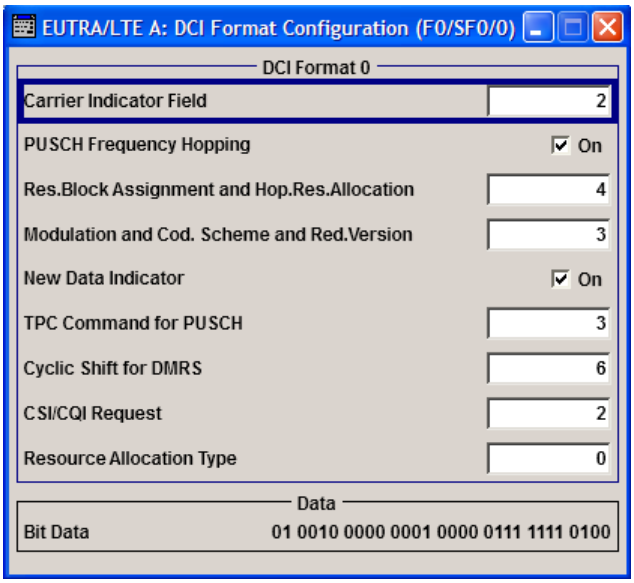
Bit Data
Displays the resulting bit data as selected with the DCI format parameters.

Mapping of the information bits is according to TS 36.212.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:BITData?` on page 634

DCI Format 0

The DCI format 0 is used for scheduling uplink transmission on PUSCH and transmits the information listed in the following table.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

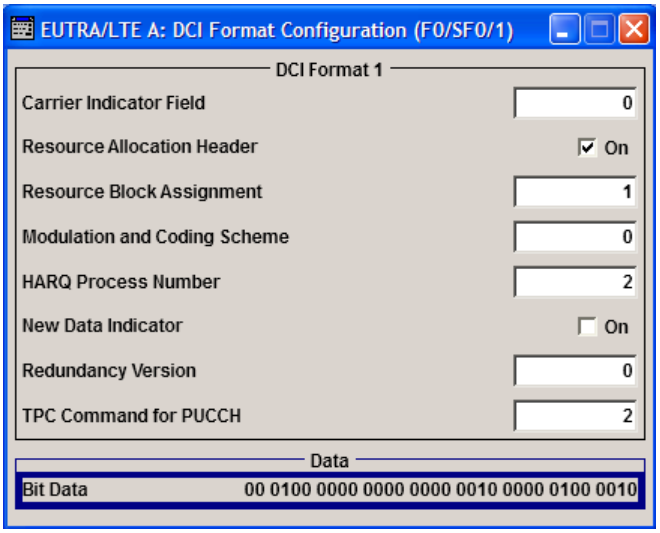
If the DCI format is used for validation of the semi-persistent scheduling (SPS) activation or release, some special DCI fields are predefined according to Tables 9.2 in TS 36.213. See also Chapter 4.8, "SPS Configuration Settings", on page 202.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634	See "Carrier Indicator Field (CIF)" on page 179
"PUSCH Frequency Hopping"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping` on page 640	
"Resource Block Assignment and Hopping Resource Allocation"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR` on page 642	
"Modulation and Coding Scheme and Redundancy Version"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 639	
"New Data Indicator"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI` on page 640	

Control Information Field	SCPI command	Dependencies
"TPC Command for PUSCH"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC` on page 646	
"Cyclic Shift for DMRS"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs` on page 636	
"UL Index"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULINdex` on page 647	TDD mode and TDD Frame Structure Settings 0
"Downlink Assignment Index"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex` on page 637	TDD mode and "UL/DL Configuration = 1 to 6"
"CSI/CQI Request"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSIRequest` on page 636	"Search Space" other than "Common" and "User > Tx Mode = TM10"
"SRS Request"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SRSRequest` on page 643	"User Configuration" > Aperiodic SRS State > "On"
"Resource Allocation Type"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAType` on page 642	

DCI Format 1

The DCI format 1 carries information for scheduling transmission of one codeword on PDSCH. The different fields of this format are summarized in the following table.



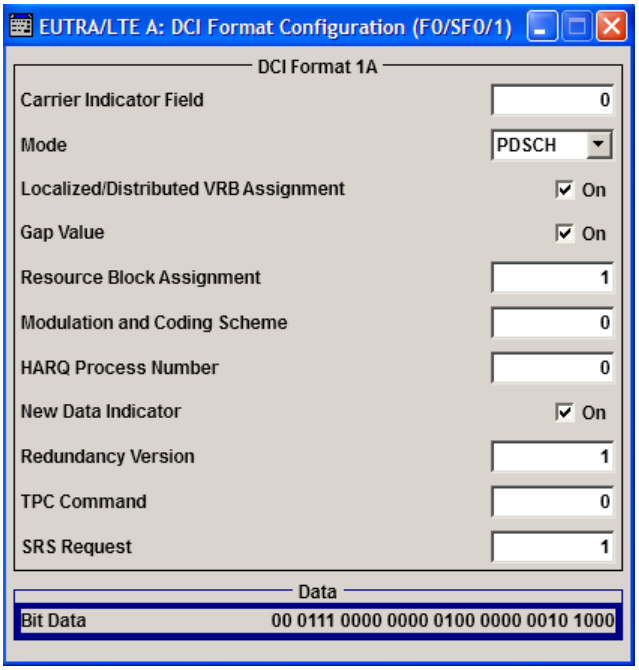
The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

If the DCI format is used for validation of the semi-persistent scheduling (SPS) activation or release, some special DCI fields are predefined according to Tables 9.2 in TS 36.213. See also Chapter 4.8, "SPS Configuration Settings", on page 202.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField on page 634	See "Carrier Indicator Field (CIF)" on page 179
"Resource Allocation Header"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH on page 642	"Channel Bandwidth > 10RBs"
"Resource Block Assignment"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 643	
"Modulation and Coding Scheme"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 639	
"HARQ Process Number"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 638	
"New Data Indicator"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 640	
"Redundancy Version"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 643	
"TPC Command for PUCCH"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 646	
"Downlink Assignment Index"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 637	TDD mode

DCI Format 1A

DCI format 1A is used for the compact scheduling of one PDSCH codeword and random access procedure initiated by a PDCCH order.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The contents of DCI Format 1A are listed in the following table; the available fields depend whether a PDSCH or PRACH is transmitted.

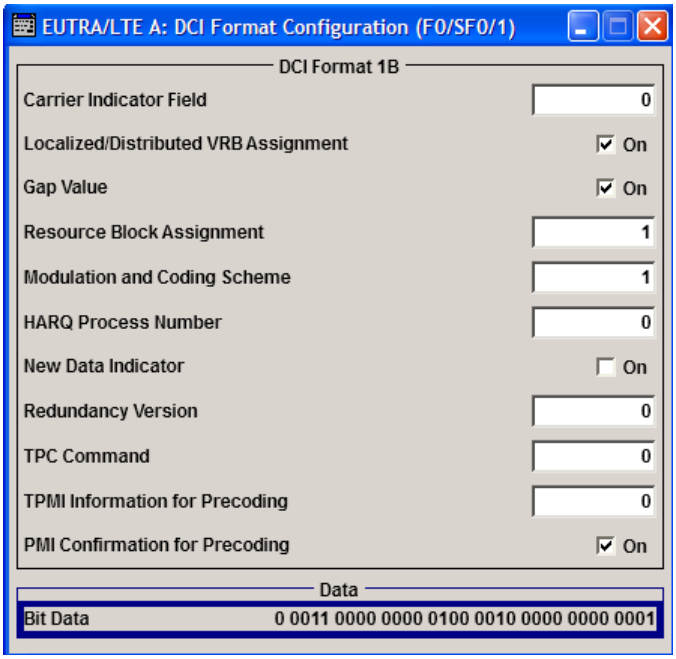
If the DCI format is used for validation of the semi-persistent scheduling (SPS) activation or release, some special DCI fields are predefined according to Tables 9.2 in TS 36.213. See also Chapter 4.8, "SPS Configuration Settings", on page 202.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634	See "Carrier Indicator Field (CIF)" on page 179
"Mode"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode` on page 634	
"Localized/Distributed VRB Assignment"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 648	
"GAP Value"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP` on page 637	"Channel Bandwidth >= 50RBs", "Distributed VBR Assignment" and "User = User x"
"Resource Block Assignment"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 643	
"Modulation and Coding Scheme"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 639	PDSCH Mode
"HARQ Process Number"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN` on page 638	PDSCH Mode
"New Data Indicator"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI` on page 640	PDSCH Mode
"Redundancy Version"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV` on page 643	PDSCH Mode
"TPC Command for PUCCH"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC` on page 646	PDSCH Mode
"Downlink Assignment Index"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex` on page 637	PDSCH Mode TDD mode
"SRS Request"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SRSRequest` on page 643	"User Configuration > User x > Aperiodic SRS > On"
"Preamble Index"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:PRINdex` on page 635	PRACH Mode
"PRACH Mask Index"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:MINDex` on page 635	PRACH Mode

DCI Format 1B

DCI format 1B is used for the compact scheduling of one PDSCH codeword with precoding information, i.e. when MIMO operation is involved.

The precoding information consists of 2 or 4 bits for 2 and 4 antennas respectively.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

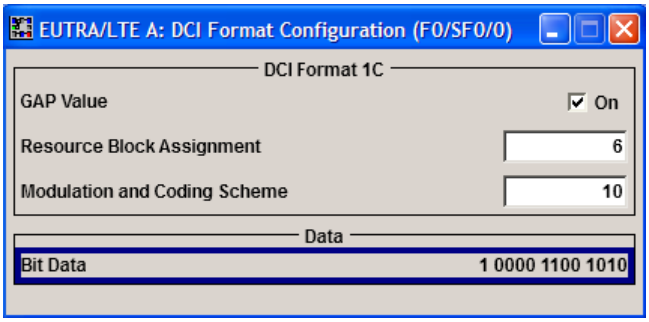
The DCI Format 1B transmits the information listed in the following table.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634	See "Carrier Indicator Field (CIF)" on page 179
"Localized/Distributed VRB Assignment"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 648	
"GAP Value"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP` on page 637	"Channel Bandwidth >= 50RBs", "Distributed VBR Assignment" and "User = User x"
"Resource Block Assignment"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 643	
"Modulation and Coding Scheme"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 639	
"HARQ Process Number"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN` on page 638	

Control Information Field	SCPI command	Dependencies
"New Data Indicator"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 640	
"Redundancy Version"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 643	
"TPC Command for PUCCH"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 646	
"Downlink Assignment Index"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 637	TDD mode
"TPMI Information for Precoding"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 647	
"PMI Confirmation for Precoding"	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI on page 641	

DCI Format 1C

DCI format 1C is used for compact scheduling of one PDSCH codeword.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The DCI Format 1C transmits the information listed in the following table.

Control Information Field	SCPI command	Dependencies
GAP Value	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 637	[Channel Bandwidth >= 50 RBs]
Resource Block Assignment	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 643	
Modulation and Coding Scheme	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 639	

DCI Format 1C for eIMTA

Option: R&S SMBV-K113

To enable this parameter, select "DCI Table" > User > "User x eIMTA".

If eIMTA is used, the DCI format 1C carries information about the UL/DL configuration numbers. Each UL/DL configuration number consists of 3 bits and indicates one of the configurations listed in Figure 3-5.

The UL/DL configuration is defined as a bit pattern. The bit pattern length is selected so that the payload size of the DCI is equal to the payload size of the DCI format 1C, when it used for compact scheduling. If the configured pattern is shorter than the required, the remaining bits are filled with zeros.

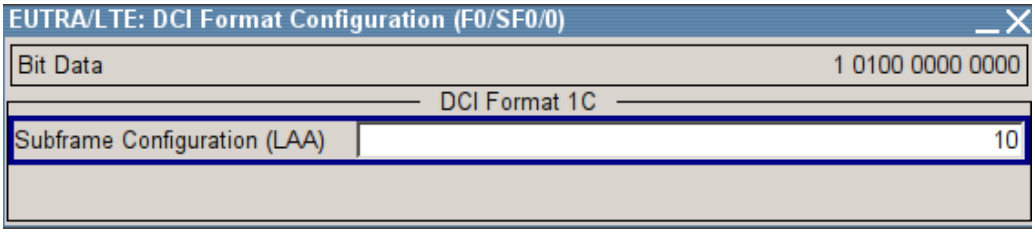
DCI format 1C for eIMTA is supported in the common search space (Search Space) and in the PCell.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULDLconf` on page 648

DCI Format 1C for LAA
Option: R&S SMBV-K119

To enable this parameter, select "DCI Table" > User > "CC-RNTI".



If LAA is used, the DCI format 1C carries information about the LAA subframe configuration.

Table 4-9: Subframe configuration for LAA in current and next subframe [36.211]

Value of "Subframe configuration for LAA" field in current subframe	Configuration of occupied OFDM symbols (current subframe, next subframe)
0000	(-,14)
0001	(-,12)
0010	(-,11)
0011	(-,10)
0100	(-,9)
0101	(-,6)
0110	(-,3)
0111	(14,*)
1000	(12,-)
1001	(11,-)
1010	(10,-)

Value of "Subframe configuration for LAA" field in current subframe	Configuration of occupied OFDM symbols (current subframe, next subframe)
1011	(9,-)
1100	(6,-)
1101	(3,-)
1110	reserved
1111	reserved

Where:

- (-, Y) means UE may assume the first Y symbols are occupied in next subframe and other symbols in the next subframe are not occupied.
- (X,-) means UE may assume the first X symbols are occupied in current subframe and other symbols in the current subframe are not occupied.
- (X,*) means UE may assume the first X symbols are occupied in current subframe, and at least the first OFDM symbol of the next subframe is not occupied.

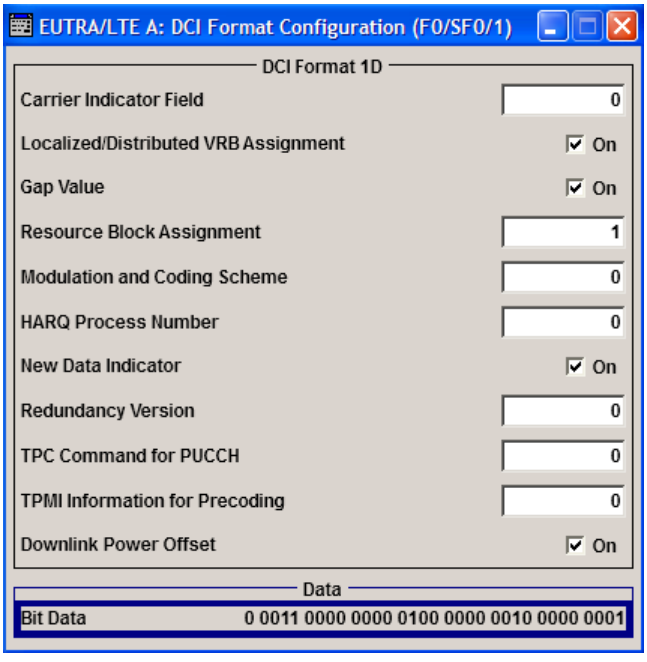
DCI format 1C for LAA is supported in the common search space (Search Space) and in the SCell.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:LAASubframe` on page 605

DCI Format 1D

DCI format 1D is used for the compact scheduling of one PDSCH codeword with precoding and power offset information.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

The DCI Format 1D transmits the information listed in the following table.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField` on page 634	See "Carrier Indicator Field (CIF)" on page 179
Localized/Distributed	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA` on page 648	
Resource Block Assignment	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA` on page 643	
GAP Value	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP` on page 637	"Channel Bandwidth >= 50RBs", "Distributed VBR Assignment" and "User = User x"
Modulation and Coding Scheme	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR` on page 639	
HARQ Process Number	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN` on page 638	
New Data Indicator	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI` on page 640	
Redundancy Version	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV` on page 643	
TPC Command for PUCCH	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC` on page 646	
Downlink Assignment Index	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex` on page 637	TDD mode
TPMI Information for Precoding	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI` on page 647	
Downlink Power Offset	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOFfset` on page 637	

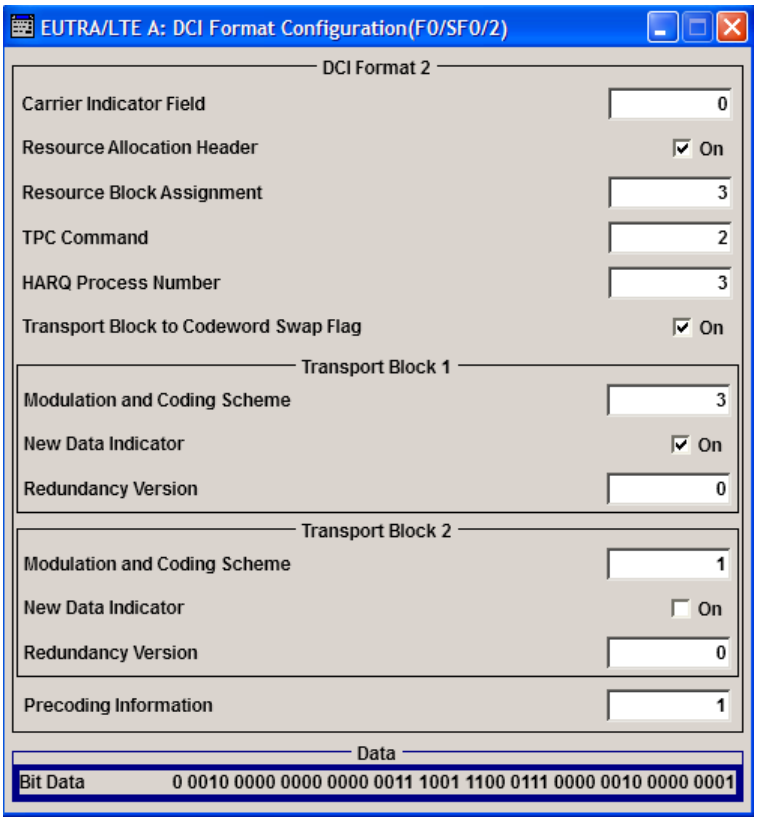
DCI Format 2/2A/2B/2C/2D

The DCI formats are used in the following cases:

- DCI format 2: for PDSCH scheduling in a spatial multiplexing configuration
- DCI format 2A: for PDSCH scheduling in a spatial multiplexing configuration, but without PMI feedback.
- DCI format 2B: in 2-, 4-Tx antenna configurations.
- DCI format 2C: in a multi-layer transmissions (Tx Mode 9).
- DCI format 2D: in a multi-layer transmissions (Tx Mode 10), using CoMP.

Since MIMO operation requires two codewords, the modulation and coding scheme, new data indicator and the redundancy version are signaled separately for each of the codewords. The spatial multiplexing also requires a transmission of precoding information.

The transport block to codeword mapping is performed according to the 3GPP specification: transport block 1 (TB1) is mapped to codeword 1/2 (CW1) and TB2 to codeword 2/2 (CW2). The "Transport Block to Codeword Swap Flag" determines the mapping in case both transport blocks are enabled. If this swap flag is enabled, the TB1 is mapped to CW2 and vice versa.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

If the DCI format is used for validation of the semi-persistent scheduling (SPS) activation or release, some special DCI fields are predefined according to Tables 9.2 in TS 36.213. See also Chapter 4.8, "SPS Configuration Settings", on page 202.

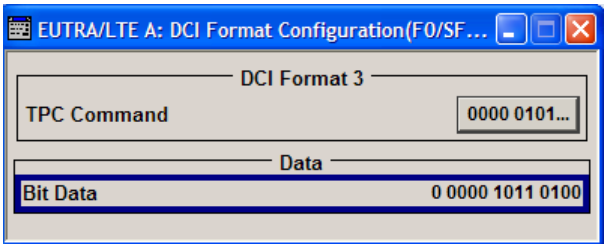
The DCI format 2D is required for downlink transmission using TM10 as the DCI format 2C is used for the TM9. The DCI format 2D is also similar to the format 2C but it carries additionally QCL (quasi-co-location) and rate matching information. The "PDSCH RE Mapping and QCL Indicator" is a two bit field that indicates one of four sets of parameters sets, as specified in the TS 36.211.

The DCI Format 2/2A/2B/2C/2D transmits the information listed in the following table.

Control Information Field	SCPI command	Dependencies
Carrier Indicator Field (CIF)	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField on page 634	See "Carrier Indicator Field (CIF)" on page 179
Resource Allocation Header	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH on page 642	"Channel Bandwidth > 10 RBs"
Resource Block Assignment	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 643	
TPC Command for PUCCH	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 646	
Downlink Assignment Index	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 637	TDD mode
HARQ Process Number	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 638	
Ant. Port(s), Layers, SCID	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:APLayer on page 633	DCI Format 2C/2D
Transport Block to Codeword Swap Flag	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SWAPflag on page 644	DCI Format 2/2A
Scrambling Identity	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SID on page 645	DCI Format 2B
Precoding Information	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRECinfo on page 641	DCI Format 2/2A
SRS Request	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SRSRequest on page 643	DCI Format 2B and TDD mode
	"Transport Block 1"	
Modulation and Coding Scheme	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:MCS on page 644	
New Data Indicator	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI on page 645	
Redundancy Version	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:RV on page 645	
	"Transport Block 2"	
Modulation and Coding Scheme	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:MCS on page 644	
New Data Indicator	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI on page 645	
Redundancy Version	[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:RV on page 645	

Control Information Field	SCPI command	Dependencies
PDSCH RE Mapping and QCL (quasi-co-location) Indicator	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PDRE` on page 640	DCI Format 2D
HARQ-ACK Resource Offset	`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HACK` on page 638	If EPDCCH is used

DCI Format 3/3A
The DCI Format 3/3A is used for the transmission of TPC Commands for PUCCH and PUSCH with 2-bit and a single bit power adjustment respectively.



The "TPC Command" is set as a bit pattern.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting Bit Data is displayed.

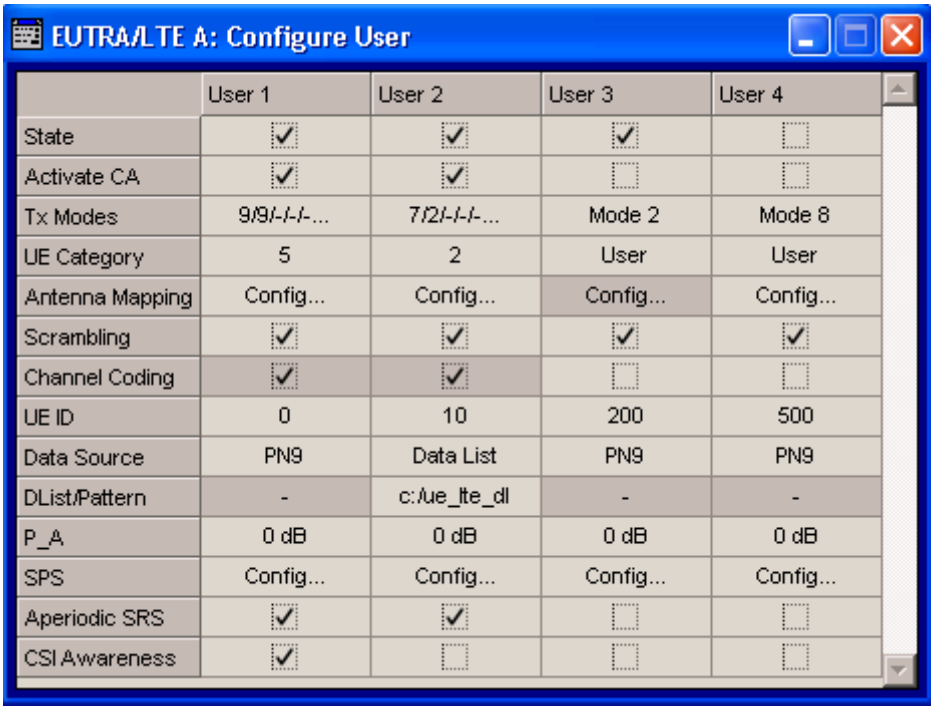
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCinstr` on page 646

4.7 User Configuration Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)"
2. Select "General DL Settings > Scheduling > Manual".

3. Select "Frame Configuration > General > General > Configure User"



	User 1	User 2	User 3	User 4
State	☑	☑	☑	☐
Activate CA	☑	☑	☐	☐
Tx Modes	9/9/-/-/-...	7/2/-/-/-...	Mode 2	Mode 8
UE Category	5	2	User	User
Antenna Mapping	Config...	Config...	Config...	Config...
Scrambling	☑	☑	☑	☑
Channel Coding	☑	☑	☐	☐
UE ID	0	10	200	500
Data Source	PN9	Data List	PN9	PN9
DList/Pattern	-	c:/ue_lte_dl	-	-
P_A	0 dB	0 dB	0 dB	0 dB
SPS	Config...	Config...	Config...	Config...
Aperiodic SRS	☑	☑	☐	☐
CSI Awareness	☑	☐	☐	☐

Use the provided settings to configure up to four scheduled UEs. To distribute them over the whole frame, set the data source of a certain allocation to "User x".
This approach ensures that a common data source is used for allocations of one user equipment also in case that these allocations are non-adjacent.

In one subframe, all allocations belonging to the same "User" use identical settings. Changing, for example, the modulation of one of the allocations of "User 1", changes the modulation in all other allocations of this user in the current subframe.

The aforementioned applies for the following settings:

- Modulation
  Different modulations can be selected for the two codewords of an allocation.

	Code Word	Mod.	Enhanced Settings	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Power /dB	Content Type	State	Confl.
0	1/1	QPSK	Config...	6	4	22	7(1/0)	Off	480	PN9	-	0.00	PBCH	On	
1	1/1	QPSK		50	2	0	0(0/0)	Off	-	PN9	-	0.00	PDCCH	Off	
2	1/1	QPSK	Config...	1	12	0	2(0/2)	On	264	PN9	-	0.00	PDSCH	On	
3	1/1	QPSK	Config...	1	12	1	2(0/2)	On	264	PN9	-	0.00	PDSCH	On	
4.1	1/2	16-QAM	Config...	1	12	2	2(0/2)	On	528	User3	-	0.00	PDSCH	On	
4.2	2/2	QPSK	Config...	1	12	2	2(0/2)	On	264		-			On	
5.1	1/2	16-QAM	Config...	1	12	3	2(0/2)	On	528	User3	-	0.00	PDSCH	On	
5.2	2/2	QPSK	Config...	1	12	3	2(0/2)	On	264		-			On	

- Complete Precoding Settings
- Scrambling settings (Scrambling State, UE ID/n_RNTI) and Channel Coding Statetemporarily.
  See also the "Enhanced Settings" dialog of each allocation (Chapter 4.4, "Enhanced PBCH, PDSCH and PMCH Settings", on page 149).

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EPDCCH Config....199
Antenna Mapping Configuration....199
Scrambling State....199
Scrambling Configuration....199
Channel Coding State....199
UE ID....199
Data Source, DList/Pattern....199
eIMTA-RNTI....200
P_A....200
SPS Configuration....200
Aperiodic SRS State....200
CSI Awareness State....201
MSC Table....201
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User
Displays the consecutive number of the users.

Remote command:
n.a.

State
Enables/disables a user.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STATe` on page 687

3GPP Release
Option: R&S SMBV-K115

Sets the 3GPP release version the UE supports.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:RELease` on page 814

Activate CA
Option: R&S SMBV-K85

Enables/disables carrier aggregation for the selected user.

If Activate Carrier Aggregation is enabled, carrier aggregation is activated automatically for all users, but can be deactivated afterwards.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe on page 687

Tx Modes
Sets the transmission mode of the user as defined in TS 36.213.

Consider the following prerequisites and interdependencies:
- "Tx Mode 8" and "Tx Mode 9" require R&S SMBV-K84/K85.
- "Tx Mode 10" requires option R&S SMBV-K112.
- The selected "Tx Mode" determines the range of allowed DCI formats, that is you can only assign valid DCI formats to this user.
  For any PDSCH allocation, the software configures its "Precoding" as a function of the selected "Tx Mode" and the selected "DCI Format".
- In "Tx Mode > User", the range for valid DCI formats is not affected.
- If a carrier aggregation is enabled (Activate Carrier Aggregation = On and Activate CA = On), you access the "TxModes Configuration" dialog.
  You can define the transmission mode a UE uses in the primary and the secondary cells.
- Option: R&S SMBV-K119
  SCells configured as LAA cells cannot use transmission modes "Tx Mode 5/6/7"
- Option: R&S SMBV-K115
  Available are "Tx Mode = User" and "Tx Mode = Mode 1, 2, 6 and 9".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM on page 687
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TXM on page 687

UL Carriers Configuration
Option: R&S SMBV-K85

If a carrier aggregation is enabled (Activate Carrier Aggregation = On), you can set the state of the associated UL carriers.

Option: R&S SMBV-K119:

LAA SCells cannot be associated with UL carriers. For SCells using "CA > SCell x > Duplexing > LAA", the corresponding "SCell x > State = Off".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ULCA<st0>:STATe on page 688

Configure Auto Sequence
Option: R&S SMBV-K112

If "General DL Settings > PDSCH Scheduling > Auto Sequence", access the "Auto Sequence" settings.

See Chapter 4.3.3, "Auto Sequence Configuration", on page 124.

UE Category
Sets the UE category.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC on page 688

EPDCCH Config
Option: R&S SMBV-K112/K115

Opens the "EPDCCH Configuration" dialog, see Chapter 4.3.4, "EPDCCH Configuration Settings", on page 132.

Antenna Mapping Configuration
Use the DL Antenna Port Mapping Settings dialog to define the mapping of the logical antenna ports to the available physical Tx antennas, in one of the following cases:
- "Tx Mode = Tx Mode 7 to 10/User"
- "EPDCCH > Activate EPDCCH > On"

Scrambling State
Enables/disables scrambling for all allocations belonging to the selected user.

The parameter "Scrambling State" determines the "Enhanced Settings > Scrambling State" of all allocations for which you select the Data Source = "User x".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe on page 696

Scrambling Configuration
Opens the "Scrambling Configuration" dialog, see Chapter 4.3.5, "Scrambling Configuration Settings", on page 136.

Channel Coding State
Sets channel coding for all allocations belonging to the selected user.

That is, the parameter "Channel Coding State" determines the "Enhanced Settings > Channel Coding State" of all allocations for which you select the Data Source = "User x".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe on page 691

UE ID
Sets the user equipment ID.

This UE ID is used for the generation of the scrambling sequence for the allocations, for which you select the DL Frame Configuration Settings > "Allocation Table" > Data Source = "User x".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID on page 692

Data Source, DList/Pattern
Selects the data source for the selected user.

The following standard data sources are available:
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"

An internally generated pseudo-random noise sequence.

- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA` on page 692
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect` on page 692
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern` on page 692

eIMTA-RNTI
Option: R&S SMBV-K113

Sets the dedicated eIMTA-RNTI used for CRC scrambling of the PDCCH.

See also "Enhanced interference mitigation & traffic adaption (eIMTA)" on page 52.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EIMTarnti` on page 693

P_A
Sets PDSCH power factor according to TS 36.213, chapter 5.2.

This power value is applied to all allocations that belong to the corresponding user. The power of an allocation is also determined by the parameter "PDSCH Scheduling Mode". In a normal operation, the power values in the allocation table are configurable parameters. In the "Auto/DCI" mode however, the power value is fixed and cannot be adjusted.

For the DCI format 1D, an additional level offset has to be considered.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA` on page 693

SPS Configuration
Accesses the SPS Configuration Settings dialog to configure a semi-persistence scheduling for the selected user.

Aperiodic SRS State
Configures if the UE supports aperiodic transmission of SRS.

The aperiodic SRS transmission is a single (one-shot) transmission. Activate this parameter to be able to trigger SRS transmissions of the user by the DCIs.

Use the parameter DCI Format 1A > "SRS Request" to select one of the three SRS parameter sets.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ASRS:STATe on page 693

CSI Awareness State
Enables/disables the CSI awareness for the selected user, i.e. informs the UE that a CSI-RS are transmitted. See also "CSI Reference Signals" on page 31.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe on page 694

MSC Table
Option: R&S SMBV-K113/-K119

Defines which of the MSC tables defined in TS 36.213 is used to specify the used modulation and coding scheme:

"1" Option: R&S SMBV-K113
Table 7.1.7.1-1

"2" Option: R&S SMBV-K113
Table 7.1.7.1-1A

"3" Option: R&S SMBV-K119
Table 7.1.7.1-1B

"4" Option: R&S SMBV-K119
Table 7.1.7.1-1C

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:MCS on page 694

TBS Alt. Index
Option: R&S SMBV-K113/-K119

If "General DL Settings > PDSCH Scheduling > Auto DCI", enables using the extended TBS range for the PDSCH allocations scheduled by DCI format 1/1B/1D/ 2/2A/2B/2C/2D.

Sets the which of the transport block size (TBS) tables defined in TS 36.213 is used:

"0" Option: R&S SMBV-K113
Table 7.1.7.1-1, up to TBS Index I_{TBS} = 26

"1" Option: R&S SMBV-K113
Alternative TBS Index I_{TBS} = 26A in table 7.1.7.1-1, TBS Index I_{TBS} = 33A in tables 7.1.7.1-1A/B/C

"2" Option: R&S SMBV-K119
Alternative TBS Index I_{TBS} = 33B in tables 7.1.7.1-1A/B/C

"3" Option: R&S SMBV-K119
Alternative TBS Index I_{TBS} = 37A in tables 7.1.7.1-1B/C

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TBAL on page 694

DMRS Alt Table
Option: R&S SMBV-K119

For Tx Modes = "TM9/TM10", sets the value of the higher-layer parameter `dmrs-tableAlt`.

With "Scheduling > Auto DCI/Auto Sequence", it defines the antenna port mapping and the value range of the parameter DCI Format 2/2A/2B/2C/2D > "Ant. Port(s), Layers, SCID".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:DMRS:STATe`
on page 695

Semi Open Loop
Option: R&S SMBV-K119

For Tx Modes = "TM9/TM10", sets the value of the higher-layer parameter `semiOpenLoop`.

With "Scheduling > Auto DCI/Auto Sequence", it defines the antenna port mapping and the value range of the parameter DCI Format 2/2A/2B/2C/2D > "Ant. Port(s), Layers, SCID".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:SEOL:STATe`
on page 695

Support two HARQ Processes
Indicates if a NB-IoT UE is capable of understanding the HARQ process bit.

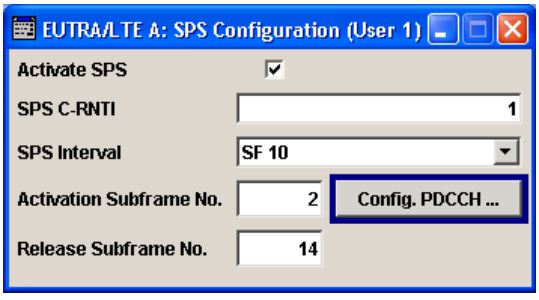
- Option: R&S SMBV-K115
  The parameter is disabled and cannot be changed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STHP:STATe` on page 696

4.8 SPS Configuration Settings

Access:

1. Select "General > Link Direction > Downlink (OFDMA)"
2. Select "Frame Configuration > General > General > Configure User"
3. Select "User# > SPS > Config"



With the provided settings, you can enable and configure a semi-persistent scheduling (SPS) for the selected user.

Semi-persistent scheduling is a scheduling method used to reduce the control signaling overhead for regularly occurring services and transmissions of relative small payloads, see "Uplink scheduling" on page 39.

Related parameters

In this firmware, the configuration, the activation and the deactivation of an SPS transmission is implemented as following:

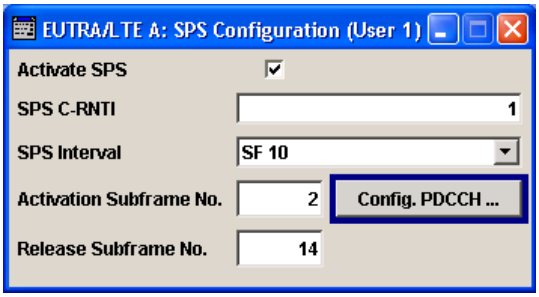
- Configuration of the SPS pattern is defined by:
  - SPS Interval
  - SPS C-RNTI
  - Activate SPS
- Activation of the SPS is defined by:
  - Activation Subframe No
  - Config PDCCH > "PDCCH Activation Subframe# > DCI Table > User > User x SPS > DCI Format" and
    "Content Act. > DCI Format Configuration > Special fields"
- Transmission
  Observe the scheduling in the OFDMA Time Plan
- Release of the SPS is defined by:
  - Release Subframe No
  - "Config PDCCH > PDCCH Release Subframe# > DCI Table > User > User x SPS > Content Rel > DCI Format Configuration > Special fields"

How to configure an SPS for User 1 and visualize the scheduling

The following is a simple example that demonstrates the necessary configuration steps and lists only the related settings. Setting beyond the scope of this example are not discussed.

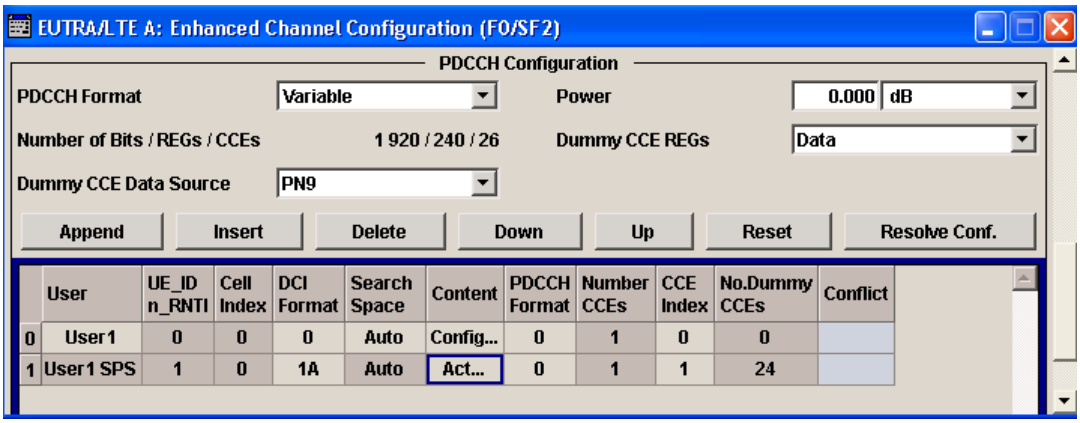
To enable a semi-persistent scheduling

1. Select "EUTRA/LTE > Filter/Clipping/ARB > ARB Sequence Length = 3 Frames".
2. Select "EUTRA/LTE > General DL Settings > PDSCH Scheduling > Auto/DCI".
3. Select "EUTRA/LTE > Frame Configuration" and enable "Number of Configurable Subframes = 30".
4. Select "Frame Configuration > General > Configure User".
   Enable "User 1 > SPS > Config".
5. In the "SPS Configuration" dialog, enable "SPS Interval = SF 10", "Activation Subframe No = 2" and "Release Subframe No = 14".



The User 1 is scheduled to start transmission in the subframe#2 and release it in subframe#14. The SPS interval is 10 subframes. If the DCIs are configured correctly, the User 1 transmits in subframe#2 and subframe#12.

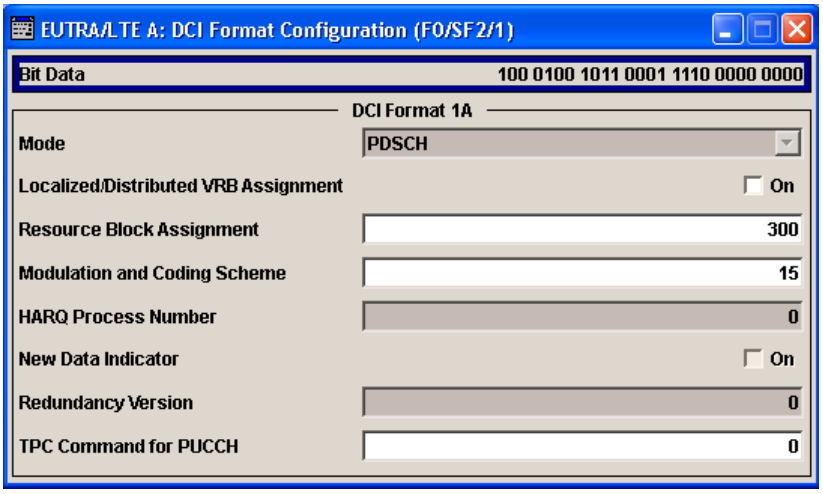
6. In the "SPS Configuration" dialog, select "Config. PDCCH".
   In the "Frame Configuration" opens and displays the settings of subframe#2. Select "Configure PCFICH, PHICH, PDCCH", and navigate to the "PDCCH Configuration".



The second PDCCH item in the DCI table confirms that the User 1 is semi-persistent scheduled ("User > User 1 SPS") and subframe#2 is the activation subframe of this SPS ("User 1 SPS > Content > Act.").

7. In the "DCI Table", select "User 1 SPS > Content > Act."

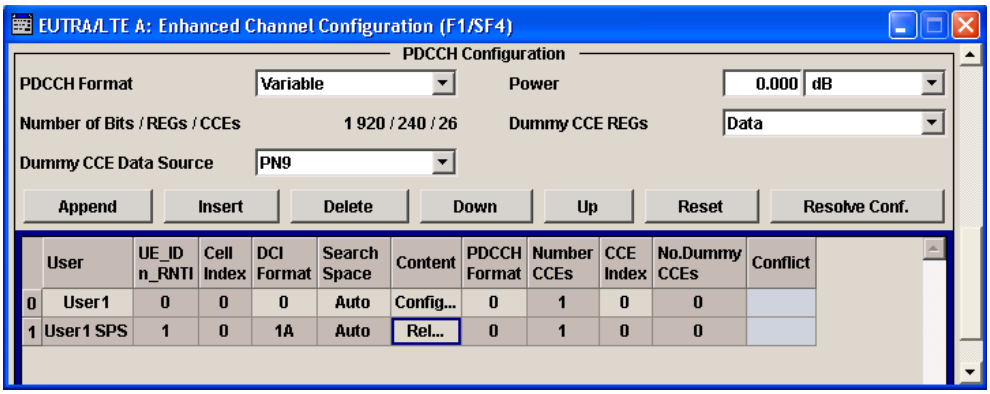
   The "DCI Configuration" dialog for DCI Format 1A opens. As defined in TS 36.213, some fields are predefined.



8. Adjust the DCI fields, for example set "Resource Block Assignment = 300" and "Modulation and Coding Scheme = 15".

   Note: In any SPS activation subframe, the maximum value allowed for the Modulation and Coding Scheme is 15; this corresponds to `0111` in binary form and is according to the requirements defined in TS 36.213.
   See also Table 4-10.

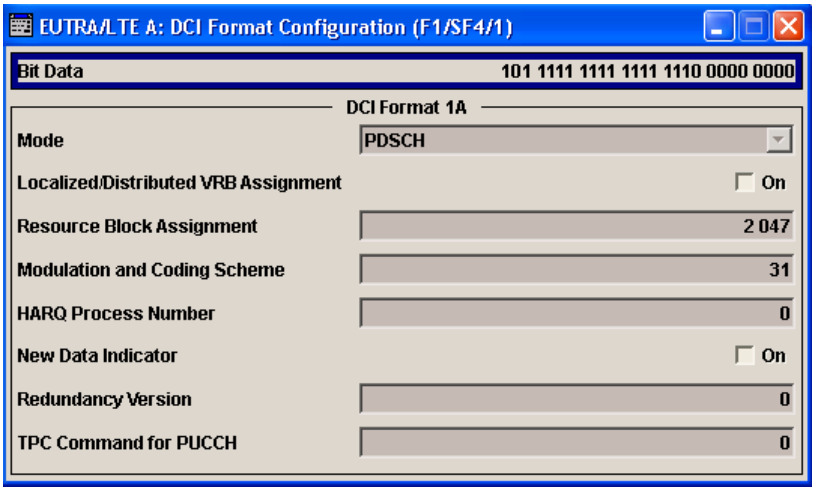
9. In the "Frame Configuration" dialog, select "Subframe = 14" and select "Configure PCFICH, PHICH, PDCCH > PDCCH Configuration".



   The second PDCCH item in the DCI table confirms that the User 1 is semi-persistent scheduled ("User > User 1 SPS") and subframe#14 is the release subframe of this SPS ("User 1 SPS > Content > Rel.").

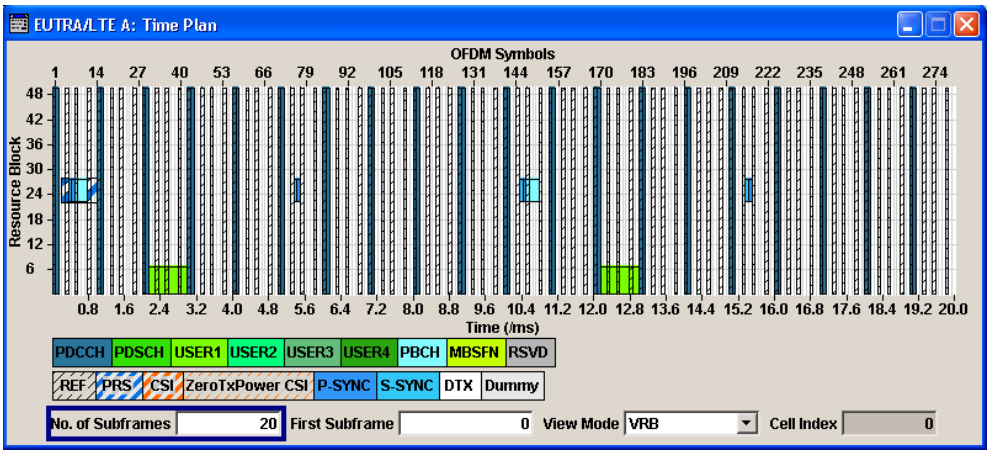
10. In the "DCI Table", select "User 1 SPS > Content > Rel."

    The "DCI Configuration" dialog for DCI Format 1A opens. The DCI fields are set as defined in TS 36.213; compare with the values in Table 4-10.



11. Open "Frame Configuration > OFDMA Timeplan" and enable:

    a) "No of Subframes = 20"
    b) "First Subframe = 0"



    The time plan confirms User 1 transmission in subframe#2 and subframe#12.

12. Select "First Subframe = 10" to display the time plan of subframe#10 to subframe#20.

    There are no more subframes allocated to User 1; The SPS is released in subframe#14.

Activate SPS 206
SPS C-RNTI 207
SPS Interval 207
Activation/Release Subframe No 207
Config PDCCH 207

Activate SPS
Enables you to configure an SPS (semi-persistence scheduling) for the selected UE and triggers the instrument to generate the required DCIs.

Define the SPS pattern (SPS Interval) and select the exact subframe the SPS transmission starts and stops (Activation/Release Subframe No).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:STATe on page 703

SPS C-RNTI
Sets the SPS C-RNTI parameter.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:CRNTi on page 704

SPS Interval
Defines the SPS interval as number of subframes (SF).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SINTerval on page 704

Activation/Release Subframe No
Defines the start and end subframes of the semi-persistent scheduling (SPS).

The UE validates an activation/deactivation request for an SPS only if the DCI fields are set as required, see "Config PDCCH" on page 207.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SACTivation on page 704
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SRELease on page 704

Config PDCCH
Accesses the (E)PDCCH Format Variable dialog for configuring the required DCI settings in the activation subframe.

The UE validates an activation/deactivation request for an SPS only if the DCI fields are set according to Tables 9.2 in TS 36.213. The Table 4-10 is an example of the DCI format 1A fields (see also "DCI Format 1A" on page 186).

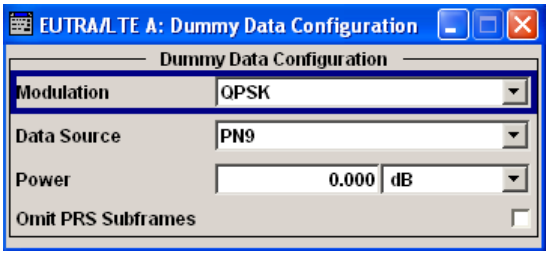
Table 4-10: PDCCH DCI format 1A fields for SPS activation and release/deactivation validation

Bit field	SPS activation value	SPS release value
"HARQ Process Number"	0	0
"Modulation and Coding Scheme"	0 .. 15	31
"Redundancy Version"	0	0
"Resource Block Assignment "	-	Set to all "1"

4.9 Dummy Data Configuration Settings

Access:

► Select "Frame Configuration > Behavior in Unsch. REs (OCNG) > Dummy Data ".



In this section, the dummy data for filling the unscheduled resource blocks and subframes are configured.

Modulation....208
Data Source....208
Power (Dummy Data)....208
Omit PRS Subframes....209

Modulation
Selects the modulation of the dummy data.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation` on page 701

Data Source
Selects the data source for the dummy data configuration.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA` on page 702
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern` on page 703
`[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect` on page 702

Power (Dummy Data)
Sets the power of the subcarriers allocated with dummy data.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer on page 702

Omit PRS Subframes
(requires R&S SMBV-K84)

If the OCNG (OFDM Channel Noise Generator) is used, you can disable (omit) the OCNG transmission in the non-muted PRS subframes, as required for RSTD Performance Tests (TS 36.133, section A.9.8.1).

Tip: Use the OFDMA Time Plan to visualize the allocated resources.

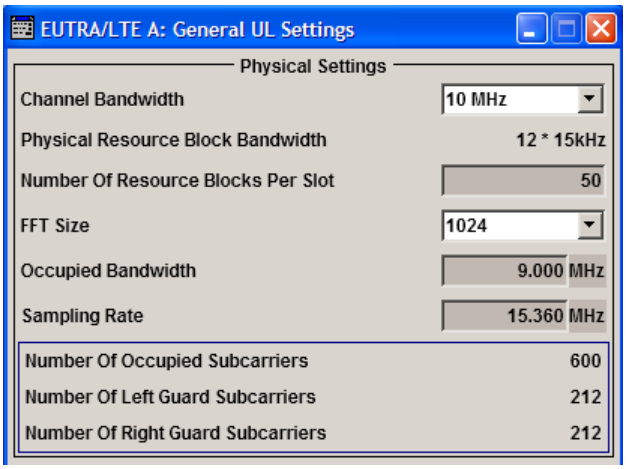
See also Example "How to visualize the effect of muting and omitting PRS transmission" on page 103.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:OPSubframes on page 703

4.10 General UL Settings

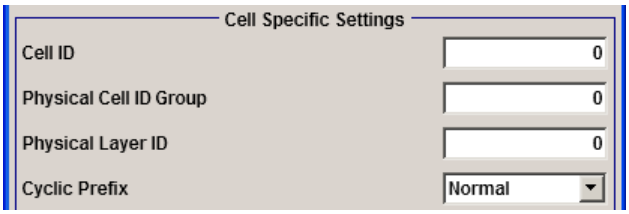
The General UL Settings menu allows configuring the EUTRA/LTE system for transmission direction uplink.

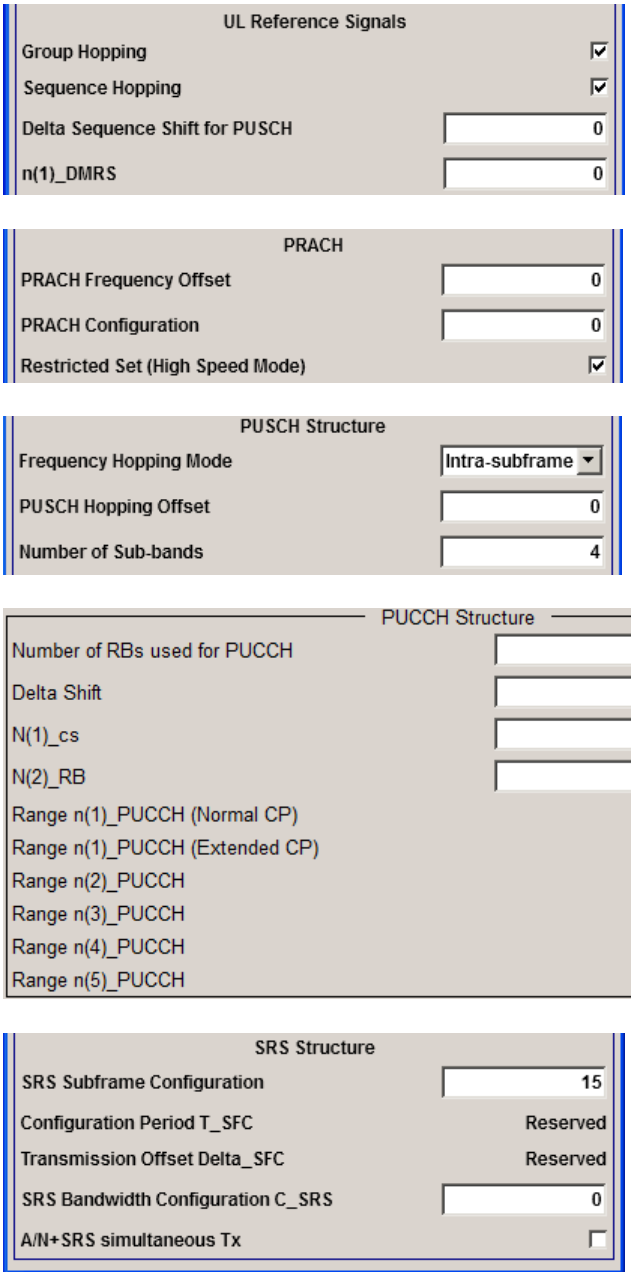
In the "Physical Settings" section, the channel bandwith respectively the number of resource blocks per slot is selected.



In the "Cell Specific Settings" section, the physical layer cell identity settings and the structure of the PUSCH, PUCCH, PRACH, SRS and the uplink reference signals are set.

The other parameters are fixed and read-only.





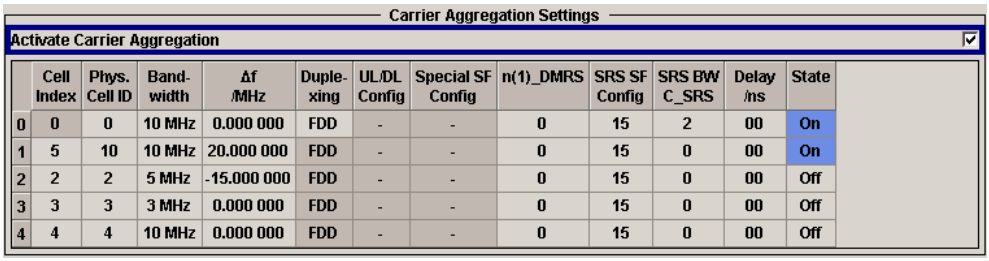
4.10.1 UL Carrier Aggregation Configuration

UL Carrier Aggregation is an LTE-A (LTE Rel. 11) feature.
It requires options R&S SMBV-K55 and R&S SMBV-K112.

Access:

1. Select "Baseband > EUTRA/LTE > General > Link Direction > Uplink (SC-FDMA)".

2. Select "General UL Settings > CA".



	Cell Index	Phys. Cell ID	Band-width	Δf /MHz	Duple-xing	UL/DL Config	Special SF Config	n(1)_DMRS	SRS SF Config	SRS BW C_SRS	Delay /ns	State
0	0	0	10 MHz	0.000 000	FDD	-	-	0	15	2	00	On
1	5	10	10 MHz	20.000 000	FDD	-	-	0	15	0	00	On
2	2	2	5 MHz	-15.000 000	FDD	-	-	0	15	0	00	Off
3	3	3	3 MHz	0.000 000	FDD	-	-	0	15	0	00	Off
4	4	4	10 MHz	0.000 000	FDD	-	-	0	15	0	00	Off

The dialog provides the settings for the configuration of one primary cell (PCell) and up to four secondary cells (SCell). The most important SCell settings are grouped in the "Carrier Aggregation" dialog.

The cell-specific parameters, like the PUCCH and PUSCH configuration, the DRS and SRS transmission and the antenna port mapping are configurable in the User Equipment Configuration dialog of the corresponding UE.

4.10.1.1 About UL Carrier Aggregation

This section lists implementation-related information.

The following apply, if UL Carrier Aggregation is enabled:

- Combination of FDD and TDD is not possible.
- Component carriers are configured independent from each other. Their settings are calculated automatically from the PCell settings and form the parameters in the "UL Carrier Aggregation Configuration" dialog.
- Simultaneous support of LTE and LTE-A UEs is provided
- UE settings are configurable; they are however the same for each cell
- Realtime Feedback is not supported

Supported LTE-A bandwidth

The LTE specification defines a maximum Channel Bandwidth of 20MHz and aggregation of up to five component carriers to achieve 100MHz bandwidth.

The R&S SMBV configured to generate more than one component carrier automatically applies the multi-carrier function. In this case, the maximum bandwidth of the generated LTE-A signal depends on the installed options.

Using the maximum sampling rate, the R&S SMBV equipped with the options R&S SMBV-B10/K522 can internally generate multicarrier signals with up to 160 MHz RF bandwidth.

For more information, see data sheet.

4.10.1.2 Carrier Aggregation Settings

The cell-specific parameters, like the PUCCH and PUSCH configuration, the DRS and SRS transmission and the antenna port mapping, are configurable in the User Equipment Configuration dialog.

Settings

Activate Carrier Aggregation....212
Component Carrier Table....212
- Cell Index....212
- Physical Cell ID....212
- Bandwidth....213
- delta f / MHz....213
- Duplexing....213
- TDD UL/DL Configuration....213
- TDD Special Subframe Config....213
- n(1)_DMRS....213
- SRS Subframe Configuration....213
- SRS Bandwidth Configuration C_SRS....214
- Delay / ns....214
- State....214

Activate Carrier Aggregation
Enables/disables the generation of several component carriers.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:STATe` on page 667

Component Carrier Table
The table provides the settings of the component carriers.

The first row displays the settings of the PCell as configured in the General UL Settings dialog.

The following four rows provide the configurable settings of the up to four SCells.

Cell Index ← Component Carrier Table
Sets the cell index of the corresponding SCell.

The cell index of the PCell is always 0.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:INDex` on page 667

Physical Cell ID ← Component Carrier Table
Sets the physical Cell ID of the corresponding component carrier.

The value of the parameter "General UL Settings" > Cell ID is set automatically to the physical cell ID of the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:ID` on page 667

Bandwidth ← Component Carrier Table
Sets the bandwidth of the corresponding component carrier.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:BW on page 668

delta f / MHz ← Component Carrier Table
Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DFReq on page 668

Duplexing ← Component Carrier Table
Selects the duplexing mode of the PCell. The duplexing mode of the SCells is set accordingly.

Combination of FDD and TDD requires option R&S SMBV-K113.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DUPLexing on page 668

TDD UL/DL Configuration ← Component Carrier Table
Sets the uplink-downlink configuration number. That is, defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

The individual carriers can use different "UL/DL Configuration". The frame configuration of the selected carries and the used duplexing are also displayed. Alternatively, use the SC-FDMA Time Plan to visualize them.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:UDConf on page 668

TDD Special Subframe Config ← Component Carrier Table
Sets the special subframe configuration number.

Together with the parameter Cyclic Prefix, this parameter defines the lengths of the DwPTS, the guard period GP and the UpPTS.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:SPSConf on page 669

n(1)_DMRS ← Component Carrier Table
Sets the part of the demodulation reference signal (DMRS) index used by the calculation of the DMRS sequence, transmitted by the PCell/SCell.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DMRS on page 669

SRS Subframe Configuration ← Component Carrier Table
Sets the cell-specific parameter SRS subframe configuration of the PCell/SCell.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:SUConfiguration on page 669

SRS Bandwidth Configuration C_SRS ← Component Carrier Table
Sets the cell-specific parameter SRS Bandwidth Configuration (C_{SRS}) of the PCell/ SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:CSRS` on page 669

Delay / ns ← Component Carrier Table
Sets the time delay of the SCell relative to the PCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:TDELay` on page 670

State ← Component Carrier Table
Activates/deactivates the component carrier.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:STATe` on page 670

4.10.2 Physical Settings

Settings:

Channel Bandwidth....214
Number of Resource Blocks Per Slot....215
FFT Size....215
Number of eMTC Narrowbands....215
Physical Resource Block Bandwidth....216
Occupied Bandwidth....216
Sampling Rate....216
Number Of Occupied Subcarriers....216
Number of Left/Right Guard Subcarriers....216

Channel Bandwidth
Sets the channel bandwidth of the EUTRA/LTE system.

The 3GPP specification defines bandwidth agonistic layer 1 where the channel bandwidth is determined by specifying the desired number of resource blocks. However, the current EUTRA standardization focuses on six bandwidths.

- "1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz"
  Select a predefined channel bandwidth.
  The parameter "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".
  The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If necessary, adjust the "FFT Size".
  See also Table 3-1 for an overview of the cross-reference between the parameters.
  If "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected, the "1.4 MHz" bandwidth is supported by LTE and eMTC; the NB-IoT-specific settings are not available for configuration.

- "200 kHz"
  Option: R&S SMBV-K115
  This channel bandwidth is **dedicated to NB-IoT**. It is available, if "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected.
  If channel bandwidth of 200 kHz is used, the LTE or eMTC-specific settings are not available for configuration. Available is only one NB-IoT carrier which works in standalone mode (Mode = "Standalone").
- "User"
  Option: R&S SMBV-K55
  Provided for backward compatibility with previous version of this software, this parameter allows you to select a user-defined bandwidth as number of resource blocks.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:BW` on page 551

Number of Resource Blocks Per Slot
Indicates the number of used resource blocks for the selected "Channel Bandwidth".

"Channel Bandwidth"	"Number of Resource Blocks Per Slot (UL)"
"1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz"	Read-only value, set automatically as function of the "Channel Bandwidth" and "Physical Resource Block Bandwidth"
"User"	"Channel Bandwidth" depends on the "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth"

The sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If necessary, adjust the value of FFT Size.

See also Table 3-1.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:NORB` on page 551

FFT Size
Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected "Number of Resource Blocks Per Slot".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:FFT` on page 552

Number of eMTC Narrowbands
Option: R&S SMBV-K115

This parameter is **dedicated to eMTC** and available if "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected.

It indicates the number of eMTC narrowbands N_{NB} available within the selected channel bandwidth.

The value is calculated as follows:

"Number of Narrorbands" = "Number of Resource Blocks" / 6

For more information, see "Narrowbands" on page 310.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:EMTC:NNBands? on page 844

Physical Resource Block Bandwidth
Displays the bandwidth of one physical resource block.

Note: In this release, this value is fixed to 12 x 15 kHz.

Remote command:
n.a.

Occupied Bandwidth
Displays the occupied bandwidth, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth? on page 552

Sampling Rate
Displays the sampling rate, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:SRATe? on page 552

Number Of Occupied Subcarriers
Displays the number of occupied subcarriers, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers? on page 553

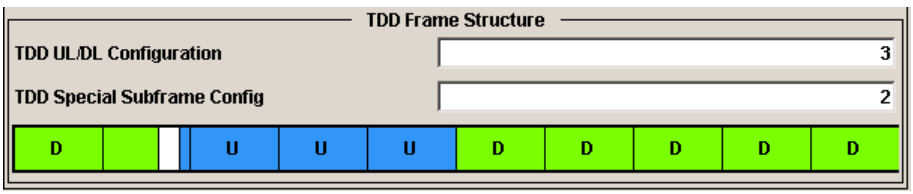
Number of Left/Right Guard Subcarriers
Displays the number of left/right guard subcarriers, calculated from the parameter "Number of Resource Blocks Per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:LGS? on page 553
[:SOURce<hw>]:BB:EUTRa:UL:RGS? on page 553

4.10.3 TDD Frame Structure Settings

Access:

► Select "EUTRA/LTE > Duplexing > TDD".



The TDD frame is configured by adjusting the UL/DL configuration and the special subframe configuration (see also Chapter 3.1.1.1, "OFDMA Parameterization", on page 19).

TDD UL/DL Configuration
Sets the UL/DL configuration number and defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:UDConf` on page 537

TDD Special Subframe Config
Sets the special subframe configuration number and together with the parameter "Cyclic Prefix" defines the lengths of the DwPTS, the guard period (GP) and the UpPTS.

The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf` on page 537

Number of UpPTS Symbols
Option: R&S SMBV-K119 (if "Mode = LTE")

For TDD Special Subframe Config = 10, sets the number of UpPTS symbols.

In all other configurations, the number of UpPTS symbols is set automatically depending on:
- "TDD UL/DL Configuration" on page 94
- "TDD Special Subframe Config" on page 94.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDD:UPTS` on page 537

4.10.4 Cell-Specific Settings

In the "Cell-Specific Settings" section, the physical layer cell ID settings, the UL Reference Signal settings, the PUSCH, PUCCH and PRACH structures are selected, as well as cell-specific SRS parameters.

Provided are the following settings:

Cell ID 218
Physical Cell ID Group 218
Physical Layer ID 218
Cyclic Prefix 218
SFN Offset 219
UL/DL Cyclic Prefix 219
eMTC Parameters 219
└ Valid Subframes 219

Cell ID
Sets the cell identity.

There are 504 unique physical layer cell identities (cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The cell ID is calculated as following:

Cell ID = 3*Physical Cell ID Group + Physical Layer ID

There is a cross-reference between the values of these three parameters and changing of one of them results in adjustment in the values of the others.

The cell ID determinates:
- The reference signal grouping hopping pattern
- The reference signal sequence hopping
- The PUSCH demodulation reference signal pseudo-random sequence
- The cyclic shifts and scrambling sequences for all PUCCH formats
- The pseudo-random sequence used for scrambling
- The pseudo-random sequence used for type 2 PUSCH frequency hopping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CID` on page 553

Physical Cell ID Group
Sets the ID of the physical cell identity group.

To configure these identities, set the parameter Physical Layer ID.

The physical layer cell identities determine the sequence shift pattern used for PUCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CIDGroup` on page 554

Physical Layer ID
Sets the identity of the physical layer within the selected physical cell identity group, set with parameter Physical Cell ID Group.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:PLID` on page 554

Cyclic Prefix
Sets the cyclic prefix length for all subframes.

The number of the SC-FDMA symbols is set automatically.

"Normal"	Normal cyclic prefix, i.e. the UL slot contains 7 SC-FDMA symbols.
"Extended"	Extended cyclic prefix, i.e. the UL slot contains 6 SC-FDMA symbols. The extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission. NB-IoT allocations cannot be activated.
"User Defined"	If Mode = LTE, the cyclic prefix length can vary over the subframes. Set the cyclic prefix length per subframe with the parameter "UL Frame Configuration" > "Cyclic Prefix.".

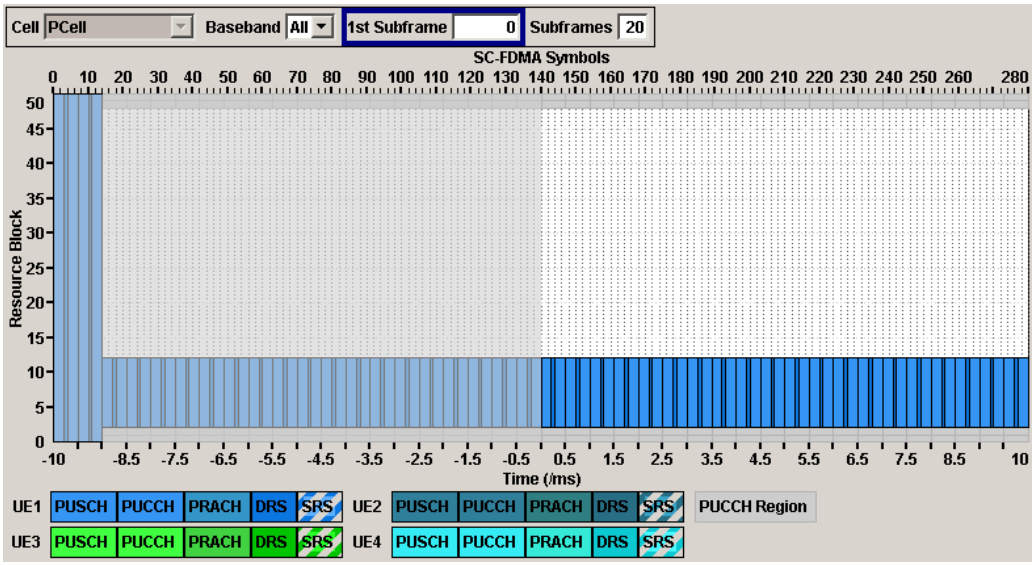
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:CPC` on page 554

SFN Offset
By default, the counting of the SFN (System Frame Number) starts with 0. Use this parameter to set a different start SFN value, e.g. to skip a defined number of frames.

Example: Visualizing the SFN offset in the SC-FDMA time plan

Perform the following:

- Select "EUTRA/LTE > General > Standard > LTE"
- Select "EUTRA/LTE > General > Filter/Clipping/ARB ...".
- Select "ARB > Sequence Length = 100 Frames".
- Select "General > Link Direction > Uplink (SC-FDMA)".
- Select "General > General Settings > Cell > SFN Offset = 1".
- Select "General > Frame Configuration > No. of PUCCH Config = No. PUSCH Config. = 40".
- Select "Frame Configuration > Subframe#0 > PUSCH > No. of RB = 50".
- Select "Frame Configuration > Time Plan" and set "Subframes = 20".



Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:SOFFset` on page 555

UL/DL Cyclic Prefix
In "Duplexing > TDD", determines the cyclic prefix for the appropriate opposite direction.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:DLCPc` on page 555
`[:SOURce<hw>]:BB:EUTRa:DL:ULCPc` on page 546

eMTC Parameters
Comprises cell-specific parameters, dedicated to eMTC.

Valid Subframes ← eMTC Parameters
Option: R&S SMBV-K115

This parameter is **dedicated to eMTC** and available if "Mode > eMTC/NB-IoT or LTE/ eMTC/NB-IoT" is selected.

It indicates that a subframe (SF) is used for eMTC transmission. If an SF is set to invalid, the eMTC transmission is postponed during this SF.

The selected subframes influence the scheduling of the eMTC transmissions (see Start Subframe).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:EMTC:VALid:SUBFrame<dir>` on page 844

4.10.5 UL Reference Signals

Access:

1. Select "LTE > Link Direction > Uplink".
2. Select "General Settings > Signals > Common".

Settings:

Group Hopping....220
Sequence Hopping....220
Delta Sequence Shift for PUSCH....221
n(1)_DMRS....221

Group Hopping
Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

17 different hopping patterns and 30 different sequence shift patterns are used for group hopping.

PUSCH and PUCCH use **the same group hopping pattern** that is calculated if the "Group Hopping" is enabled. The group hopping pattern is generated by a pseudo-random sequence generator. The sequence shift patterns are derived as follows:

- PUCCH
  From the physical layer cell ID set as a combination of the parameters Physical Cell ID Group and Physical Layer ID.
- PUSCH
  By the parameter Delta Sequence Shift for PUSCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping` on page 555

Sequence Hopping
Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

If sequence hopping and Group Hopping are be activated simultaneously, only group hopping is applied as defined in TS 36.211.

The sequence hopping is generated by a pseudo-random sequence generator.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping on page 555

Delta Sequence Shift for PUSCH
Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift on page 556

n(1)_DMRS
Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used. It is used for the calculation of the DMRS sequence.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS on page 556

4.10.6 PRACH Settings

The cell-specific parameters in this section determine the PRACH configuration according to the TS 36.211.

The UE-specific parameters, necessary for the complete definition of the PRACH, are configurable in the User Equipment Configuration dialog of the corresponding UE.

PRACH Frequency Offset 221
PRACH Configuration 221
PRACH Restricted Set 223

PRACH Frequency Offset
For preamble formats 0 to 3, sets the prach-FrequencyOffset $n^{RA}_{PRBoffset}$ as defined in the TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number that fulfills the equation:

$0 <= n^{RA}_{PRBoffset} <=$ Number of Resource Blocks Per Slot - 6

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset on page 558

PRACH Configuration
Sets the PRACH configuration index as defined in the TS 36.211. PRACH configuration defines the time and frequency resources in which random access preamble transmission is allowed.

The PRACH allocation occupies a bandwidth of 6 RBs.

The PRACH distribution (subframe, length, offset) depends on several other parameters:
- Selected "Cyclic Prefix"
- Selected PRACH Frequency Offset
- Selected frame format, i.e. on the selected "Duplexing Mode" mode
- Selected Frequency Resource Index (for TDD mode).

Not all combinations of channel bandwidth, PRACH configuration and PRACH frequency offset are allowed.

The table below gives an overview on the dependency of the value range of the parameter "PRACH Configuration" and other parameters.

Duplexing Mode	TDD Special Subframe Config	(Global) Cyclic Prefix	PRACH Configuration
FDD	-	Normal/Extended	0 to 63
TDD	0 to 3	Normal/Extended	0 to 47
	4	Normal	0 to 47
	4	Extended	0 to 57
	5 to 8	Normal/Extended	0 to 57

The Preamble Format is automatically derived form the "PRACH Configuration".

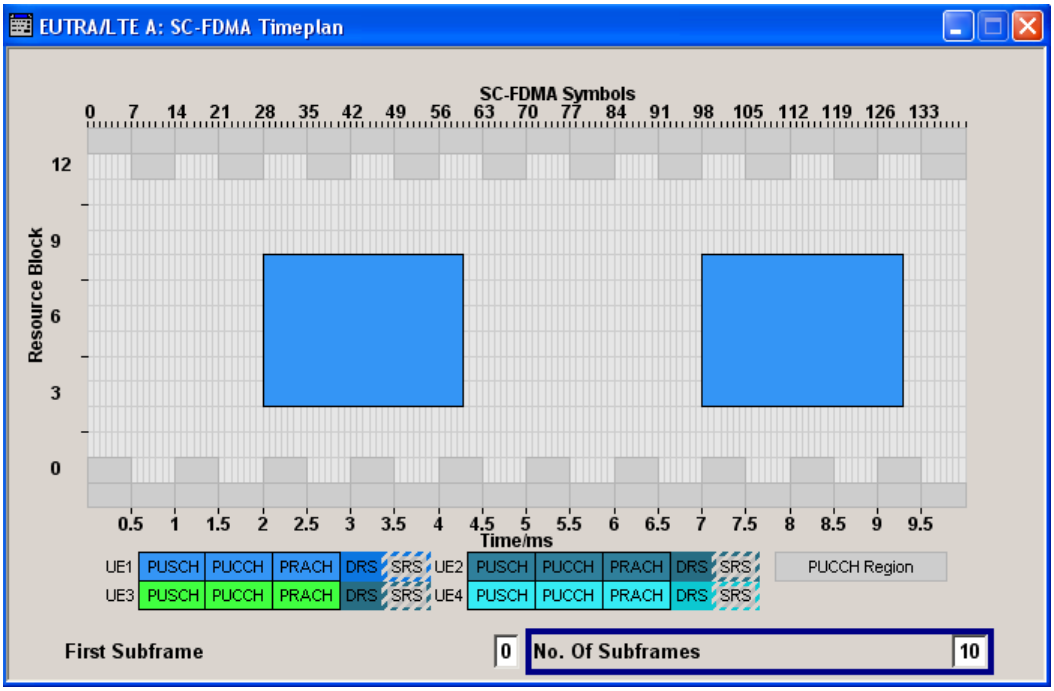
Use the SC-FDMA Time plan to display the PRACH distribution.

Example:

PRACH example configuration:

- "Duplexing Mode = FDD"
- "General UL Settings > Cell > Cyclic Prefix = Normal"
- "General UL Settings > Physical > Channel Bandwidth = 3 MHz"
- "General UL Settings > PRACH > PRACH Frequency Offset = 5"
- "PRACH Configuration = 55"
  (Preamble Format = 3)
- Adjusted the PRACH frequency offset

Observe the timeplan.



Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:CONFiguration on page 558

PRACH Restricted Set
Selects whether a restricted preamble set ("Type A" or "Type B") or the unrestricted preamble set (normal mode) will be used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:RSET on page 559

4.10.7 PUSCH Structure

Provided are the following settings:

Frequency Hopping Mode 223
PUSCH Hopping Offset 223
Number of Sub-bands 223

Frequency Hopping Mode
Sets the frequency hopping mode for PUSCH.

Frequency hopping is applied according to TS 36.213.

"Inter-subframe"	The PUSCH position in terms of used resource blocks is changed each subframe.
"Intra-subframe"	Both intra- and inter-subframe hopping are performed. The PUSCH position in terms of used resource blocks is changed each slot and each subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHMode on page 559

PUSCH Hopping Offset
Sets the PUSCH Hopping Offset N_{RB}^{HO}.

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHOFfset on page 559

Number of Sub-bands
Sets the number of sub-bands (N_{sb}) into that the total range of physical resource blocks available for PUSCH transmission is divided. The frequency hopping is performed at sub-band level.

The size of one sub-band is determinate by the number of resource blocks available for PUSCH transmission, the "Number of Sub-bands" and the PUSCH hopping parameters.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM on page 560

4.10.8 PUCCH Structure

Settings:

Number of RBs used for PUCCH 224
Delta Shift 224
N(1)_cs 225
N(2)_RB 225
Range n(1)_PUCCH (Normal/Extended CP) 225
Range n(2)_PUCCH 225
Range n(3)_PUCCH 225
Range n(4)_PUCCH/Range n(5)_PUCCH 226

Number of RBs used for PUCCH
Sets the PUCCH region in terms of reserved resource blocks, at the edges of the channel bandwidth (see Figure 3-18).

The PUCCH region is displayed on the time plan.

Example:

- "Physical > Channel Bandwidth = 3 MHz"
- "General UL Settings > PUCCH > Number of RBs used for PUCCH = 3"
- "UL Frame Configuration > PUCCH > Format = 2a" and "PUCCH State > On"

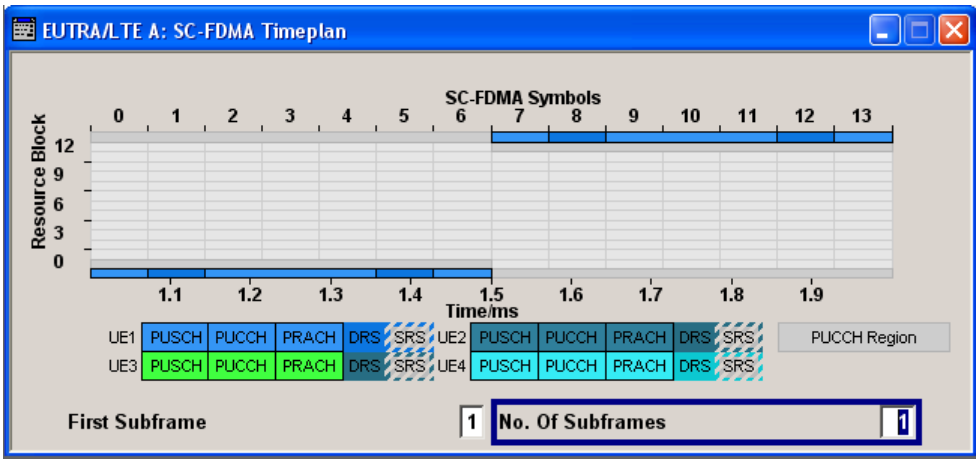


Figure 4-9: Example: Representation of subframe with PUCCH region with three reserved resource blocks on the time plan

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB` on page 560

Delta Shift
Sets the delta shift parameter, i.e. the cyclic shift difference between two adjacent PUCCH resource indices with the same orthogonal cover sequence (OC).

The delta shift determinates the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b (see also Table 3-5).

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift on page 560

N(1)_cs
Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Only one resource block per slot can support a combination of the PUCCH formats 1/1a/1b and 2/2a/2b.

The number of cyclic shifts available for PUCCH format 2/2a/2b N(2)_cs in a block with combination of PUCCH formats is calculated as follows:

N(2)_cs = 12 - N(1)_cs -2

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS on page 560

N(2)_RB
Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

There can be only one resource block per slot that supports a combination of the PUCCH formats 1/1a/1b and 2/2a/2b. Hence, the number of RBs per slot available for PUCCH format 1/1a/1b is determinate by "N(2)_RB".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB on page 561

Range n(1)_PUCCH (Normal/Extended CP)
Displays the range of the possible PUCCH format 1/1a/1b transmissions from different UEs in one subframe and per cyclic prefix.

Insufficient ranges are displayed as '-'.

The parameter "Range n(1)_PUCCH (Normal CP)" determines the value range of the index "n_PUCCH" for PUCCH format 1/1a/1b.

See n_PUCCH

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax? on page 561
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax? on page 561

Range n(2)_PUCCH
Displays the range of possible number of PUCCH format 2/2a/2b transmissions from different UEs in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max? on page 562

Range n(3)_PUCCH
Displays the range of possible number of PUCCH format 3 transmissions from different UEs in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max? on page 562

Range n(4)_PUCCH/Range n(5)_PUCCH
Option: R&S SMBV-K119

Displays the range of possible number of PUCCH format 4 and 5 transmissions from different UEs in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N4Max? on page 562
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N5Max? on page 562

4.10.9 Cell-Specific SRS Settings

The cell-specific parameters in this section determine the structure of the sounding reference signal (SRS) according to the TS 36.211.

Access:

1. Select "LTE > Link Direction > Uplink".
2. Select "General Settings > Signals > SRS"

   To configure the UE-specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, use the settings in the "UEx > User Equipment > SRS" dialog.
   See Chapter 4.12.6, "Sounding Reference Signal (SRS)", on page 251.

   To enable an aperiodic SRS transmission, use the parameters:
   - "DL Frame Configuration > Configure User" > Aperiodic SRS State.
   - "SRS Request" flag in the DCI formats "DL Frame Configuration > PDCCH > DCI Format > Config", for example DCI Format 1A.
   - SRS set parameters in the "User Equipment" > Sounding Reference Signal (SRS) dialog.

Settings:

SRS Subframe Configuration 226
Configuration Period T_SFC 227
Transmission Offset Delta_SFC 227
SRS Bandwidth Configuration C_SRS 227
A/N + SRS simultaneous Tx 227
SRS MaxUpPTS 227

SRS Subframe Configuration
Sets the cell-specific parameter SRS subframe configuration.

This parameter can also influence the shortening of PUCCH/PUSCH transmissions, regardless whether the UEs are configured to send an SRS in the subframe or not.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration on page 557

Configuration Period T_SFC
Displays the value for the cell-specific parameter configuration period T_{SFC} in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?` on page 558

Transmission Offset Delta_SFC
Displays the value for the cell-specific parameter transmission offset $Delta_{SFC}$ in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?` on page 557

SRS Bandwidth Configuration C_SRS
Sets the cell-specific parameter SRS bandwidth configuration (C_{SRS}).

The SRS bandwidth configuration C_{SRS}, the SRS Bandwidth B_SRS and the "Channel Bandwidth" determine the length of the sounding reference signal sequence, calculated according to TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS` on page 557

A/N + SRS simultaneous Tx
Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

Simultaneous transmission of SRS and PUCCH is allowed only for PUCCH formats 1, 1a, 1b and 3, since CQI reports are never simultaneously transmitted with SRS.

If this parameter is disabled, the SRS is not transmitted in the corresponding subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx` on page 556

SRS MaxUpPTS
In TDD duplexing mode, enables the cell-specific parameter `srsMaxUpPts`.

If enabled, an SRS is transmitted in the frequency area of the UpPTS field that does not overlap with the frequency resources reserved for a possible PRACH preamble format 4 transmission.

This is done by reconfiguring the number of SRS resource blocks in the special subframes, which would otherwise be determined by C_SRS and B_SRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs` on page 556

4.11 UL Frame Configuration Settings

Access:

1. Select "LTE General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration"

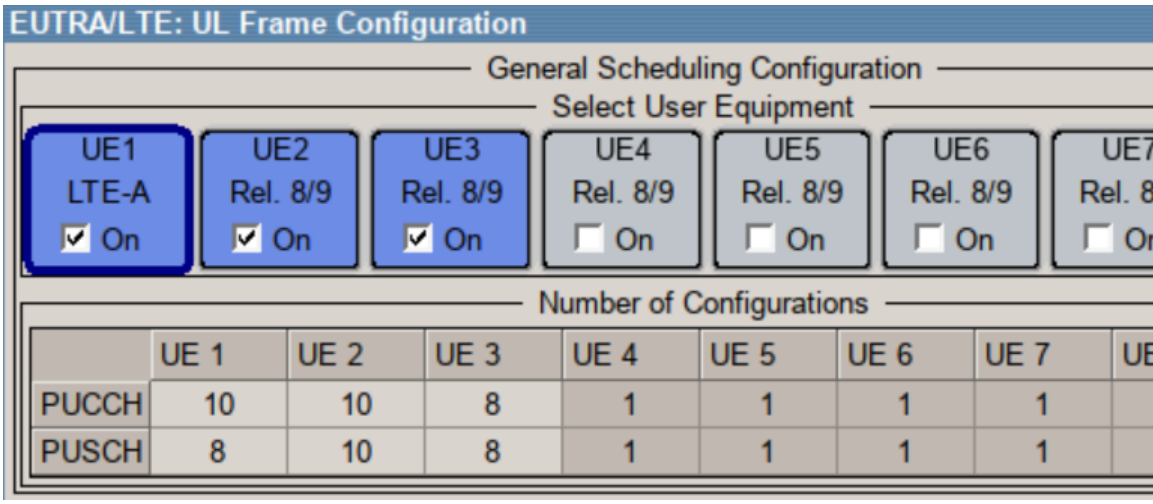
   This dialog allows you to configure the subframes and the SC-FDMA resource allocations.
   The dialog consists of the following sections:

- General Scheduling Configuration Settings 228
- Subframe Configuration 230
- UL Allocation Table 232

4.11.1 General Scheduling Configuration Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General Scheduling Configuration"



This dialog provides access to the user equipment settings and settings concerning the UL scheduling, like configuring the subframes and adjusting the PUCCH/ PUSCH scheduling.

Settings:

UEx 229
Number Of PUCCH/PUSCH Configurations/Number Of Configurable Subframes 229

UEx
Accesses the User Equipment Configuration dialog for configuring the UE settings.

The check box activates or deactivates the selected UE. The 3GPP release the UE is compliant to is displayed.

Note: Disabling the UE deactivates its allocations: the reference signal, PUSCH/ PUCCH allocations, and PRACH are not transmitted.

Remote command:
n.a.

Number Of PUCCH/PUSCH Configurations/Number Of Configurable Subframes

- If "3GPP Release > eMTC/NB-IoT":
  PUSCH and PUCCH configurations are defined entirely in the "User Equipment Configuration" dialog.
- If "3GPP Release > LTE/LTE-A":
  Sets the number of configurable subframes in the up to four configurable frames, i.e. determines the scheduling cycle per UE.
  All uplink subframes are filled periodically with the configured subframes except for the Sounding Reference Signal. You can set the SRS individually for each UE in the User Equipment Configuration dialog.
  The maximum number of configurable subframes depends on the following:
  – Select duplexing mode (TDD or FDD)
  – Configured TDD Frame Structure Settings
  – If TDD special subframe configuration 10 is used.

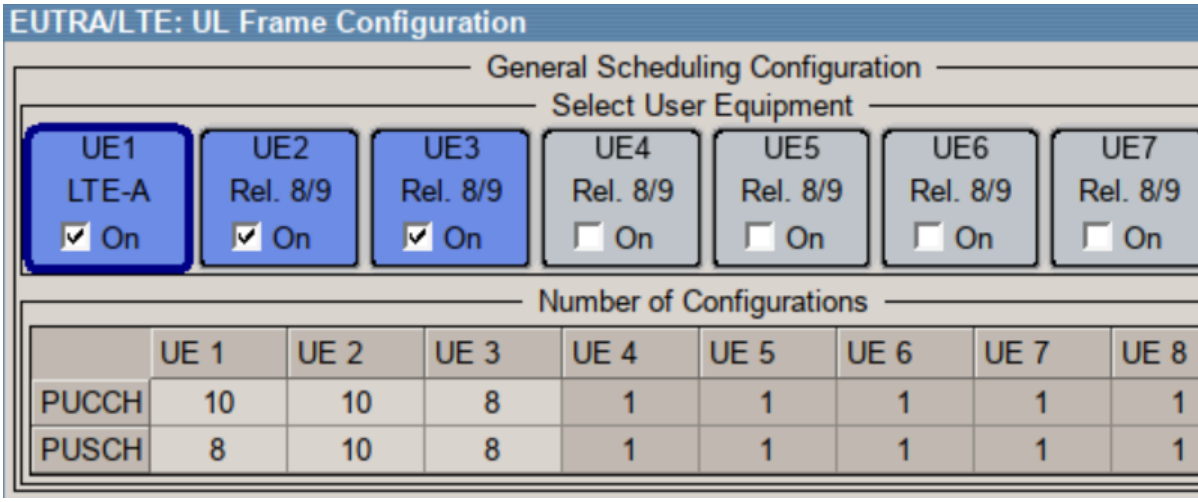
  For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see Chapter B.3, "Four Configurable Frames in Uplink and Downlink Direction", on page 896.
  – For "LTE" UEs, the "No Of Configurable Uplink Subframes" is the same for PUCCH and PUSCH.
  – For "LTE-A" UEs, the scheduling cycles are independent per PUSCH and PUCCH.
    The number of configurable subframes can be defined individually per PUCCH and per PUSCH. This enables the configuration of PUCCH and PUSCH with different repetition patterns.

Example: Independent cycles for PUSCH and PUCCH of the same LTE-Advanced UE

As described in the test case 8.2.4, TS 36.141, the PUCCH of the UE has to be transmitted once a frame and the PUSCH - once each eight subframes.

- Set "UE1" > User Equipment Configuration > 3GPP Release = LTE-Advanced.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUCCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUSCH" = 8
- Configure the PUCCH and PUSCH allocations of UE1 as required.

Example: Independent cycles for PUSCH and PUCCH of the same LTE Rel. 8/9 UE



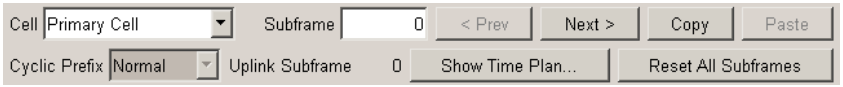
- Select "UE2" > UE ID/n_RNTI = UE ID_{UE2}.
- Set "UE3" > UE ID/n_RNTI = UE ID_{UE2}
- Configure the allocations of as required.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE2 > PUCCH/PUSCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE3 > PUCCH/PUSCH" = 8

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh` on page 662
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh` on page 662

4.11.2 Subframe Configuration

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe Configuration"



Provided are the settings for selecting and configuring the subframes. In the allocation table section, the individual allocation parameters for a subframe are set.

Cell 231
Subframe 231
Next/Prev 231
Copy/Paste Subframe Settings 231
Cyclic Prefix (UL) 231

Subframe Information....231
Show Time Plan....232
Reset All Subframes....232

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

Subframe
Sets the subframe to be configured/displayed in the frame configuration table.

All uplink subframes are filled periodically with the configured subframes except for the Sounding Reference Signal. SRS is set individually for each UE in the User Equipment Configuration dialog.

Subframes behind the configurable range of the corresponding UE or channel (Number Of PUCCH/PUSCH Configurations/Number Of Configurable Subframes) are displayed as read-only.

Remote command:
n.a.

Next/Prev
Navigates through the subframes.

Remote command:
n.a.

Copy/Paste Subframe Settings
Copies/pastes the settings of the selected subframe. Sounding Reference Signals are not considered.

For more detailed information, see Chapter B.1, "Copy/Paste Subframe", on page 895.

Remote command:
n.a.

Cyclic Prefix (UL)
Configuration of the cyclic prefix per subframe is only enabled, if the parameter Cyclic Prefix is set to User Defined.

The number of the SC-FDMA symbols per subframe is set automatically

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix` on page 662

Subframe Information
Displays the kind of the selected subframe, i.e. "Special Subframe", "Uplink Subframe", "Downlink Subframe".

For "Uplink Subframe", it is also shown the uplink subframe number, which is especially useful for TDD duplexing mode.

Remote command:
n.a.

Show Time Plan
Calls the time plan for the SC-FDMA resource allocation.

The dialog is described in detail in section Chapter 6.2, "SC-FDMA Time Plan", on page 449.

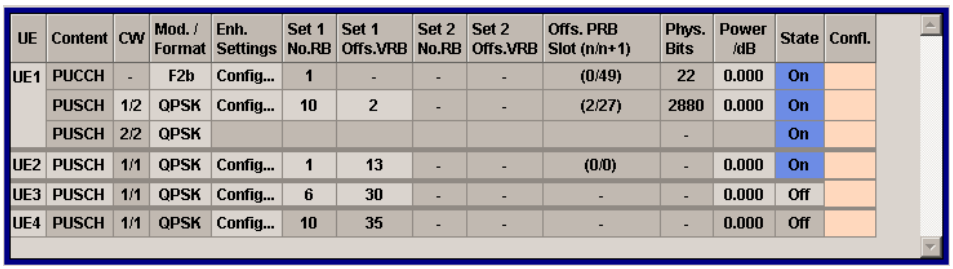
Remote command:
n.a.

Reset All Subframes
Resets settings of all subframes including cyclic prefix to the default values.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame` on page 662

4.11.3 UL Allocation Table

The resource allocation table is where the individual allocation parameters for a subframe are set.



UE	Content	CW	Mod. / Format	Enh. Settings	Set 1 No.RB	Set 1 Offs.VRB	Set 2 No.RB	Set 2 Offs.VRB	Offs. PRB Slot (n/n+1)	Phys. Bits	Power /dB	State	Confl.
UE1	PUCCH	-	F2b	Config...	1	-	-	-	(0/49)	22	0.000	On	
	PUSCH	1/2	QPSK	Config...	10	2	-	-	(2/27)	2880	0.000	On	
	PUSCH	2/2	QPSK							-		On	
UE2	PUSCH	1/1	QPSK	Config...	1	13	-	-	(0/0)	-	0.000	On	
UE3	PUSCH	1/1	QPSK	Config...	6	30	-	-	-	-	0.000	Off	
UE4	PUSCH	1/1	QPSK	Config...	10	35	-	-	-	-	0.000	Off	

User Equipment..... 232
Content (UL)..... 232
Codeword (UL)..... 233
Modulation/Format..... 233
Enhanced Settings UL..... 234
Set 1/Set 2 No. RB..... 234
Set 1/Set 2 Offset VRB..... 235
Offset PRB Slot (n/n+1)..... 236
Phys. Bits / Total Number of Physical Bits..... 236
Power (UL)..... 236
State (UL)..... 236
Conflict (UL)..... 237

User Equipment
Accesses the settings of the UE the selected allocation belongs to, see Chapter 4.12, "User Equipment Configuration", on page 237.

Remote command:
n.a.

Content (UL)
Selects the content type of the selected allocation.

Use the setting in dialog User Equipment Configuration to configure the PUSCH data source.

"eMTC" and "NB-IoT" indicates UEs configured for IoT transmission ("UL Frame Configuration > General > UEx" > 3GPP Release).

The allocation table does not display information on the eMTC/NB-IoT transmission. To access the related setting, select Enhanced Settings UL > "Config".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 663

Codeword (UL)
Option: R&S SMBV-K85

Determines whether one or two codewords use the same physical resource, and whether codeword 1/2 or codeword 2/2 is configured with the selected PUSCH allocation.

See also Figure 3-31.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CODWords` on page 672

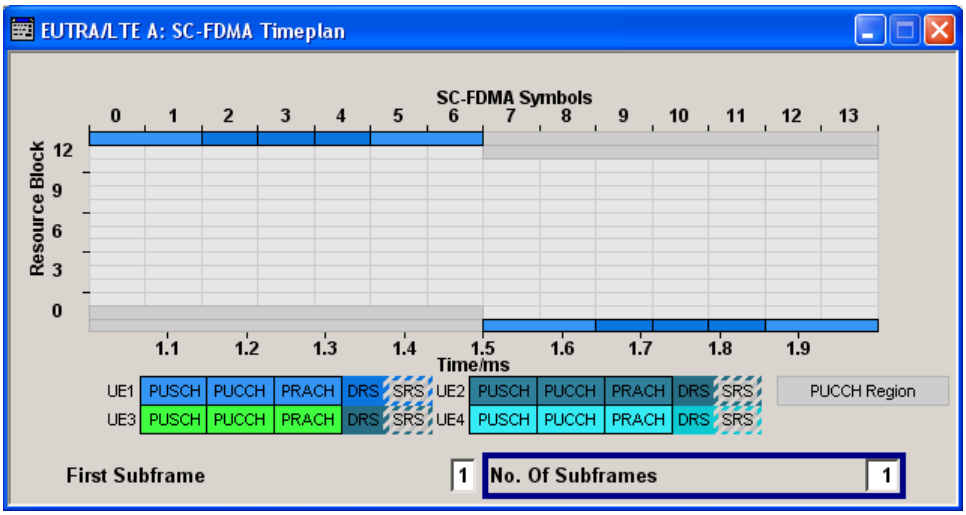
Modulation/Format
For PUSCH allocation, this parameter sets the modulation scheme for the allocation.

This parameter is read-only, if a predefined FRC is selected.

For PUCCH allocation, this parameter sets the PUCCH Format. See Chapter 3.1.2.3, "Uplink Control Information Transmission", on page 35 for an overview of the allowed PUCCH formats. Use the "SC-FDMA Time Plan" to visualize the position and structure of the configured PUCCH allocation.

Example:

The figure below shows an example of a subframe with PUCCH region with three reserved resource blocks and "PUCCH Format" on page 301 1/1a/1b.



Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>][:PUSCh]:MODulation on page 663
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:PUCCh]:FORMat on page 663

Enhanced Settings UL
Accesses a dialog with further channel configuration settings, see:
- Chapter 4.13, "Enhanced PUSCH Settings", on page 291
- Chapter 4.14, "Enhanced PUCCH Settings", on page 300
- Chapter 5.3.5.1, "NB-IoT Allocation Settings", on page 381
- Chapter 5.3.8.2, "UE-Specific eMTC PUSCH Transmissions Settings", on page 426

Remote command:
n.a.

Set 1/Set 2 No. RB
Option: R&S SMBV-K85

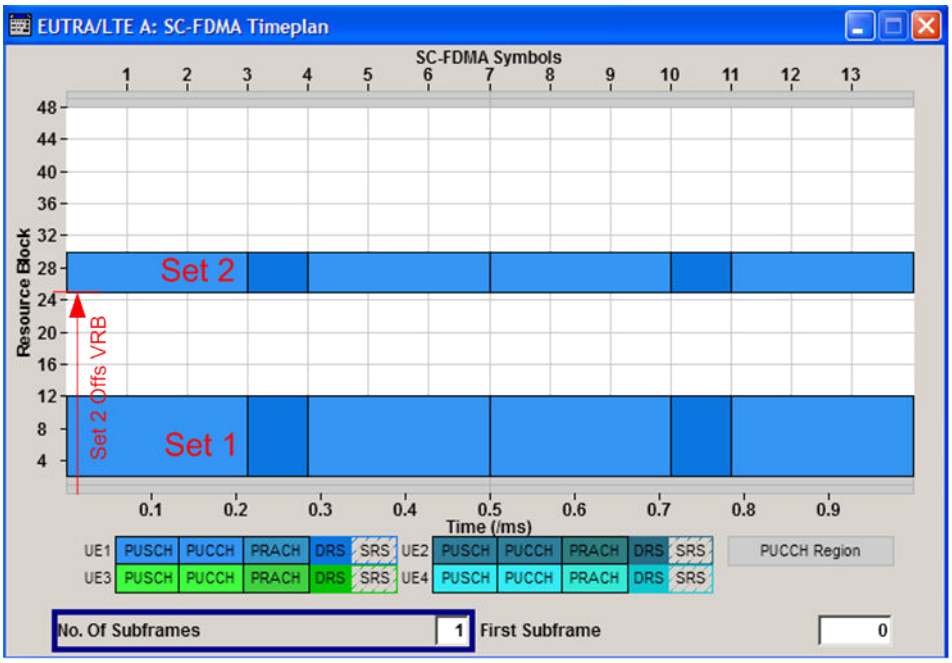
The LTE Rel. 10 specification defines PUSCH transmission not only in a continuous frequency region but also in two "sets" or "clusters" of resource blocks (see Figure 3-28).

The parameter defines the size of the selected allocation in resource blocks of the corresponding set.

This parameter is read-only, if a predefined FRC is selected.

Example: Clustered PUSCH Transmission

- Select "User Equipment Configuration (UE1) > 3GPP Release > Rel.10".
- In the "UL Frame Configuration > Subframe > Allocation Table", configure the PUSCH allocation of UE1 as follow:
  – "Set 1 No. RB" = 10, "Set 1 Offs. VRB" = 2
  – "Set 2 No. RB" = 5, "Set 2 Offs. VRB" = 25
  – "State" = ON
- Select "Show Time Plan" to visualize the configured allocations



Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount` on page 664
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?` on page 664
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount` on page 664

Set 1/Set 2 Offset VRB
Option: R&S SMBV-K85

For the corresponding set, sets the virtual resource block offset of the selected subframe (see also Example "Clustered PUSCH Transmission" on page 235).

This parameter is read-only, if a predefined FRC is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset` on page 664
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset` on page 664

Offset PRB Slot (n/n+1)
Displays the start resource block of the selected allocation in the first and the second slot of the subframe.

Consider the following interdependencies, if frequency hopping is used:
- The start physical resource blocks in slot n and slot n+1 are set automatically These values can deviate from the Set 1/Set 2 Offset VRB
- If an intra-subframe hopping for hopping type 2 is applied, the start resource block in slot 1 is defined by the selected Number of Sub-bands

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<gr>:RBOFfset?` on page 665

Phys. Bits / Total Number of Physical Bits
Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PHYSbits?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:PHYSbits?` on page 665

Power (UL)
Sets the power for the selected allocation, i.e. PUSCH or PUCCH power level.

The PUSCH power level (P_{PUSCH}) and the PUCCH power level (P_{PUCCH}) can vary per subframe.

Further power-related parameters:
- UE Power (P_{UE}): for global adjustment of the transmit power of the UE
- DRS Power Offset (P_{DRS_offset}) and SRS Power Offset (P_{SRS_offset}): for boosting the reference signals, DRS and SRS, per UE.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer` on page 665

State (UL)
Sets the allocation to active or inactive state.

"On" Enables the allocation of the select UE.
Option: R&S SMBV-K119: If TDD special subframe configuration is used, the state of the PUSCH allocations is defined by the parameter State.

"Off" Disables the allocation.
The PUSCH/PUCCH and the DRS are deactivated.
Other allocations of the same UE and the SRS are not affected.

"Auto" Option: R&S SMBV- K115

For IoT allocations with "Content = eMTC/NB-IoT", indicates that it is automatically configured as set in the dialogs:

- Chapter 5.3.8.2, "UE-Specific eMTC PUSCH Transmissions Settings", on page 426
- Chapter 5.3.5.1, "NB-IoT Allocation Settings", on page 381

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe` on page 666
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe` on page 666
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe` on page 666

Conflict (UL)
Indicates a conflict between UEs and in case an allocation exceeds the available number of resource blocks.

For more information, see Chapter A.2, "Uplink", on page 891.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?` on page 666
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?` on page 666
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFlict?` on page 666

4.12 User Equipment Configuration

Access:

1. Select "LTE General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".

   You can configure up to four scheduled user equipments (UE) and freely distribute them over the time. You can also configure the structure of the demodulation reference signal (DRS) and the sounding reference signal (SRS) per UE.

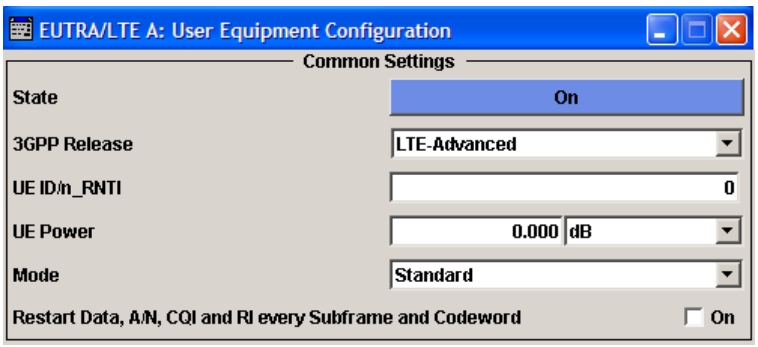
The dialog consists of the following sections:

- Common Settings....238
- Physical Uplink Control Channel (PUCCH)....240
- FRC Configuration....241
- Physical Uplink Shared Channel (PUSCH)....245
- Demodulation Reference Signal (DRS)....249
- Sounding Reference Signal (SRS)....251
- Sidelink Settings....260
- Antenna Port Mapping....285
- PRACH Power Ramping....287
- PRACH Configuration....288

4.12.1 Common Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)"
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "Common".



The available settings allow you to configure the state of the user equipment, the UE's release, UE ID, and the operational mode.

Settings:

State....238
3GPP Release....239
Restart Data, A/N, CQI and RI Every Subframe and Codeword/Restart Data and A/N Every Subframe....239
Override Cell ID....239
Cell ID....239
UE ID/n_RNTI....240
UE Power....240
Mode....240

State
Activates or deactivates the user equipment.

Disabling the UE deactivates its allocations: the reference signal, PUSCH (or PUCCH) allocations, and PRACH are not transmitted.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe on page 707

3GPP Release
Sets the 3GPP release version supported by the UE.

Generally, each UE can work in one of the modes: LTE, LTE-A, eMTC or NB-IoT. The available values depend on the installed options and the value of the parameter Mode.

"Mode"	Description	Required options	"3GPP Release"
"LTE"	Standalone LTE	R&S SMBV-K55 R&S SMBV-K85	"Release 8/9" "LTE-Advanced"
"eMTC/NB-IoT"	Standalone IoT	R&S SMBV-K115	"eMTC, NB-IoT"
"LTE/eMTC/NB-IoT"	Mixed LTE and IoT	R&S SMBV-K55 and R&S SMBV-K115	"Release 8/9, LTE-Advanced, eMTC, NB-IoT"

Several further settings are enabled only for LTE-A or IoT UEs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease on page 706

Restart Data, A/N, CQI and RI Every Subframe and Codeword/Restart Data and A/N Every Subframe
If activated, the indicated values are restarted at the specified intervals.

This parameter is always enabled, if real-time feedback is active.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart on page 706

Override Cell ID
If carrier aggregation is disabled, you can enable this parameter and set an user-defined cell ID for the selected user.

This cell ID value is used in the signal calculation for the particular UE instead of the common cell ID, set with the parameter "General UL Settings > Cell" > Cell ID.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:OCID:STATe on page 708

Cell ID
If "Override Cell ID" on page 239 > "On", with this parameter you set an user-defined cell ID for the selected user.

This cell ID value is used in the signal calculation of UE instead of the common cell ID, set with the parameter "General UL Settings > Cell" > Cell ID.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CID on page 708

UE ID/n_RNTI
Sets the radio network temporary identifier (RNTI) of the UE.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID` on page 707

UE Power
Sets the power level of the selected UE (P_{UE}).

The P_{UE} determines the power levels of the reference signals (DRS and SRS) and of the allocations, PUSCH (P_{PUSCH}) and PUCCH (P_{PUCCH}). Use the P_{UE} for global adjustment of the transmit power of the UEs.

Further power-related parameters:
- Power: varies the PUSCH and PUCCH power per subframe.
- Power, dB: varies the PUSCH and PUCCH power per eMTC transmission
  Power, dB: varies the NPUSCH (P_{NPUSCH}) power per NB-IoT transmission
- DRS Power Offset (P_{DSR_offset}): boosts the reference signals DRS per UE.
- "SRS Power Offset" on page 253 (P_{SRS_offset}): boosts the reference signals SRS per UE.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer` on page 707

Mode
Selects whether the user equipment is in standard or in PRACH mode.

If UL carrier aggregation is used, PRACH mode is disabled.

See:
- Chapter 4.12.10, "PRACH Configuration", on page 288
- Chapter 5.3.10, "eMTC PRACH Settings", on page 441
- Chapter 5.3.6, "NPRACH Settings", on page 389

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE` on page 707

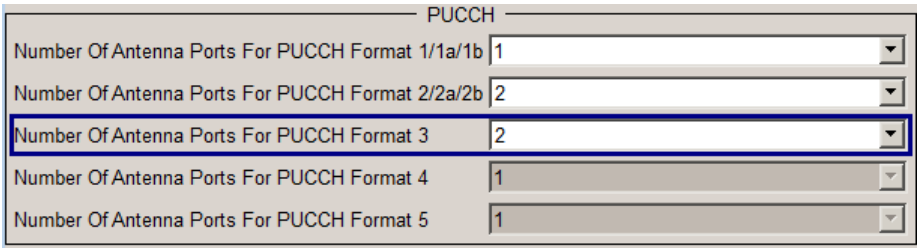
4.12.2 Physical Uplink Control Channel (PUCCH)

Option: R&S SMBV-K85 for generation of LTE signals with UL-MIMO. PUCCH is available in the primary cell (PCell) only.

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)"
2. Select "Frame Configuration > General > Select User Equipment > UEx"
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced"
4. Select "PUCCH".

   With these settings, you define the number of antenna ports used for each of the PUCCH formats.



5. Set the number of available ports for PUCCH per PUCCH format.

Settings:

Number of Antenna Ports for PUCCH per PUCCH Format
For 3GPP Release = "LTE-Advanced" UEs, sets the number of antenna ports used for every PUCCH format transmission.

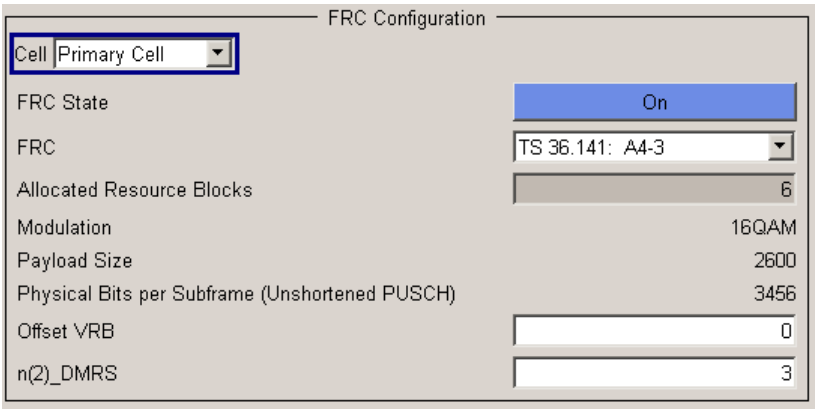
eMTC UEs ("3GPP Release = eMTC") support transmission with one antenna port.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F1Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F2Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F3Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F4Naport?` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F5Naport?` on page 720

4.12.3 FRC Configuration

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "FRC".



This dialog enables a quick configuration of the predefined fixed reference channels (FRC) according to:

- TS 36.141, Annex A "Reference measurement channels"

- TS 36.521, Annex A "Measurement channels".

If "FRC" is enabled, several parameters are predefined and their values are displayed as read-only values, see Table 4-11.

Table 4-11: Parameters affected by the RFC configuration

Dialog	Parameter	Value
"UE Configuration"	Scrambling	On
	Channel coding state	On
	Interleaver	On
	SRS state	Off (the SRS can be activated manually if FRC state is on)
"UL Allocation Table"	Modulation	According to the selected FRC
PUSCH allocations of the corresponding UE in all subframes	No. RB	According to the selected FRC
"Enhanced PUSCH Settings"	Frequency hopping	Off
For the corresponding UE in all subframes	HARQ ACK type	None
	Number of CQI bits	0
	Number of coded CQI bits	0
	Transport block Size/Payload	According to the selected FRC

Settings:

Cell....242
FRC State....242
FRC....243
Allocated Resource Blocks....244
Modulation (FRC)....244
Payload Size (FRC)....244
Physical Bits Per Subframe (Unshortened PUSCH)....244
Offset VRB (FRC)....244
n(2)_DMRS (FRC)....244

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

FRC State
Enables/disables FRC configuration.

"On" If "FRC" is enabled, several parameters are predefined and their values are displayed as read-only values. To reconfigure any of these parameters, disable the FRC configuration.
An exception is the SRS state. You can change it even while an FRC is used.

"Off" FRC cannot be used if Cyclic Prefix = "User Defined".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:STATe`
on page 710

FRC
Selects a predefined fixed reference channel according to TS 36.141 or to TS 36.521.

3GPP specifies the FRCs for a specific channel bandwidth (i.e. number of resource blocks) and cyclic prefix. Depending on the current configuration, some FRCs are not listed.

If Cyclic Prefix = "User Defined", FRC cannot be used.

Table 4-12: Supported FRCs from 3GPP TS 36.141

FRC	Description
A1_1 to A1_7	FRC for reference sensitivity and in-channel selectivity (QPSK, R=1/3)
A2_1 to A2_3	FRC for dynamic range (16QAM, R=2/3)
A3_1 to A3_7	FRC for performance requirements (QPSK 1/3)
A4_1 to A4_8	FRC for performance requirements (16QAM 3/4)
A5_1 to A5_7	FRC for performance requirements (64QAM 5/6)
A7_1 to A7_6	FRC for UL timing adjustment (scenario 1)
A8_1 to A8_6	FRC for UL timing adjustment (scenario 2)
A12_1 to A12_6	FRC for performance requirements (QPSK 0.36)
A13_1 to A13_6	FRC for performance requirements (16QAM 1/2)
A17_1 to A17_6	Option: R&S SMBV-K119 FRC for performance requirements (256QAM, 5/6)
A18_1 to A18_6	Option: R&S SMBV-K119 FRC for PUSCH transmission in UpTPS (16QAM, 0.56) Available in "Duplexing = TDD" and TDD Special Subframe Config = "10".
A19_1 to A19_6	Option: R&S SMBV-K119 FRC for PUSCH transmission in UpTPS (256QAM, 0.69) Available in "Duplexing = TDD" and TDD Special Subframe Config = "10".

Table 4-13: Supported FRCs from 3GPP TS 36.521-1

FRC (Duplexing = FDD)	FRC (Duplexing = TDD)	Description
A.2.2.1.1	A.2.3.1.1	Reference channels for QPSK with full RB allocation
A.2.2.1.2	A.2.3.1.2	Reference channels for 16-QAM with full RB allocation
A.2.2.2.1	A.2.3.2.1	Reference channels for QPSK with partial RB allocation
A.2.2.2.2	A.2.3.2.2	Reference channels for 16-QAM with partial RB allocation
A.2.2.3	A.2.3.3	Uplink reference channels for sustained data-rate test

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TYPE
on page 710

Allocated Resource Blocks
Displays the number of the allocated resource blocks for the selected FRC. For FRCs "A.2.2.2.1" and "A.2.2.2.2", this parameter can also be set to different values according to TS 36.521.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:ALRB
on page 708

Modulation (FRC)
Displays the modulation for the selected FRC.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:MODulation?
on page 709

Payload Size (FRC)
Displays the payload size for the selected FRC.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:PASize?
on page 709

Physical Bits Per Subframe (Unshortened PUSCH)
Displays the total number of physical bits available for the PUSCH allocation per subframe, in that unshortened PUSCH is transmitted. Shortened PUSCH transmission occurs in a cell-specific SRS subframe or in subframes where SRS is transmitted.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TNOBits?
on page 710

Offset VRB (FRC)
Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

The VRB Offset set for the individual subframes in the "UL Allocation Table" are overwritten.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:VRBoffset
on page 711

n(2)_DMRS (FRC)
Sets the UE-specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

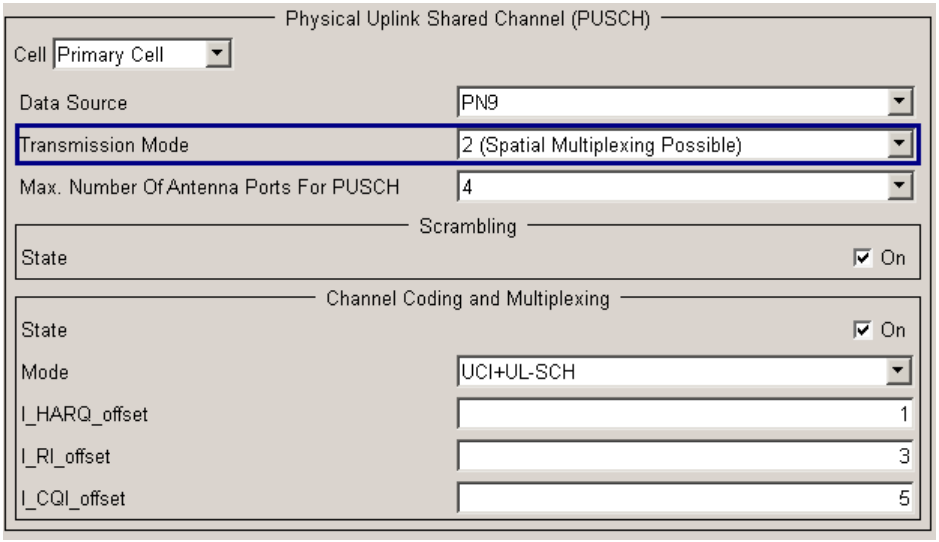
The "Enhanced PUSCH Settings" > n(2)_DMRS,λ (Layer λ) set for the individual subframes for the corresponding UE is overwritten.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:N2DMrs
on page 709

4.12.4 Physical Uplink Shared Channel (PUSCH)

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx"
3. Select "PUSCH"



In this dialog, the data source for the PUSCH can be selected and the channel coding can be configured. Use the Enhanced PUSCH Settings dialog to adjust the additional settings for channel coding of the control information and the multiplexing of the data and control information.

Settings:

Cell....246
NPUSCH + SRS simultaneous Tx....246
Data Source....246
Transmission Mode....246
Max. Number of AP for PUSCH....247
State Scrambling (PUSCH)....247
Channel Coding and Multiplexing (PUSCH)....247
└ State....247
└ Mode....248
└ I_HARQ_offset....248
└ I_RI_offset....248
└ I_CQI_offset....248

└ O_CQI-Min....248
PUSCH in UpPTS....248
└ State....249
└ Less DMRS....249
└ Number of Symbols....249

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

NPUSCH + SRS simultaneous Tx
For "UEx > 3GPP Release = NB-IoT", enables simultaneous transmission of NPUSCH and SRS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:NPSSim` on page 857

Data Source
Selects the data source for the PUSCH allocation.

If Restart Data, A/N, CQI and RI Every Subframe and Codeword > Off, new data is retrived from the data source for every subframe where PUSCH is configured.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DATA` on page 715
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:PATTern` on page 715
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DSELect` on page 716

Transmission Mode
Option: R&S SMBV-K85

For 3GPP Release = "LTE-A", sets the PUSCH transmission mode according to TS 36.213.

"1 (Spatial Multiplexing not Possible)"
This is the predefined value if:
- "FRC State > On"
- 3GPP Release = "eMTC/NB-IoT"

"2 (Spatial Multiplexing Possible)"
See also "Uplink MIMO" on page 48.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:TXMode` on page 716

Max. Number of AP for PUSCH
Option: R&S SMBV-K85

For 3GPP Release = Release 10 UEs, sets the number of antenna ports (AP) for PUSCH transmission for that the UE is configured.

Transmission Mode	"1 (Spatial Multiplexing not Possible)"	"2 (Spatial Multiplexing Possible)"
"Number of Antenna Ports for PUSCH"	1	2 or 4

To set the currently used number of antenna ports, use the parameter Number of Used Antenna Port.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:NAPort` on page 716

State Scrambling (PUSCH)
Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

This parameter is always enabled, if a predefined FRC is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:SCRambling:STATe` on page 717

Channel Coding and Multiplexing (PUSCH)
Comprises the following settings:

State ← Channel Coding and Multiplexing (PUSCH)
Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

If this parameter is disabled, the content retrieved from the Data Source is forwarded to the scrambler without any coding processing.

Additional parameters for the encoding of control information can be set in Enhanced PUSCH Settings dialog.

This parameter is always enabled, if a predefined FRC is selected.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:STATe on page 717

Mode ← Channel Coding and Multiplexing (PUSCH)
Defines the information transmitted on the PUSCH.

"UCI+UL-SCH" Control information and data are multiplexed into the PUSCH.

"UL-SCH" Only data is transmitted on PUSCH.

"UCI only" Only uplink control information is transmitted on PUSCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:MODE on page 717

I_HARQ_offset ← Channel Coding and Multiplexing (PUSCH)
Sets the HARQ-ACK offset index for control information MCS offset determination according to TS 36.213, chapter 8.6.3.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IHARqoffset on page 718

I_RI_offset ← Channel Coding and Multiplexing (PUSCH)
Sets the RI offset index for control information MCS offset determination according to TS 36.213, chapter 8.6.3.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IRIoffset on page 718

I_CQI_offset ← Channel Coding and Multiplexing (PUSCH)
Sets the CQI offset index for control information MCS offset determination according to TS 36.213, chapter 8.6.3.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:ICQioffset on page 718

O_CQI-Min ← Channel Coding and Multiplexing (PUSCH)
(Enabled in "UCI only" transmission)

Sets the parameter O-CQI-Min, where O_CQI-Min is the number of CQI bits including CRC bits assuming rank equals to 1.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:OCQimin on page 719

PUSCH in UpPTS
Option: R&S SMBV-K119

Access: "Link Direction = Uplink", "Duplexing Mode = TDD", "General Settings > Physical > TDD Special Subframe Configuration = 10", "Frame Configuration > UEx > PUSCH > PUSCH in UpPTS".

The following parameters are defined for each cell, if TDD is used and the cell is configured with TDD Special Subframe Config = "10".

State ← PUSCH in UpPTS
Enables PUSCH transmission in the UpTPS part of the special subframe.

If enabled, you can further configure the PUSCH for the corresponding subrame in the "UL Frame Configuration > Subframe > Allocation table". The PUSCH state ("State (UL)" on page 236) is read-only and is set as set with the "UL Frame Configuration > General > UEx > PUSCH > State" parameter.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:STATe`
on page 719

Less DMRS ← PUSCH in UpPTS
If enabled, the number of used demodulation reference signals (DMRS) is reduced.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:LDMRs`
on page 720

Number of Symbols ← PUSCH in UpPTS
Sets the number of symbols used for the PUSCH transmission.

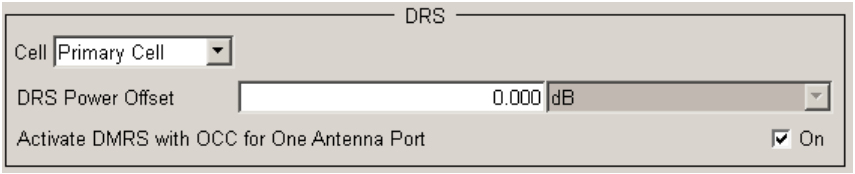
The available number of symbols depends on the used Cyclic Prefix and whether Less DMRS is enabled.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:NSYM`
on page 720

4.12.5 Demodulation Reference Signal (DRS)

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "DRS".



Comprises the parameters of the demodulation reference signal.

Settings:

Cell....250
DRS Power Offset....250
Activate DMRS with OCC for One Antenna Port....250
Enhanced DMRS....250

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

DRS Power Offset
Sets the power offset of the DRS relative to the power level of the PUSCH or PUCCH allocation of the corresponding subframe.

The selected DRS power offset (P_{DRS_Offset}) applies for all subframes.

Depending on the allocation of the subframe, the effective power level of the DRS is calculated as following:

$P_{DRS}=P_{UE}+P_{PUSCH/PUCCH}+P_{DRS_Offset}$

The PUSCH and PUCCH power levels (P_{PUSCH} and P_{PUCCH}) can vary per subframe.

For global adjustment of the transmit power of the corresponding UE, use the parameter UE Power (P_{UE}).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:POWoffset` on page 721

Activate DMRS with OCC for One Antenna Port
Option: R&S SMBV-K85

For UEs with 3GPP Release = "LTE-A", activate demodulation reference signal (DRS) with an orthogonal cover code (OCC) even if only one antenna port is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:DWOCc` on page 721

Enhanced DMRS
Option: R&S SMBV-K119

Sets the higher-layer parameter `ul-DMRS-IFDMA` as defined in TS 36.211 and TS 36.212.

The combination of the two parameters Enhanced DMRS > "On" and Bit for DMRS Mapping Table > "On" enables mapping the DMRS sequence on each second subcarrier.

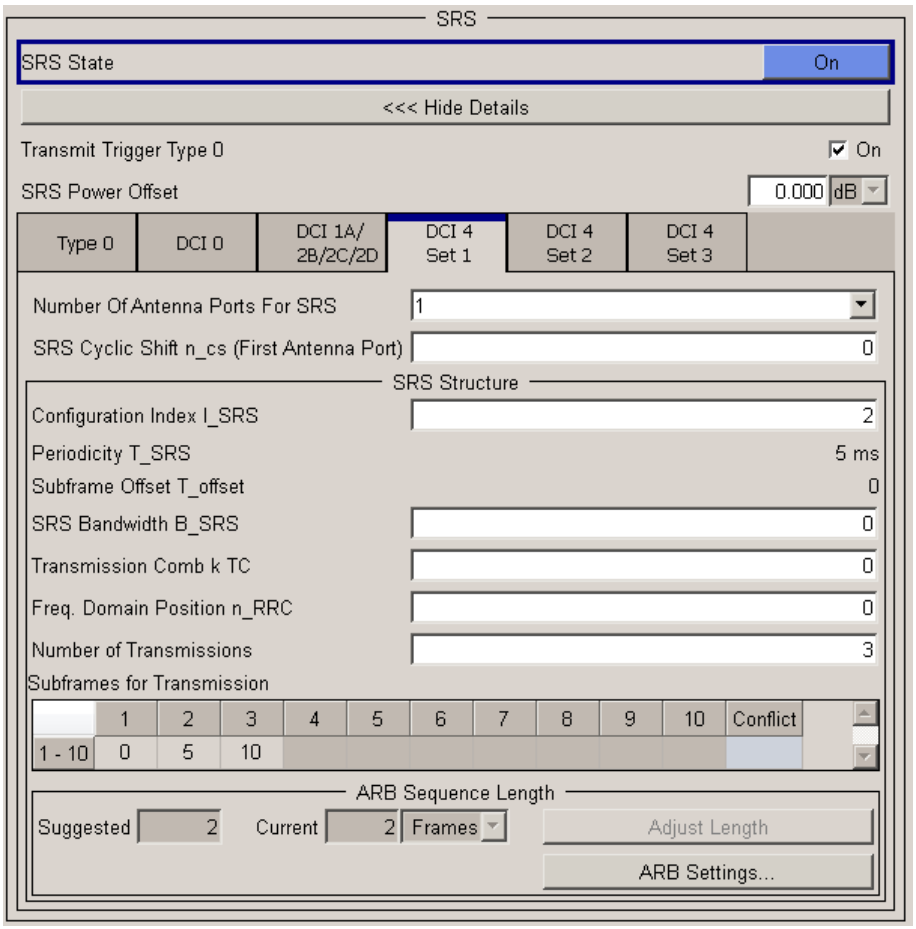
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:ENHanced` on page 721

4.12.6 Sounding Reference Signal (SRS)

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "3GPP Release > LTE-Advanced".
4. Select "SRS".

   For LTE-Advanced UEs, the dialog consists of several subtabs, one for the "trigger type 0" SRS and further for the SRS sets.



   In the "SRS Structure" section, you can configure the **UE-specific SRS parameters** according to TS 36.213 and TS 36.211.

The **cell-specific parameters**, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the "General UL Settings" dialog.

See General UL Settings.

To visualize the SRS transmission, use the SC-FDMA time plan.

Settings:

Cell 252
SRS State 252
Show Signal Structure Configuration Details>>> 252
Transmit Trigger Type 0 252
SRS Power Offset 253
SRS Set Configuration 253
- Number of Antenna Ports for SRS 253
- SRS Cyclic Shift n_CS (First AP) 254
- SRS UpPTS Add 254
- SRS Structure 254
  - Configuration Index I_SRS 254
  - Periodicity T_SRS 255
  - Subframe Offset T_offset 256
  - SRS Bandwidth B_SRS 257
  - Transmission Comb Num k TC 258
  - Transmission Comb k TC 259
  - Hopping Bandwidth b_hop 259
  - Freq. Domain Position n_RRC 259
  - Number of Transmissions 259
  - Subframes for Transmission 259
  - Suggested 260
  - Adjust Length 260
  - ARB Settings 260

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

SRS State
Enables/disables sending of SRS for the corresponding UE.

In the symbols reserved for SRS transmission, PUSCH is not transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:STATe`
on page 721

Show Signal Structure Configuration Details>>>
Expands the settings for configuring the sounding reference signal structure, see "SRS Structure" on page 254.

Remote command:
n.a.

Transmit Trigger Type 0
The 3GPP specification defines two types of SRS transmission:
- **Periodic SRS**
  SRS occurs at regular time intervals.
  Periodic SRS is referred as "trigger type 0" SRS. It is known form LTE Rel. 8
- **Aperiodic SRS**

The aperiodic SRS transmission is a single (one-shot) transmission.
Aperiodic SRS is referred as "trigger type 1" SRS. It is introduced by LTE Rel. 10.

"On" Trigger type 0 is used.
The SRS is configured by higher levels.
To configure the SRS structure, use the settings in the "Type 0" dialog .

"Off" Trigger type 1 is used.
The SRS is triggered by the PDCCH DCI content, in particular by the DCI format 0/4/1A/2B/2C/2D (DCI formats 2B/2C for TDD only).
To configure the SRS structure, use the dedicated settings in the "DCI 0/1A/2B/2C/2D/4 Set 1 to 3" dialogs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:TT0` on page 722

SRS Power Offset
Sets the power offset of the SRS relative to the power of the corresponding UE.

The selected SRS power offset applies for all subframes.

The effective power level of the SRS is calculated as follows:

$P_{SRS} = P_{UE}+P_{SRS_Offset}$

For global adjustment of the transmit power of the corresponding UE, use the parameter UE Power (P_{UE}).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:POWoffset` on page 722

SRS Set Configuration
Rel. 8/9 UEs support only "trigger type 0" SRS. There is one SRS set of parameters and one tab, "Type 0", where the SRS structure is defined.

For LTE-Advanced/eMTC UEs, the aperiodic SRS is triggered by the "SRS Request" flag in one of the DCI formats 0/1A/4/2B/2C/2D:

- Triggering aperiodic SRS by using DCI format 0 requires one dedicated SRS set of parameters ("DCI 0")
- The triggering by using DCI formats 1A/2A/2B/2C uses a common SRS set ("DCI 1A/2B/2C/2D")
- For the triggering by DCI format 4, the specification defines 3 SRS sets ("DCI 4 Set 1", "DCI 4 Set 2" and "DCI 4 Set 3")

Number of Antenna Ports for SRS ← SRS Set Configuration
Option: R&S SMBV-K85

For 3GPP Release = "LTE-Advanced/eMTC" UEs, sets the number of antenna ports used for every SRS transmission.

"Max. Number of Antenna Ports for PUSCH"	1	2	4
"Number of Antenna Ports for SRS"	1, 2, 4	1, 2	1, 4

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NAPort` on page 723

SRS Cyclic Shift n_CS (First AP) ← SRS Set Configuration
Sets the cyclic shift n_CS used for the generation of the sounding reference signal CAZAC sequence for the first port. The n_cs for the other ports are calculated automatically; they have a fixed relation to the first one.

The different shifts of the same Zadoff-Chu sequence are orthogonal to each other. Thus, you can apply different SRS cyclic shifts to schedule different users to transmit simultaneously their sounding reference signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:CYCShift` on page 723

SRS UpPTS Add ← SRS Set Configuration
Option: R&S SMBV-K119

In TDD mode, sets the higher layer parameter `srs-UpPtsAdd`, as specified in TS 36.211.

This parameter defines the number of additional SC-FDMA symbols in UpPTS and thus determines the total length of GP and UpPTS.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:UPPTsadd` on page 724

SRS Structure ← SRS Set Configuration
Use the following parameters to define the SRS structure:

Configuration Index I_SRS ← SRS Structure ← SRS Set Configuration
Sets the UE-specific parameter SRS configuration index I_{SRS}.

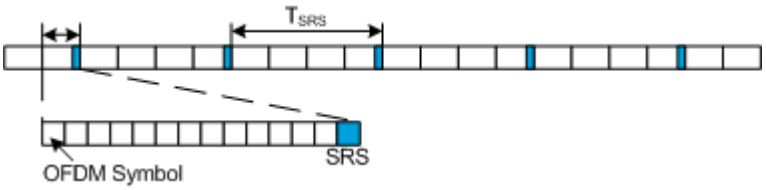
Depending on the selected "Duplexing Mode", this parameter determines the parameters SRS Periodicity T SRS and SRS Subframe Offset T_offset as defined in the TS 36.213, table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:ISRS` on page 725

Periodicity T_SRS ← SRS Structure ← SRS Set Configuration
Displays the UE-specific parameter SRS periodicity T_{SRS}, i.e. displays the interval of milliseconds after which the SRS is transmitted. The displayed value depends on the selected SRS Configuration Index I_SRS and "Duplexing Mode" as defined in the TS 36.213, table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

Adjust the SRS configuration index to enable more frequent SRS transmission like each 2 ms or an infrequently SRS transmission like each 320 ms for instance.

For TDD duplexing mode, a T_SRS of 2 ms means that SRS is transmitted two times in 5 ms.



Example:

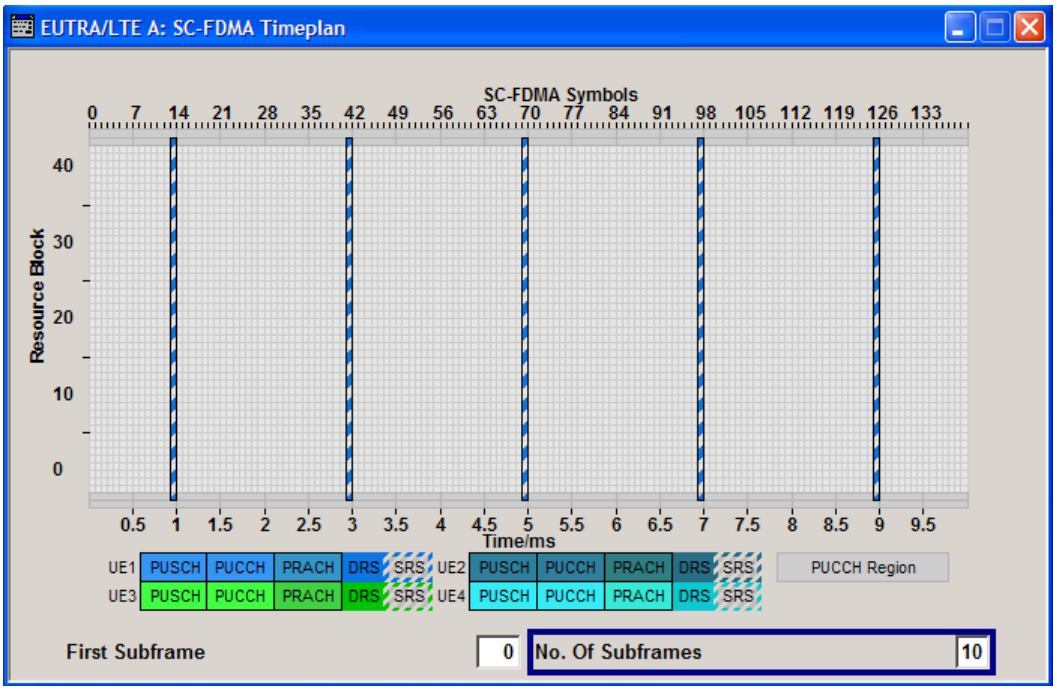
"Configuration Index = 0", i.e. "Periodicity T_SRS = 2 ms" and "Subframe Offset T_offset = 0"

"SRS State > On"

"Duplexing > FDD"

The default values of all other SRS parameters are left unchanged.

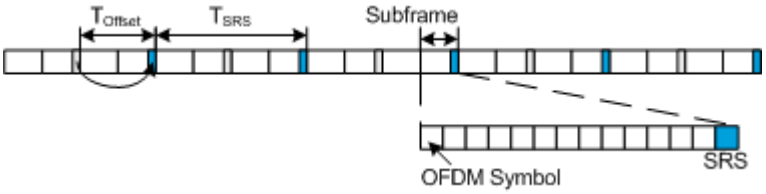
The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled.



Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TSRS?` on page 725

Subframe Offset T_offset ← SRS Structure ← SRS Set Configuration
Displays the UE-specific parameter SRS subframe offset T_{offset}, depending on the selected SRS Configuration Index I_SRS and "Duplexing Mode" as defined in the TS 36.213, table 8.2-1 (FDD) and 8.2-2 (TDD).

An SRS subframe offset shifts the SRS pattern. While SRS periodicity T_SRS remains constant, the SRS transmission is delayed with period of time equal to the SRS subframe offset T_offset.

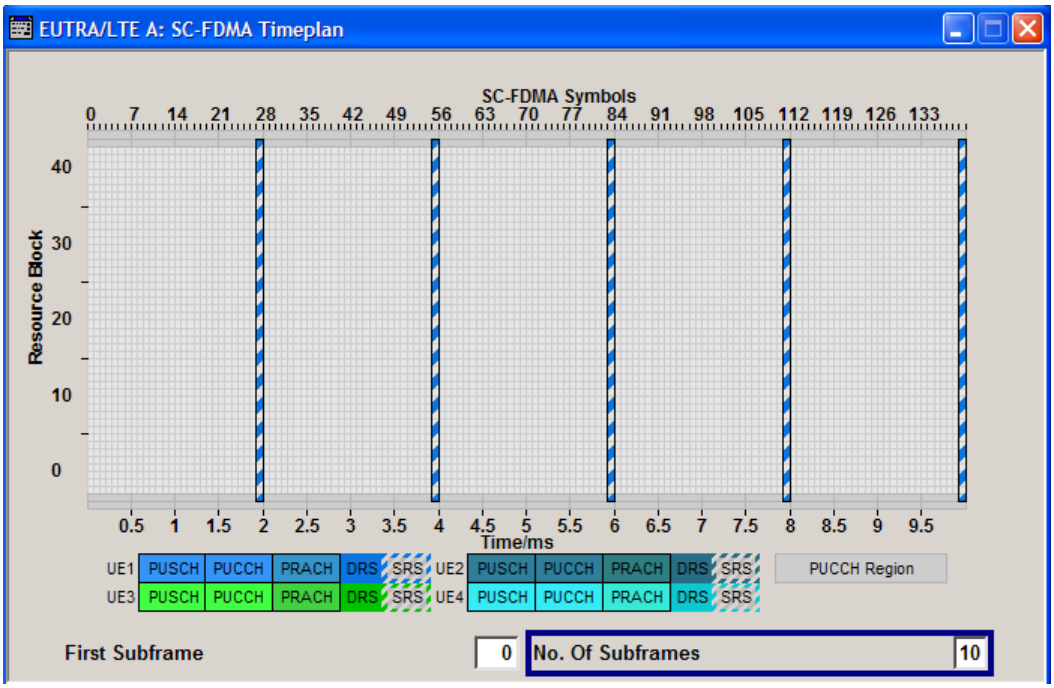


Example:

- "Configuration Index = 1", i.e. "Periodicity T_SRS = 2 ms" and "Subframe Offset T_offset = 1"
- "SRS State > On"
- "Duplexing > FDD"

The default values of all other SRS parameters are left unchanged.

The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled. Compared to the SRS transmission with T_{offset} = 0, the SRS transmission is delayed with 1 ms.



For TDD duplexing mode, a T_offset of 0 or 5 means that SRS is transmitted in the second last symbol of the special subframe (in the UpPTS part). For this case, adjust the parameter TDD Special Subframe Config so that an UpPTS field length of two symbols is assured.

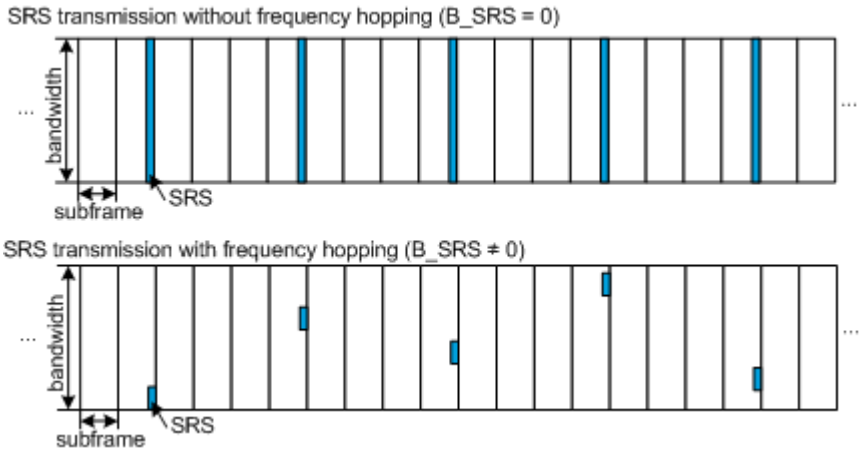
For TDD duplexing mode with T_SRS value of 2 ms, two T_offset values are displayed, corresponding to the two SRS transmissions per 5 ms. For example, the values 0, 1 mean that two SRS transmissions occur, both in the special subframe. One of them is in the second last symbol and the other one, in the last symbol of the subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TOFFset?` on page 726

SRS Bandwidth B_SRS ← SRS Structure ← SRS Set Configuration
Sets the bandwidth covered by a single SRS transmission. That is the UE-specific parameter SRS bandwidth B_{SRS}, as defined in the TS 36.211, chapter 5.5.3.2.

The SRS can span the entire frequency bandwidth or use frequency hopping where several narrowband SRSs cover the same total bandwidth.

There are 4 SRS bandwidths defined in the standard. The most narrow SRS bandwidth (B_SRS = 3) spans 4 resource blocks and is available for all channel bandwidths. The other 3 values of the parameter B_SRS define more wideband SRS bandwidths, available depending on the channel bandwidth.



The SRS transmission bandwidth is determined also by the "SRS Bandwidth Configuration C_{SRS}".

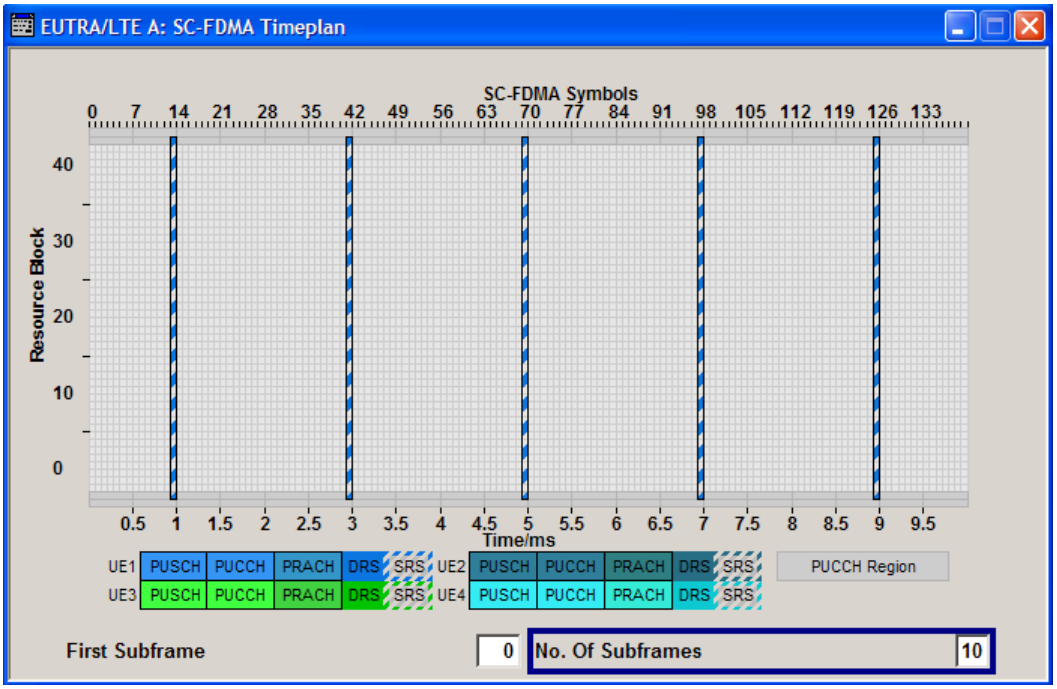
Example:

"SRS State > On"

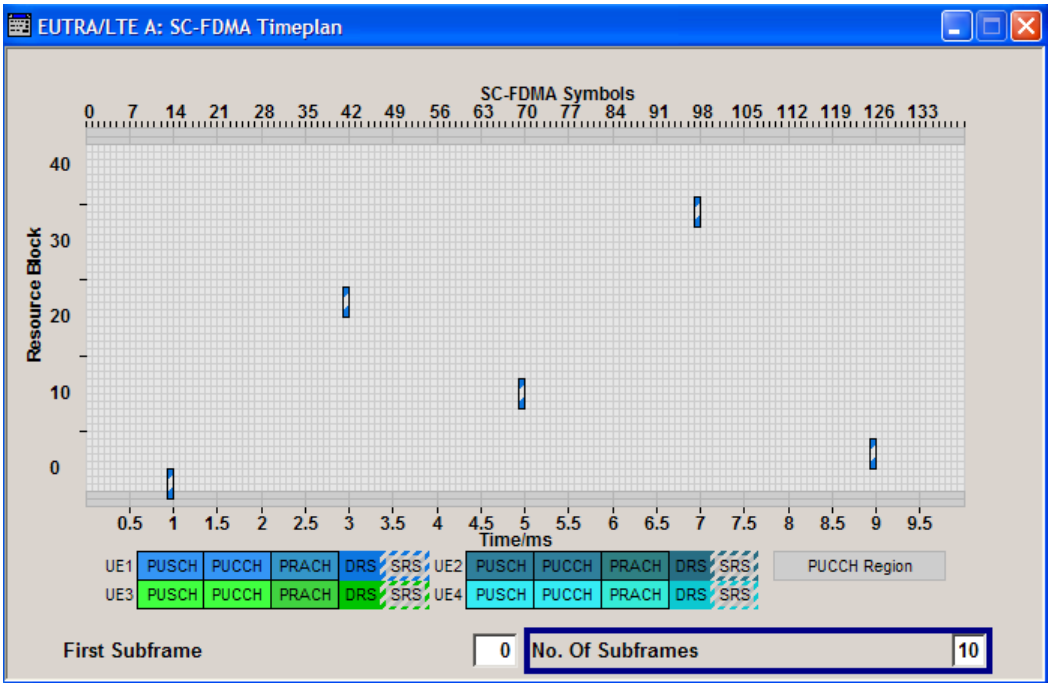
"Duplexing > FDD"

The default values of all other SRS parameters are left unchanged.

For "B_SRS = 0", the SC-FDMA time plan shows a wideband SRS without frequency hopping.



Changing the SRS bandwidth to "B_SRS = 3" results in the most narrowband SRS transmission with SRS bandwidth of 4 RBs and enabled frequency hopping.



Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:BSRS` on page 725

Transmission Comb Num k TC ← SRS Structure ← SRS Set Configuration
Option: R&S SMBV-K119

In TDD mode, sets the UE-specific parameter number of combs (`transmissionCombNum`), as defined in the TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NKTC` on page 727

Transmission Comb k TC ← SRS Structure ← SRS Set Configuration
Sets the UE-specific parameter transmission comb parameter k_{TC}, as defined in the TS 36.211, chapter 5.5.3.2.

The SRS is transmitted on alternating subcarriers, where with k_{TC} = 1 every odd and with k_{TC} = 0 every even subcarrier is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TRComb` on page 726

Hopping Bandwidth b_hop ← SRS Structure ← SRS Set Configuration
(for trigger type 0 SRS ("Type 0"))

Sets the UE-specific parameter frequency hopping bandwidth b_{hop}, as defined in the TS 36.211, chapter 5.5.3.2.

SRS frequency hopping is enabled, if $b_{HOP}<B_{SRS}$. Hopping bandwidth is the frequency band in that the SRS hops.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:BHOP` on page 725

Freq. Domain Position n_RRC ← SRS Structure ← SRS Set Configuration
Sets the UE-specific parameter `frqDomainPosition` n_{RRC}, as defined in the TS 36.211, chapter 5.5.3.2.

This parameter determines the starting physical resource block of the SRS transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NRRC` on page 727

Number of Transmissions ← SRS Structure ← SRS Set Configuration
Sets the number of SRS transmissions.

That is, the number of cells in the table Subframes for Transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NTRans` on page 723

Subframes for Transmission ← SRS Structure ← SRS Set Configuration
Sets the subframes in that the SRS is transmitted. The values correspond to the values of the SRS parameter Configuration Index I_SRS.

A conflict is indicated in the following situations:

- The subframe number is already used in the SRS set
- The subframe number is used in another SRS set of the same UE

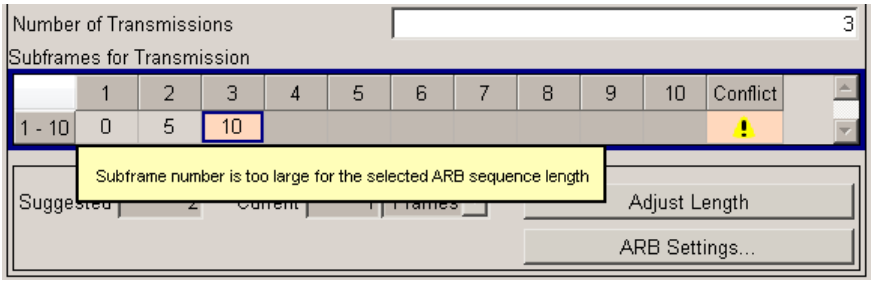


Figure 4-10: Example of conflict indication: DCI 4 Set 2 and DCI 1A/2B/2C/2D SRS sets use configuration index (subframe number) = 2

- The subframe number is outside the current ARB sequence length.

Note: If there is conflict, observe the tooltip.
Change the subframe index or select Adjust Length to set the "ARB Sequence Length" to the proposed value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:SUBF<subfidx>` on page 724

Suggested ← SRS Structure ← SRS Set Configuration
Indicates the suggest ARB sequence length as number of frames.

Select "Adjust Length" to set the ARB sequence length to the proposed value.

Adjust Length ← SRS Structure ← SRS Set Configuration
Set the ARB sequence length to the proposed value.

This function is active, if an SRS transmission is configured in subframe number that is outside of the frames in the current "ARB Sequence Length".

ARB Settings ← SRS Structure ← SRS Set Configuration
Access the "ARB" dialog and displays the "ARB Sequence Length" value.

See "Sequence Length" on page 64

4.12.7 Sidelink Settings

- D2D communication and discovery modes
  Option: R&S SMBV-K113
- V2X communication mode
  Option: R&S SMBV-K119

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "General > General UL Settings > Cell" > "Cyclic Prefix = Normal or Extended".

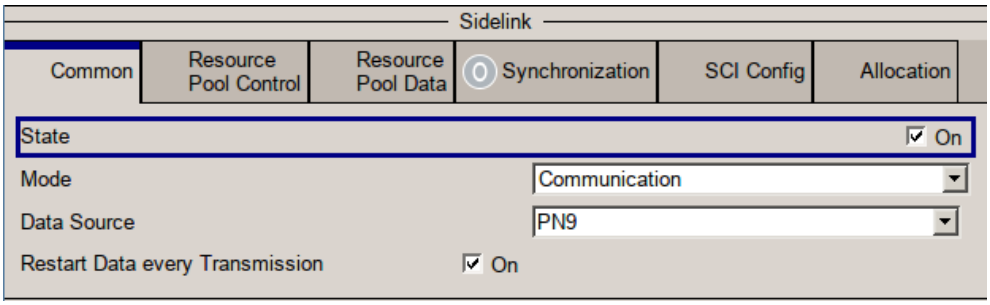
3. Select "Frame Configuration > General > Select User Equipment > UEx".
4. Select "Sidelink".
5. Open the "Time Plan" to observe the configuration.

- Common Sidelink Settings....261
- Resource Pool Control and Resource Pool Settings....262
- Resource Pool Data Settings....268
- RMC Settings....272
- Synchronization Settings....273
- SCI Configuration Settings....275
- SCI Format Configuration....278
- Allocation Settings....281
- PSCCH, PSDCH and PSSCH Enhanced Settings....283

4.12.7.1 Common Sidelink Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Sidelink > Common".



With the provided settings, you can select the mode in that the sidelink is working.

State....261
Mode....261
Data Source....262
Restart Data every Transmission....262

State
Enables transmission of the sidelink.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:STATe` on page 735

Mode
Sets the mode of the sidelink communication.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:MODE on page 736

Data Source
Selects the sidelink data source.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DATA on page 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DSELect on page 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:PATTern on page 736

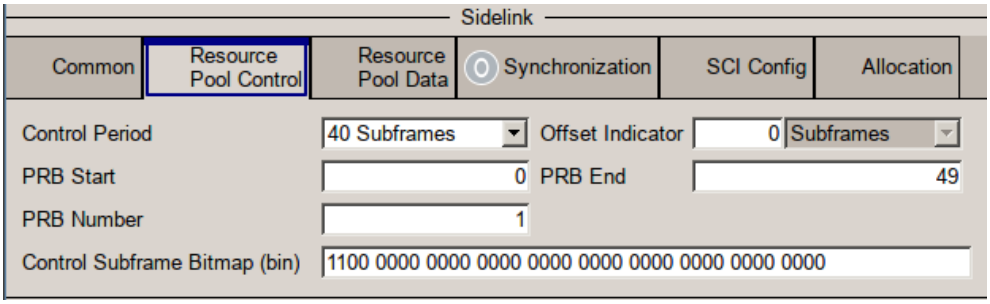
Restart Data every Transmission
If enabled, the data source is restarted at each SL transmission.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RESTart on page 737

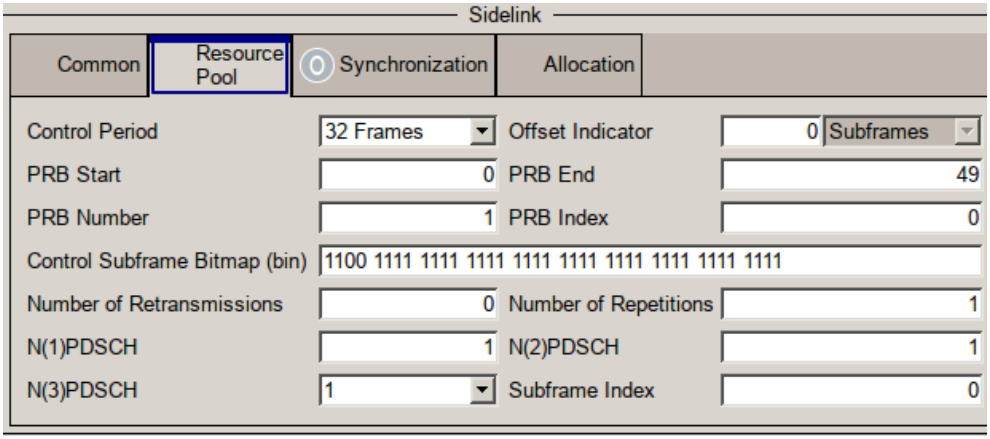
4.12.7.2 Resource Pool Control and Resource Pool Settings

Access:

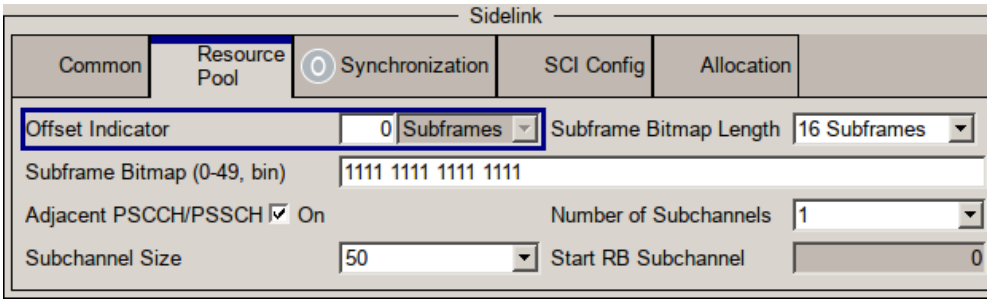
1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Sidelink > Common > Mode > Communication".
4. Select "Sidelink > Resource Pool Control".



5. Select "Sidelink > Common > Mode > Discovery".
Select "Sidelink > Resource Pool".



6. Select "Sidelink > Common > Mode > V2X Communication".
Select "Sidelink > Resource Pool".



The provided settings depend on the selected SL mode. For "Mode = Communication", for example, you can configure the resource pool for the sidelink control region.
Here, you can define the resource blocks reserved for sidelink transmission by setting the three parameters PRB Start, PRB End and PRB Number.

Control Period 264
Offset Indicator 264
PRB Start, PRB End 265
PRB Number 265
Control Subframe Bitmap/Subframe Bitmap 265
Resource pool (RP) settings dedicated to the discovery mode 266

└ Number of Retransmission 266
└ Number of Repetitions 266
└ N(1)PDSCH/N(2)PDSCH/N(3)PDSCH 266
└ Subframe Index 266
└ PRB Index 267
Resource pool (RP) settings dedicated to the V2X communication mode 267
└ Subframe Bitmap Length 267
└ Subframe Bitmap (0 - 49)/Subframe Bitmap (50 - 100) 267
└ Adjacent PSCCH/PSSCH 268
└ Number of Subchannels 268
└ Subchannel Size 268
└ Start RB Subchannel 268

Control Period

For "Sidelink > Common > Mode > Discovery/Communication", sets the period over which resources are allocated for sidelink control period (SC period).

Depending on the "Sidelink > Common > Mode", this parameter sets one of the parameters listed in Table 4-14. As shown in the table, the SL communication is based on equal-sized PSCCH periods, with period length depending on the duplexing mode.

Table 4-14: Value range depending on the duplexing mode and the SL mode

"Sidelink > Common > Mode"	Parameter according to TS 36.331	Duplexing	TDD UL/DL configuration	Control period
Communication	SL-CommResourcePool	FDD	-	40, 80, 160, 320 subframes
		TDD	0	70, 140, 280 subframes
			1 to 5	40, 80, 160, 320 subframes
			6	60, 120, 240 subframes
Discovery	discPeriod	-	-	32, 64, 128, 256, 512, 1024 frames

Remote command:

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:CPERiod` on page 737

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:CPERiod` on page 737

Offset Indicator

Sets the parameter SL-OffsetIndicator, i.e. the offset from the SFN=0 after that the SL control region starts and thus defines the starting subframe of the repeating subframe bitmap (Control Subframe Bitmap/Subframe Bitmap)

If "Control Period Offset = 0", then the first subframe of the resource pool starts from the first subframe of SFN = 0.

"User Equipment Configuration > Sidelink > Common > Mode"	Value range
Communication V2X communication	0 to 319
Discovery	0 to10239

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:OFFSetind on page 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:OFFSetind on page 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:OFFSet on page 738

PRB Start, PRB End
For "Sidelink > Common > Mode > Communication/Discovery", sets the parameters `prb-Start` and `prb-End` and define allocation of the two SL bands. The two bands occupy equal bandwidth, that is set in terms of resource blocks by the parameter `prb-Num`, see PRB Number.

The default values for the "PRB Start" and "PRB End" depend on the selected "Channel Bandwidth".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PRBStart on page 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PREND on page 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBStart on page 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PREND on page 738

PRB Number
For "Sidelink > Common > Mode > Communication/Discovery", sets the parameter `prb-Num` and defines the number of resource blocks each of the SL bands occupies.

The SL transmission is allowed on set of resources (subframes and resource blocks) called resource pool. If a subframe is used or not for SL transmission is defined by the subframe bitmap.

Within a subframe allowed for SL transmission, the resources used for SL are divided into two bands, where the first one starts at the `prb-Start` and the second ends at the `prb-End`. Each of the two bands occupies a `prb-Num` resource blocks.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PRBNumber on page 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBNumber on page 739

Control Subframe Bitmap/Subframe Bitmap
Sets the subframe bitmap (`SubframeBitmapSL`) and thus defines which subframes are allowed for SL transmission (PSCCH).

The bitmap is a sequence of bits and has different length depending on the duplexing mode. The bitmap must contain at least two bits set to 1, because the PSCCH transmission occurs in two subframes.

The bit value indication is as follows:
- 1: indicates subframes used for PSCCH transmission
- The last 1: indicates the the beginning of the PSSCH transmission
- 0: indicates subframes used for PSSCH transmission.

Table 4-15: Bitmap length range depending on the duplexing mode for Mode > Communication/ Discovery

Duplexing	TDD UL/DL configuration	Bitmap length, bits
FDD	-	40
TDD	0	42
	1	16
	2	8
	3	12
	4	8
	5	4
	6	30

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:SFBMp` on page 739
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFBMp` on page 739

Resource pool (RP) settings dedicated to the discovery mode
Access: select "Sidelink > Common > Mode > Discovery" and "Sidelink > Resource Pool".

Number of Retransmission ← Resource pool (RP) settings dedicated to the discovery mode
Sets the parameter `numRetx` and defines how many times the PSDCH is retransmitted while working in discovery mode. The PDSCH comprises of 232 transport blocks.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NRETrans` on page 739

Number of Repetitions ← Resource pool (RP) settings dedicated to the discovery mode
Sets the parameter `numRepetition` and defines how many times the PSDCH is repeated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NREPetitions` on page 739

N(1)PDSCH/N(2)PDSCH/N(3)PDSCH ← Resource pool (RP) settings dedicated to the discovery mode
Sets the PDSCH resource index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N1PDsch` on page 740
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N2PDsch` on page 740
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N3PDsch` on page 740

Subframe Index ← Resource pool (RP) settings dedicated to the discovery mode
Sets the subframe index `discSF-Index` as defined in TS 36.331.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFINdex on page 742

PRB Index ← Resource pool (RP) settings dedicated to the discovery mode
Sets the physical resource block index `discPRB-Index` as defined in TS 36.331.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRINdex on page 743

Resource pool (RP) settings dedicated to the V2X communication mode
Option: R&S SMBV-K119

The V2X communication mode commonly describes the three scenarios:
- V2V: vehicle-to-vehicle operation
- V2P: vehicle-to-pedestrian operation
- V2I: vehicle-to-network/infrastructure operation.

The V2X communication reuses the resource grid of the SL transmission. The resource pools are defined by the parameters:
- RPStart (Start RB Subchannel)
- NubSubchannels (Number of Subchannels)
- SizeSubchannels (Subchannel Size).

Subframe Bitmap Length ← Resource pool (RP) settings dedicated to the V2X communication mode
For "Sidelink > Common > Mode > V2X Communication", set the bitmap length.

Table 4-16: Value range depending on the duplexing mode and the SL mode

"Sidelink > Common > Mode"	Duplexing	TDD UL/DL configuration	Control period, subframes
V2X communication	FDD	-	16, 20, 100
	TDD	0	60
		1	40
		2, 4	20
		3	30
		5	10
		6	50

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BMPLength on page 741

Subframe Bitmap (0 - 49)/Subframe Bitmap (50 - 100) ← Resource pool (RP) settings dedicated to the V2X communication mode
Sets the subframe bitmap (`SubframeBitmapSL`) and thus defines which subframes are allowed for SL transmission (PSCCH).

The bitmap is a sequence of bits and has different length depending as selected with the parameter Subframe Bitmap Length.

The "Subframe Bitmap (50 - 100)" is enabled, if "Subframe Bitmap Length ≥ 60 Subframes".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITLow on page 741
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITHigh on page 741

Adjacent PSCCH/PSSCH ← Resource pool (RP) settings dedicated to the V2X communication mode
If enabled, the PSCCH and PSSCH channels are allocated on contiguous resources, where the PSCCH is allocated at the lower end of the subchannel.

If "Number of Subchannels > 1", the PSCCH is transmitted in the subchannel as set with the parameter Subchannel.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:ADJC on page 741

Number of Subchannels ← Resource pool (RP) settings dedicated to the V2X communication mode
Sets the number of subchannels.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBChannels on page 742

Subchannel Size ← Resource pool (RP) settings dedicated to the V2X communication mode
Sets the number of resource blocks the subchannel spans.

The allowed value depends on whether "Adjacent PSCCH/PSSCH" are used or not.

The value is also limited by the constraint: "Subchannel Size"*"Number of Subchannels" ≤ N_RB, where N_RB is the number of resource blocks depending on the selected "Channel Bandwidth".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBSize on page 742

Start RB Subchannel ← Resource pool (RP) settings dedicated to the V2X communication mode
Sets the first RB in the subchannel.

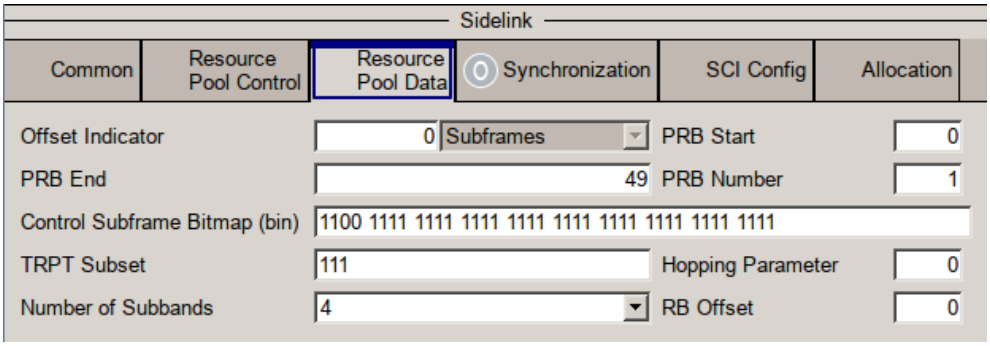
Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SRBSubchan on page 742

4.12.7.3 Resource Pool Data Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".

4. Select "Sidelink > Common > Mode" > **"Communication"**.
5. Select "Sidelink > Resource Pool Data".



With the provided settings, you can configure the resource pool (RP) for the sidelink data region.
The data region starts directly after the last bit of the Control Subframe Bitmap(`SubframeBitmapSL`) which is set to 1. The data region itself contains a bitmap, the TRTP bitmap (TRPT Subset). The latter indicates the subframes which are used for the data transmission. The TRTP bitmap is repeated until the end of the SC period is reached.
Two types of resource pools are defined, the reception resource pool (Rx RP) and the transmission resource pool (Tx RP).

Offset Indicator....269
PRB Start, PRB End....270
PRB Number....270
Control Subframe Bitmap....270
TRPT Subset....271
Hopping Parameter....271
Number of Subbands....271
RB Offset....271

Offset Indicator
Sets the parameter `SL-OffsetIndicator`, i.e. the offset from the SFN=0 after that the SL control region starts and thus defines the starting subframe of the repeating subframe bitmap (Control Subframe Bitmap).

If "Control Period Offset = 0", then the first subframe of the resource pool starts from the first subframe of SFN = 0.

"User Equipment Configuration > Sidelink > Common > Mode"	Value range
Communication	0 to 319
Discovery	0 to10240

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:OFFSetind` on page 738

PRB Start, PRB End
Sets the parameters `prb-Start` and `prb-End` and define allocation of the two SL bands. The two bands occupy equal bandwidth, that is set in terms of resource blocks by the parameter `PRB-Num`.

The default values for the "PRB Start" and "PRB End" depend on the selected "Channel Bandwidth".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBStart` on page 738
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PREND` on page 738

PRB Number
Sets the parameter `prb-Num` and defines the number of resource blocks each of the SL bands occupies.

The SL transmission is allowed on set of resources (subframes and resource blocks) called resource pool. Whether a subframe is used or not for SL transmission is defined by the subframe bitmap.

Within a subframe allowed for SL transmission, the resources used for SL are divided into two bands, where the first one starts at the `prb-Start` and the second ends at the `prb-End`. Each of the two bands occupies a `prb-Num` resource blocks.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBNumber` on page 739

Control Subframe Bitmap
Sets the subframe bitmap (`SubframeBitmapSL`) and thus defines which subframes are allowed for SL transmission (PSCCH).

The bitmap is a sequence of bits and has different length depending on the duplexing mode. The bitmap must contain at least two bits set to 1, because the PSCCH transmission occurs in two subframes.

The bit value indication is as follows:
- 1: indicates subframes used for PSCCH transmission
- The last 1: indicates the the beginning of the PSSCH transmission
- 0: indicates subframes used for PSSCH transmission.

Table 4-17: Bitmap length range depending on the duplexing mode

Duplexing	TDD UL/DL configuration	Bitmap length, bits
FDD	-	40
TDD	0	42
	1	16
	2	8
	3	12
	4	8
	5	4
	6	30

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:SFBMp on page 739

TRPT Subset
The TRPT subset is a kind of an additional restriction for PSSCH subframe allocations form the total subframes available for PSSCH transmission. The TRPT subset is a time resources pattern that indicates the set of available subframes to be used for sidelink communication. If the TRPT subset is not signaled, the UE assumes that the whole TRPT set is available.

The TRPT bitmap is repeated until the end of the SC period is reached.

Table 4-18: TRPT subset length depending on the duplexing mode

Duplexing	TDD UL/DL configuration	TRTP subset length, bits
FDD	-	3
TDD	0	5
	1	3
	2	3
	3	4
	4	3
	5	3
	6	4

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:TRPTsubset on page 743

Hopping Parameter
Sets the frequency hopping parameter.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:HOPPingparam on page 743

Number of Subbands
Sets the number of subbands. The SL transmission can use 1, 2 or 4 subbands.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:NSUBbands on page 743

RB Offset
Shifts the band in the frequency domain by the selected number of resource blocks (RB).

Table 4-19: Value range depending on the bandwidth

Bandwidth	RB offset
1.4 MHz	0 to 4
3 MHz	0 to 12
5 MHz	0 to 22

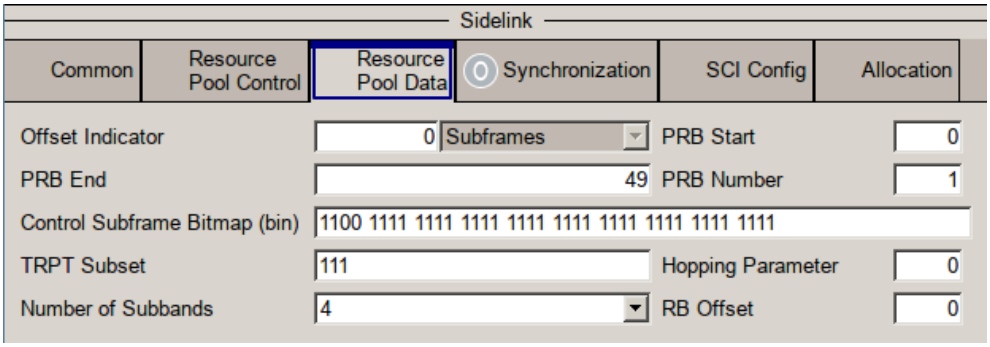
Bandwidth	RB offset
10 MHz	0 to 48
15 MHz	0 to 72
20 MHz	0 to 98

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:RBOFfset` on page 744

4.12.7.4 RMC Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Sidelink > Common > Mode" > **"V2X Communication"**.
5. Select "Sidelink > RMC".



With the provided settings, you can select a preconfigured reference measurement channel (RMC).

State....272
RMC....273
Allocated Resource Blocks....273
Modulation....273
Payload Size....273
Pysical Bits per Subframe....273

State
If enabled, the settings according to the selected reference measurement channel (RMC) are applied.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:STATe` on page 755

RMC
Selects one of the predefined reference measurement channels.

All further settings in this dialog are set automatically.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:RMC` on page 756

Allocated Resource Blocks
Indicates the number of resource blocks the allocation spans.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:ARBLocks?` on page 756

Modulation
Indicates the used modulation scheme.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:MODulation?` on page 756

Payload Size
Indicates the payload size.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PAYSize?` on page 756

Pysical Bits per Subframe
indicates the number of used physical bits per subframe

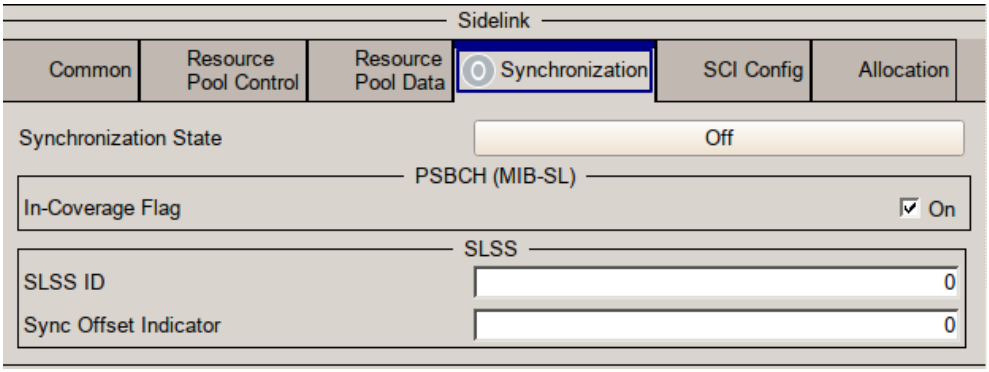
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PHYSbits?` on page 757

4.12.7.5 Synchronization Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".

4. Select "Sidelink > Synchronization".



The dialog comprises the settings of the sidelink synchronization signal (SLSS) and the sidelink common control information, carried by a single message on the PSBCH (physical sidelink broadcast channel).

Depending on the SL "Sidelink > Common" > Mode, this single message is:

- Option: R&S SMBV-K113
  The master information block-SL (MIB-SL) message for sidelink discovery and sidelink communication
- Option: R&S SMBV-K119
  The master information block-SL-V2X (MIB-SL-V2X) message for V2X sidelink communication.

The MIB-SL transmission on a fixed schedule with a periodicity of 40 ms and without repetitions, where the subframes in that the MIB-SL is scheduled are defined by the parameter "Sync Offset Indicator" on page 275.
The MIB-SL-V2X is also transmitted on a fixed schedule but it uses a periodicity of 160 ms without repetitions.

Synchronization State 274
PSBCH (MIB-SL) 274
└ In-coverage Flag 275
SLSS 275
└ SLSS ID 275
└ Sync Offset Indicator 275

Synchronization State
Enables using the two types of synchronization signals for the SL transmission:

- Sidelink synchronization signals (SLSS) used for synchronization in time and frequency
- Master information block SL (MIB-SL) that provides additional information.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:STATe` on page 744

PSBCH (MIB-SL)
The MIB-SL is one of the SL synchronization signals. It is transmitted over the PBCCH and carries the following information:

In-coverage Flag ← PSBCH (MIB-SL)
Sets the parameter `inCoverage` according to TS 36.331. It indicates whether the sender is in the coverage of a cell or not.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:INCoverage` on page 744

SLSS
There are primary and secondary SL synchronization signals (SLSSs), the PSSS and the SSSS. Each of the synchronization signals spans 62 resource elements, located around the center carrier. In the time domain, the SLSS span two subsequent symbols.

The SLSS is additionally defined by the following parameters:

SLSS ID ← SLSS
Sets the SLSS ID form that the receiving UE detects if the transmitting UE is in coverage of at least if it receives its synchronization from the LTE cell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:SLSSid` on page 745

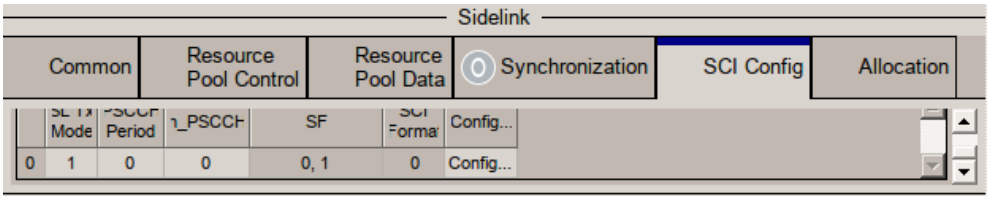
Sync Offset Indicator ← SLSS
Sets the parameter `syncOffsetIndicator` according to TS 36.331 that defines the subframes in that the MIB-SL is scheduled.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:OFFSetind` on page 745

4.12.7.6 SCI Configuration Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Sidelink > Common > Mode > Communication".
   Or "Sidelink > Common > Mode > V2X Communication"
5. Select "Sidelink > SCI Config".



With the provided settings, you can configure the number of SCI (SL control information) configurations, the SCI format and the content of the SCI.

Number of SCI Config....276
SCI Table....276
└ SL Tx Mode....276
└ PSCCH Period....276
└ n_PSCCH....276
└ Start SF....277
└ Subchannel....277
└ SF....277
└ SCI Format....277
└ Config....277

Number of SCI Config
Sets the number of SCI (SL control information) configurations. In the SCI table, there is one table row per SCI configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NSCI` on page 745

SCI Table
In the SCI table, there is one table row per SCI configuration.

SL Tx Mode ← SCI Table
Sets the transmission mode of the SL transmission.

The Tx mode defines how the resources from a resource pool (RP) are assigned and influence the start of the data part.

"1" (Mode 1)	The resource assignment, incl. the resources within an RP is indicated by the eNB.
"2" (Mode 2)	The UE uses a set of predefined pools and selects the resources thereof.
"3", "4" (Mode 3 and 4)	Option: R&S SMBV-K119 Set the transmission mode for "Sidelink > Common > Mode > V2X Communication".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXMode` on page 745

PSCCH Period ← SCI Table
For "Sidelink > Common > Mode > Communication", the subframes used for SL transmissions are distributed over different PSCCH periods. The PSCCH period is defined with the parameter "Resource Pool Control" > Control Period.

This parameter defines the PSCCH period in that the SCI configuration is performed.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PSCPeriod` on page 746

n_PSCCH ← SCI Table
For "Sidelink > Common > Mode > Communication", sets the parameter n_PSCCH and determines the resources in the time and the frequency domain that a transmitting UE uses for the PSCCH transmission.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:NPSCch on page 746

Start SF ← SCI Table
Option: R&S SMBV-K119

For "Sidelink > Common > Mode > V2X Communication", sets the first subframe used for the SL transmission, where the starting SF of the subsequent configuration has to be greater than the period of the previous one.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:STARtsf on page 747

Subchannel ← SCI Table
Option: R&S SMBV-K119

For "Sidelink > Common > Mode > V2X Communication", sets the used subchannel.

The number of subchannels is set with the parameter Number of Subchannels.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SUBChannel
on page 747

SF ← SCI Table
Indicates the subframe numbers of the subframes that can be used for SL transmission. The values are calculated automatically.

- In "Sidelink > Common > Mode > Communication/Discovery" mode, the PSCCH allocation uses two subframes.
- In "Sidelink > Common > Mode > V2X Communication" mode, the PSCCH allocation uses one or 2 subframes.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SF? on page 746

SCI Format ← SCI Table
Sets the SCI (SL control information) format.

"0" SCI format 0, required for "Sidelink > Common" > Mode = "Communication"

"1" Option: R&S SMBV-K119
SCI format 1, required for V2X transmission ("Sidelink > Common" > Mode = "V2X Communication").

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FORMat on page 746

Config ← SCI Table
Opens a dialog with further settings to configure the content of the SCI with the selected format, see Chapter 4.12.7.7, "SCI Format Configuration", on page 278.

4.12.7.7 SCI Format Configuration

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Sidelink > Common > Mode > Communication".
   Or "Sidelink > Common > Mode > V2X Communication"
5. Select "Sidelink > SCI Config > SCI Format = e.g. 0".
6. Select "Config".

   In this dialog, you configure the content of the SCI (SL control information) in the selected format ("Sidelink > SCI Config" > SCI Format).

The SCI carries information from that the receiving device detects the PSSCH and retrieves information on the set of resources in which the PSSCH is transmitted.

Settings:

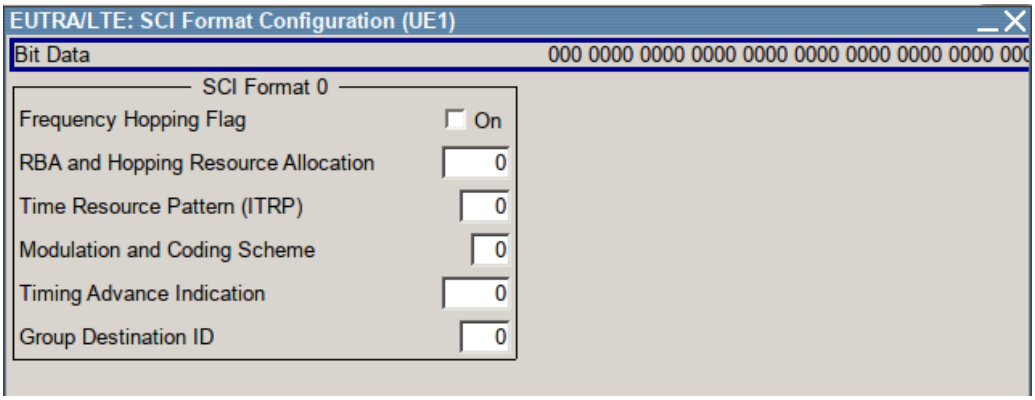
Bit Data..... 278
SCI Format 0..... 278
SCI Format 1..... 279

Bit Data
Displays the resulting bit data as selected with the SCI format parameters.

Mapping of the information bits is according to TS 36.212.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:BITData?` on page 747

SCI Format 0
The SCI format 0 is defined for SL transmission in communication mode ("Sidelink > Common > Mode > Communication").



The fields defined in the SCI format are mapped to the information bits according to the 3GPP specification and the resulting "Bit Data" on page 278 is displayed.

The bit data length depends on the "Channel Bandwidth" and the value of the SCI parameter "RBA and Hopping Resource Allocation".

"Channel Bandwidth", MHz	Number of bits in the "Bit Data" field
1.4	37
3	39
5	41
10	43
15	44
20	45

Control information field	SCPI command	Dependencies
"Frequency Hopping Flag"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FHFLag` on page 748	
"RBA and Hopping Resource Allocation"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RBAHoppalloc` on page 748	Value range depends on the "Channel Bandwidth"
"Time Resource Pattern (ITPR)"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TRP` on page 748	Value range for "SL Tx Mode = 1" • For FDD and "TDD Config = 1, 2, 4, and 5": 0 to 106 • For "TDD Config = 0": 1 to 127 • For "TDD Config = 3 and 6": 1 to 63 For "SL Tx Mode = 2", automatically set.
"Modulation and Coding Scheme"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:MCS` on page 748	
"Timing Advance"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TAINd` on page 749	For "SL Tx Mode = 1": 0 to 2047 For "SL Tx Mode = 2": 0
"Group Destination ID"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:GRID` on page 749	

SCI Format 1
Option: R&S SMBV-K119

The SCI format 1 is defined for SL transmission in V2X communication mode ("Sidelink > Common > Mode > V2X Communication").

The fields defined in the SCI format are mapped to the information bits according to the 3GPP specification and the resulting "Bit Data" on page 278 is displayed.

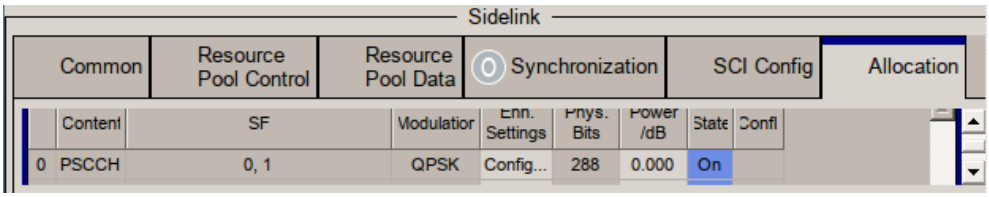
The bit data is 32 bits long; filling zeros are appended in case the resulting bit data is shorter than 32 bits.

Control information field	SCPI command	Dependencies
"Priority"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PRIRity` on page 750	
"Resource Reservation"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RREServation` on page 750	Value range: • For "Tx Mode = 3": 0 • For "Tx Mode = 4": 0 to 12
"Frequency Resource Location of initial Tx and ReTX"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FREQresloc` on page 749	Length in bits and value range depends on the "Number of Subchannels": • 1: 0 bits • 3: 3 bits [0 to 7) 5: 4 bits [0 to 15] 8: 6 bits [0 to 63] 10: 6 bits [0 to 63] 15: 7 bits [0 to 127] 20: 8 bits [0 to 255] • For TDD config = 0: 0 to 127 • For TDD config = 3 and 6: 1 to 63 For "SL Tx Mode = 2", automatically set.
"Time Gap between initial Tx and ReTx"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TIMGap` on page 750	
"Modulation and Coding Scheme"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:MCS` on page 748	
"Retransmission Index"	`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXINdex?` on page 751	

4.12.7.8 Allocation Settings

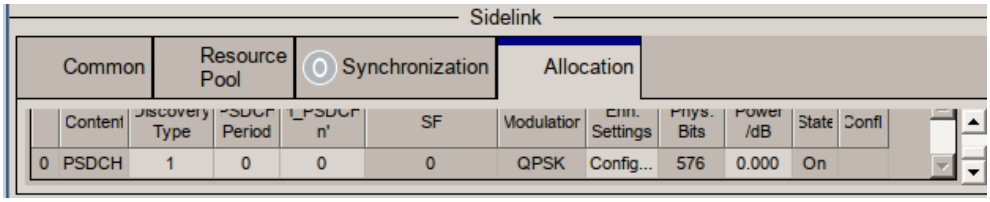
Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Sidelink > Common > Mode > Communication".
   Or "Sidelink > Common > Mode > V2X Communication"
5. Select "Sidelink > Allocation".



The number of channels is set automatically, depending on the number of SCIs, the SCI format and its content.

6. Select "Sidelink > Common > Mode > Discovery".
   Select "Sidelink > Allocation".



With the provided settings, you can configure the SL allocations.
The provided settings depend on the selected SL mode.

Number of Transmissions 281
Content 282
Discovery Type 282
PSDCH Period 282
n_PSDCH/n' 282
SF 282
Modulation 283
Enchanced Settings > Config 283
Physical Bits 283
Power 283
State 283
Conflict 283

Number of Transmissions
For "Sidelink > Common > Mode > Discovery", sets the number of transmissions.

The value defines the number of rows in the allocation table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NALLoc on page 751

Content
Indicates allocation content, i.e. selects the channel to be transmitted:
- PSCCH: physical sidelink control channel
- PSDCH: physical sidelink discovery channel
- PSSCH: physical sidelink shared channel

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONTent?
on page 751

Discovery Type
For "Sidelink > Common > Mode > Discovery" and "Content = PSDCH", selects one of the discovery types, type 1 or type 2B.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:DISCtype
on page 751

PSDCH Period
For "Sidelink > Common > Mode > Discovery" and "Content = PSDCH", sets the period of the PSDCH, where the period of the subsequent channel has to be greater than the period of the previous one.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PSDPeriod
on page 752

n_PSDCH/n'
For "Sidelink > Common > Mode > Discovery" and "Content = PSDCH", sets the parameter n_PSDCH or n' as defined in TS 36.213, where n_PSDCH applies for discovery type 1 and n' - for discovery type 2B.

Value range depends on the selected Discovery Type and the resource pool configuration.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:NPDSch on page 752

SF
Indicates the subframe numbers of the allocated subframe. The values are calculated automatically.

The PSCCH is transmitted over 2 subframes, whereas the PSSCH over 4.

The PSDCH transmission depends on the Number of Retransmission defined in the resource pool.

For "Sidelink > Common > Mode > V2X Communication", the subframes depend on the value of the SCI Format 1 > "Time Gap between initial Tx and ReTx".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SF? on page 752

Modulation
Indicates or sets the used modulation, depending on the selected channel type ("Content").

- PSCCH: QPSK
- PSDCH: QPSK
- PSSCH: QPSK, 16QAM

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:MODulation?
on page 753

Enchanced Settings > Config
Opens a dialog with further settings for the selected channel.

Physical Bits
Indicates the number of physical bits occupied by the channel.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PHYSbits?
on page 753

Power
Sets the power of the selected channel.

The value is set relative to the UE power.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:POWer on page 753

State
Enables the transmission of the selected channel.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:STATe on page 753

Conflict
A conflict is indicated if two allocations overlap.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONFlict?
on page 754

4.12.7.9 PSCCH, PSDCH and PSSCH Enhanced Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".

3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Sidelink > Common > Mode > Communication".
   Or "Sidelink > Common > Mode > V2X Communication"
5. Select "Sidelink > Allocation > Enhanced Settings > Config".
6. Select "Enhanced Settings > Scrambling".

   With the provided settings, you can configure the channel coding and scrambling settings of the selected channel.

DRS > Cyclic Shift....284
Scrambling....284
└ State....284
Channel coding....284
└ State....284
└ Number of Physical Bits....285
└ Transport Block Index....285
└ Transport Block Size....285

DRS > Cyclic Shift
Sets the cyclic shift used by the generation of the DRS (demodulation reference signal) sequence.

For "Sidelink > Common > Mode > Communication/Discovery", the value for PSCCH is fixed to "Cyclic Shift = 0".

For "Sidelink > Common > Mode > V2X Communication", the value for PSCCH is one of the following {0, 3, 6, 9}.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CYCShift`
on page 754

Scrambling
Comprises the scrambling settings:

State ← Scrambling
Enables scrambling.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SCRambling:STATe`
on page 754

Channel coding
Access: select "Sidelink > Allocation > Content > PSSCH" and select "Enhanced Settings > Config".

State ← Channel coding
Enables channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:STATe
on page 755

Number of Physical Bits ← Channel coding
Indicates the resulting number of physical bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PHYSbits?
on page 753

Transport Block Index ← Channel coding
Indicates the resulting transport block index.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSI?
on page 755

Transport Block Size ← Channel coding
Indicates the resulting transport block size.

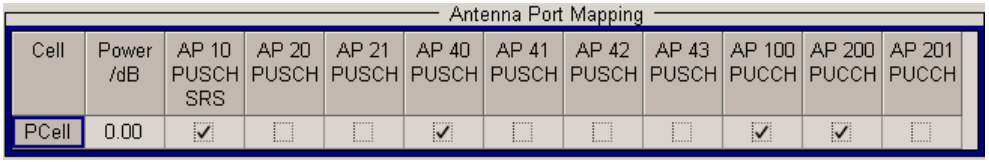
Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSize?
on page 755

4.12.8 Antenna Port Mapping

Option: R&S SMBV-K85

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx".
3. Select "User Equipment Configuration > Common > 3GPP Release > LTE-Advanced".
4. Select "Antenna Port Mapping".



The "Antenna Port Mapping" settings define which baseband generates which antenna port.

Settings:

Cell....286
Power....286
Antenna port mapping table....286

Cell
Indicates the cell (primary cell or secondary cell).

Power
Applies a power offset to the selected PCell or SCell.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CELL<dir0>:POFFset` on page 728

Antenna port mapping table
The mapping table is a matrix with the following dimension:
- Nnumber of rows equal to the number of physical Tx antennas (Basebands)
- Number of columns equal of the number of antenna ports (AP).

The available antenna ports depend on:
- Max. Number of AP for PUSCH
- Number of Antenna Ports for PUCCH per PUCCH Format
- Number of Antenna Ports for SRS

The Table 4-20 gives an overview of the available antenna port numbers as a function of the enabled "Number of Antenna Ports" per channel/signal.

Table 4-20: Available antenna port numbers

Number of antenna ports	**1**	**2**	**4**
Physical channel/signal			
PUSCH	10	20 21	40 41 42 43
PUCCH	100	200 201	-
SRS	10	20 21	40 41 42 43

Per activated baseband, you can activate exactly one PUSCH, one PUCCH, and one SRS antenna port.

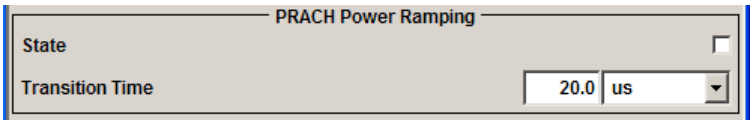
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP10Map:ROW<bbid>`
on page 727
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP20Map:ROW<bbid>`
on page 727
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP21Map:ROW<bbid>`
on page 727
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP40Map:ROW<bbid>`
on page 727
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP41Map:ROW<bbid>`
on page 727

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP42Map:ROW<bbid>
on page 727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP43Map:ROW<bbid>
on page 727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP100Map:ROW<bbid>
on page 728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP200Map:ROW<bbid>
on page 728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP201Map:ROW<bbid>
on page 728

4.12.9 PRACH Power Ramping

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx"
3. Select "Common > Mode > PRACH"



This dialog comprises the settings needed for configuring the PRACH power ramping.

Settings:

State PRACH Power Ramping.....287
Transition Time.....287

State PRACH Power Ramping
Activates power ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function (sin ^ 2).

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRSTate on page 711

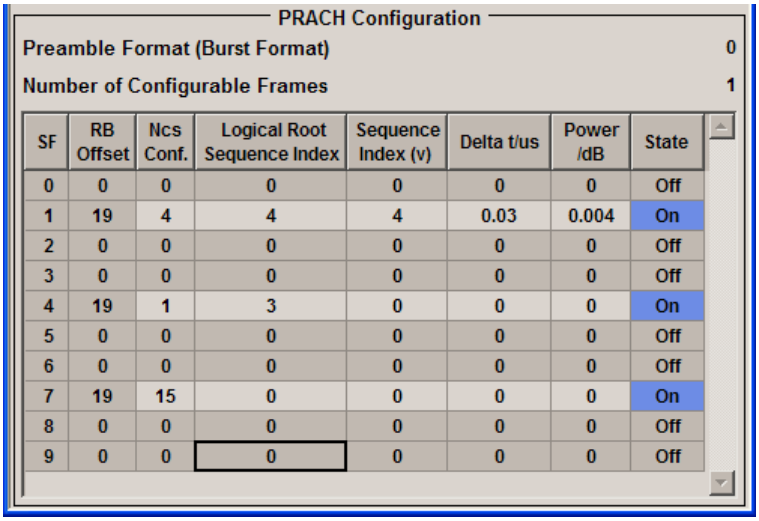
Transition Time
Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRTT on page 712

4.12.10 PRACH Configuration

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UEx"
3. Select "Common" > **"Mode = PRACH"**
4. Select "PRACH".



In this dialog, the UE-specific parameters according to TS 36.211 are enabled for configuration.
The cell-specific parameters, necessary for the complete definition of the PRACH, are configurable in the dialog "General UL Settings" > "PRACH".

Settings:

Preamble Format (Burst Format)....288
Number of Configurable Frames....289
SF....289
RB Offset....289
Frequency Resource Index....289
Ncs Configuration....289
Logical Root Sequence Index....290
Sequence Index (v)....290
Delta t/us....290
Power....290
State....290

Preamble Format (Burst Format)
Displays the preamble format.

The "Preamble Format" is automatically derived from the PRACH Configuration .

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRFormat? on page 712

Number of Configurable Frames
Shows how many frames can be configured.

A maximum number of 20 frames are available for configuration; the currently available number of frames depends on the selected ARB Sequence Length.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:CFRames? on page 712

SF
Displays the consecutive number of the subframe.

The subframes available for configuration depend on the selected "Duplexing" mode and "PRACH Configuration".

Remote command:
n.a.

RB Offset
Displays the starting RB, as set with the parameter PRACH Frequency Offset .

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RBOFfset
on page 713

Frequency Resource Index
This parameter is enabled in TDD duplexing mode only.

Sets the frequency resource index f_{RA} for the selected subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:FRINdex
on page 713

Ncs Configuration
Selects the Ncs configuration of the selected subframe, i.e. determines the Ncs value for the selected preamble set according to TS 36.211, table 5.7.2.-2 and 5.7.2-3.

The value range of this parameter depends on the selected duplexing mode, PRACH configuration and whether a restricted preamble set is enabled or not.

Table 4-21: Value range Ncs configuration

Parameter	Value range
PRACH Restricted Set = "Off"	0 to 15
"Restricted Preamble Set = Type A"	0 to 14
"Restricted Preamble Set = Type B"	0 to 12
TDD + PRACH Configuration > 47	0 to 6

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:NCSConf
on page 713

Logical Root Sequence Index
Selects the logical root sequence index for the selected subframe.

The value range of this parameter depends on the combination of selected duplexing mode and PRACH configuration.

Parameter	Value range "Logical Root Sequence Index"
TDD + PRACH Configuration > 47 i.e. preamble format 4	0 to 137
All other cases	0 to 837

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RSEQuence
on page 714

Sequence Index (v)
Selects the sequence index **v** for the selected subframe, i.e. selects which one of the 64 preambles available in a cell is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:SINDex
on page 714

Delta t/us
Sets the parameter Delta_t in us.

A value of delta t different than 0 causes a time shift of the configured preamble.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:DT on page 714

Power
Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:POWer on page 713

State
Enables/disables the PRACH for the selected subframe.

The subframes available for configuration depend on the selected PRACH configuration.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:STATe on page 715

4.13 Enhanced PUSCH Settings

This dialog allows you to define and configure PUSCH parameters, such as the settings of the uplink shared channel (UL-SCH), HARQ control information, and the Channel Quality Control Information (CQI).

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUSCH".
3. Select "Enhanced Settings > Configure".

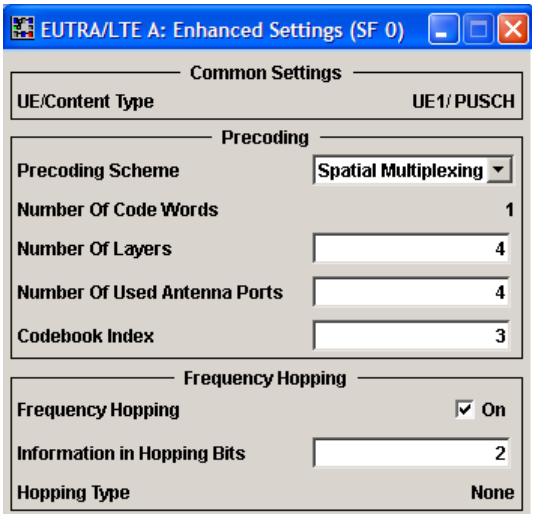
   In this dialog you can:
   - Define the precoding parameters, see "Precoding" on page 292
   - Enable and configure frequency hopping, see "Frequency Hopping" on page 293
   - Set the cyclic shift used by the demodulation reference signal (DRS), see Chapter 4.13.2, "Demodulation Reference Signal (DRS)", on page 294
   - Adjust the parameters for channel coding of the control information (HARQ and CQI), see Chapter 4.13.3, "Channel Coding / Multiplexing", on page 295
   - Configure the multiplexing of the control information with the data transmission over the UL-SCH

4.13.1 Common PUSCH Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUSCH".
3. Select "Enhanced Settings > Configure".
4. Select "Frequency Hopping".
5. To enable spatial multiplexing, select "Precoding > Precoding Scheme > Spatial Multiplex".
   a) Select "Frame Configuration > General > Select User Equipment > UE1... UE4"
   b) Select "3GPP Release = Release 10"
   c) Select "PUSCH"
   d) Select "Transmission Mode = 2 (Spatial Multiplexing)"
   e) Select "Number of Antenna Ports for PUSCH = 2 or 4"
   f) In the "Enhanced PUSCH Settings" dialog, select "Precoding > Precoding Scheme > Spatial Multiplexing"

The frequency hopping is automatically disabled.



The provided further settings depend on the selected channel coding, see Chapter 4.13.3, "Channel Coding / Multiplexing", on page 295.
The common settings comprise the following precoding and frequency hopping settings:

UE/Content Type 292
Precoding 292
└ Precoding Scheme 292
└ Number of Codewords 293
└ Number of Layers 293
└ Number of Used Antenna Port 293
└ Codebook Index 293
Frequency Hopping 293
└ Frequency Hopping 293
└ Information in Hopping Bits 294
└ Hopping Type 294

UE/Content Type
Displays the UE number and the content type of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 663

Precoding
The generation of LTE signals with UL-MIMO is an LTE Rel. 10 feature that requires the additional option R&S SMBV-K85 LTE-Advanced.

Precoding Scheme ← Precoding
For Max. Number of AP for PUSCH > 1, enables spatial multiplexing for the PUSCH of the current user in the current subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:SCHeme on page 671

Number of Codewords ← Precoding
Displays the number of the used codewords.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CODWords on page 672

Number of Layers ← Precoding
Sets the number of layers.

The combination of number of codewords and number of layers determines the layer mapping for the selected precoding scheme, see also Figure 3-31.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NOLayers on page 672

Number of Used Antenna Port ← Precoding
Sets the number of used antenna ports form the number of antenna ports that are configured for PUSCH transmission (see Max. Number of AP for PUSCH).

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NAPused on page 673

Codebook Index ← Precoding
Sets the codebook index and selects the predefined pre-coder matrix.

The number of available codebook indices depends on the number of used antenna ports.

The combination of the codebook index and the Number of Layers determines the precoding matrix used for precoding (see also Figure 3-31).

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBINdex on page 673

Frequency Hopping
Frequency hopping is applied according to TS 36.213.

Frequency hopping is disabled, if spatial multiplexing is used (see Precoding Scheme).

Frequency Hopping ← Frequency Hopping
Enables/disables frequency hopping for PUSCH.

Based on the Information in Hopping Bits, a UE performing PUSCH frequency hopping applies one of the two possible Hopping Type.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe on page 674

Information in Hopping Bits ← Frequency Hopping
Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition. This information determines whether type 1 or type 2 hopping is used in the subframe, and - in case of type 1 - also determines the exact hopping function to use.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits` on page 675

Hopping Type ← Frequency Hopping
Displays the frequency hopping type used.

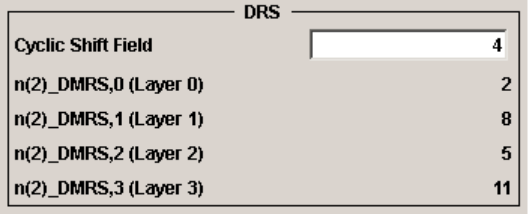
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE?` on page 674

4.13.2 Demodulation Reference Signal (DRS)

Option: R&S SMBV-K85

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUSCH".
3. Select "Enhanced Settings > Configure".
4. Select "DRS".



Cyclic Shift Field
Cyclic shifts are used to separate the DRS signals of different users in the time domain. This parameter sets the cyclic shift field in the uplink-related DCI formats, see Table 4-22.

See also "DCI Format 3/3A" on page 195.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:CYCShift` on page 675

n(2)_DMRS,λ (Layer λ)
Displays the part of the demodulation reference signal (DMRS) index $n^{(2)}_{DMRS,\lambda}$ per layer, where the number of layers λ is defined with Number of Layers.

Table 4-22: DRS index n(2)_DMRS,λ as function of the cyclic shifts and number of layers λ

Cyclic Shift Field in DCI Formats	λ = 0 (1 layer)	λ = 1 (2 layers)	λ = 2 (3 layers)	λ = 3 (4 layers)
000	0	6	3	9
001	6	0	9	3
010	3	9	6	0
011	4	10	7	1
100	2	8	5	11
101	8	2	11	5
110	10	4	1	7
111	9	3	0	6

The DMRS index is part of the uplink scheduling assignment and valid for one UE in the subframe. This index applies when multiple shifts within a cell are used and is used by the calculation of the DRS sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:NDMRs<layer>?` on page 673

Bit for DMRS Mapping Table
Option: R&S SMBV-K119

Sets the *Cyclic Shift Field mapping table for DMRS bit* field as defined in TS 36.211 and TS 36.212.

The combination of the two parameters Enhanced DMRS > "On" and Bit for DMRS Mapping Table > "On" enables mapping the DMRS sequence on each second subcarrier.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:MAPPing` on page 674

4.13.3 Channel Coding / Multiplexing

Access:

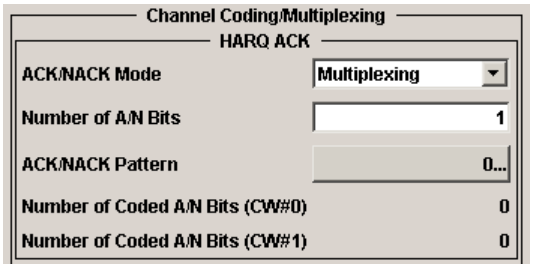
1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > General > Select User Equipment > UE1... UE4"
3. Select "PUSCH > Channel Coding and Multiplexing > State > On" (refer to Channel Coding)
4. Select "Mode > UCI+UL-SCH " or "Mode > UCI only" (refer to Mode)
5. Select "Frame Configuration > Subframe > Content > PUSCH"

6. Select "Enhanced Settings > Configure > Channel Coding/Multiplexing"

   In this dialog, you can adjust the parameters for channel coding of the control information (HARQ and CQI) and configure the multiplexing of this control information with the data transmission over the UL-SCH.

HARQ ACK Settings ... 296
└ ACK/NACK Mode ... 296
└ N_bundled ... 296
└ Number of A/N Bits ... 297
└ ACK/NACK Pattern ... 297
└ Number of Coded A/N Bits (CW) ... 297
Rank Indication (RI) Settings ... 297
└ Number of RI Bits ... 297
└ RI Pattern ... 297
└ Number of Coded RI Bits (CW) ... 298
Channel Quality Indication (CQI) Settings ... 298
└ Number of CQI Bits ... 298
└ CQI Pattern ... 298
└ Number of Coded CQI Bits ... 298
└ CQI mapped to ... 299
UL-SCH Settings ... 299
└ Phys. Bits / Total Number of Physical Bits ... 299
└ Number of Coded UL-SCH Bits ... 299
└ Transport Block Size/Payload (PUSCH) ... 299
└ Redundancy Version Index (PUSCH) ... 300

HARQ ACK Settings



The following HARQ ACK settings are available:

ACK/NACK Mode ← HARQ ACK Settings
Sets the ACK/NACK mode to Multiplexing or Bundling according to TS 36.212, chapter 5.2.2.6.

ACK/NACK mode Bundling is defined for TDD duplexing mode only.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE` on page 675

N_bundled ← HARQ ACK Settings
For "ACK/NACK Mode Bundling", sets the parameter N_bundled according to TS 36.212, section 5.2.2.6.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled on page 676

Number of A/N Bits ← HARQ ACK Settings
Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS on page 676

ACK/NACK Pattern ← HARQ ACK Settings
Sets the ACK/NACK bits in form of a 64 bits long pattern.

A "1" indicates an ACK, a "0" - a NACK.

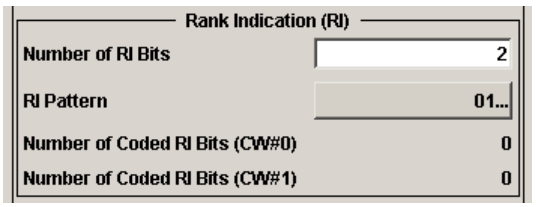
The pattern is read out cyclically and if the pattern is longer than the selected "Number of ACK/NACK Bits", different bits are transmitted in different subframes using this configuration.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern on page 677

Number of Coded A/N Bits (CW) ← HARQ ACK Settings
Displays the number of coded ACK/NACK bits per codeword.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:HARQ:CBITs? on page 676

Rank Indication (RI) Settings



Following RI settings are available:

Number of RI Bits ← Rank Indication (RI) Settings
Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS on page 679

RI Pattern ← Rank Indication (RI) Settings
Sets the RI bits in form of a 64 bits long pattern.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of RI Bits", different bits are transmitted in different subframes using this configuration.

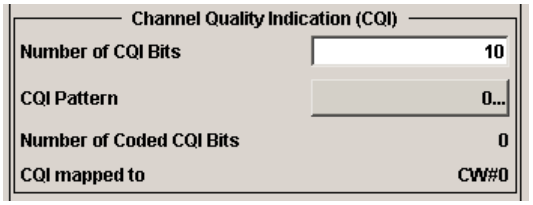
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern` on page 679

Number of Coded RI Bits (CW) ← Rank Indication (RI) Settings
Displays the number of coded RI bits per codeword.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the Number of Physical Bits for UL-SCH is determinate by the number of coded bits used for CQI and RI transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:RI:CBITs?` on page 679

Channel Quality Indication (CQI) Settings



Following CQI settings are available:

Number of CQI Bits ← Channel Quality Indication (CQI) Settings
Sets the number of CQI bits before channel coding.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the Number of Physical Bits for UL-SCH is determinate by the number of coded bits used for CQI and RI transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS` on page 678

CQI Pattern ← Channel Quality Indication (CQI) Settings
Sets the CQI pattern for the PUSCH.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of CQI Bits", different bits are transmitted in different subframes using this configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern` on page 678

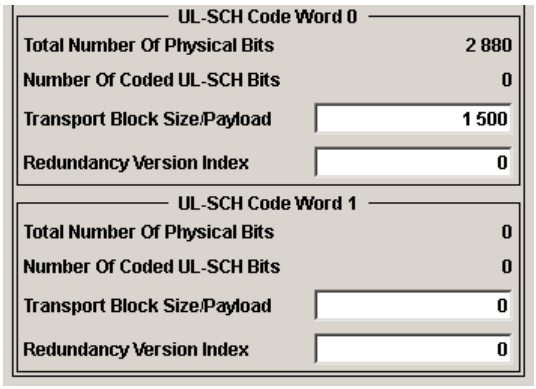
Number of Coded CQI Bits ← Channel Quality Indication (CQI) Settings
Displays the number of coded CQI bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?` on page 677

CQI mapped to ← Channel Quality Indication (CQI) Settings
Indicates the codeword the CQI is mapped to.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CODWord?` on page 678

UL-SCH Settings
Displays the UL-SCH parameters per codeword.



Phys. Bits / Total Number of Physical Bits ← UL-SCH Settings
Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PHYSbits?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?` on page 665
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:PHYSbits?` on page 665

Number of Coded UL-SCH Bits ← UL-SCH Settings
Displays the number of physical bits used for UL-SCH transmission.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the value is calculated as follow:

"Number of Coded UL-SCH Bits" = Total Number of Physical Bits - Number of Coded CQI Bits - Number of Coded RI Bits (CW)

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:ULSCh:BITS?` on page 680

Transport Block Size/Payload (PUSCH) ← UL-SCH Settings
Sets the size of the transport block per codeword.

In "Channel Coding Mode = UCI + UL-SCH", if "UL-SCH Codeword 1 > Transport Block Size = 0", "UL-SCH Codeword 2 > Transport Block Size" is set to 0, too.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:TBSize on page 681

Redundancy Version Index (PUSCH) ← UL-SCH Settings
Sets the redundancy version index.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:RVINdex on page 681

4.14 Enhanced PUCCH Settings

Access:

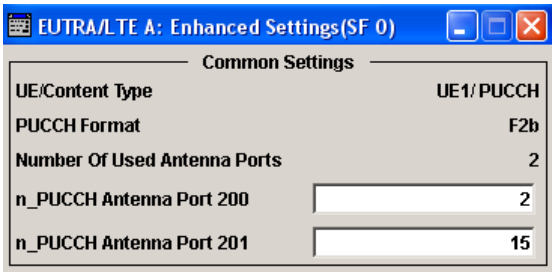
1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH".
3. Select "Enhanced Settings > Configure".

   This dialog displays the PUCCH relevant settings and allows you to define and configure the PUCCH resource index:
   - Chapter 4.14.1, "Common Settings", on page 300
   - Chapter 4.14.2, "Channel Coding / Multiplexing", on page 302

4.14.1 Common Settings

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH"
3. Select "Enhanced Settings > Configure > Common"



This dialog displays the PUCCH relevant settings and allows you to define and configure the PUCCH resource index.

Provided are the following settings:

UE/Content Type 301
PUCCH Format 301
Number of Used Antenna Ports 301
n_PUCCH 301

UE/Content Type
Displays the UE number and the content type of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType`
on page 663

PUCCH Format
Sets the PUCCH Format.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:PUCCh]:FORMat`
on page 663

Number of Used Antenna Ports
Option: R&S SMBV-K85

Displays the number of antenna ports used for transmissions of the current PUCCH format, see Number of Antenna Ports for PUCCH per PUCCH Format.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NAPused?`
on page 681

n_PUCCH
Sets the PUCCH resource index.

3GPP Release	Parameter name	Description
Release 8/9	"n_PUCCH"	Sets the PUCCH resource index
LTE-Advanced	"n_PUCCH Antenna Port 100/200"	Sets the resource index for the first or the only one PUCCH antenna port
LTE-Advanced	"n_PUCCH Antenna Port 201"	Sets the resource index for the second PUCCH antenna port

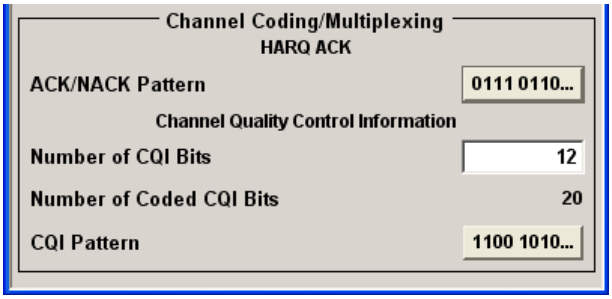
For configuration of multi-user PUCCH tests according to TS 36.141, annex A9, set the n_PUCCH parameter to the value defined in table A.9-1, column "RS orthogonal cover / ACK/NACK orthogonal cover". The R&S SMBV calculates and configures automatically the values defined in the columns "Cyclic shift index" and "Orthogonal cover index".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR<ap>`
on page 682

4.14.2 Channel Coding / Multiplexing

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH"
3. Select "Enhanced Settings > Configure > Channel Coding/Multiplexing"



This dialog and the parameters available for configuration depend on the selected PUCCH Format for the corresponding allocation.
PUCCH Format 1 carries no control information, i.e. the entire "Channel Coding/ Multiplexing" section is not displayed.
CQI control information is carried by PUCCH formats 2/2a/2b and the CQI parameters are enabled if one of these formats is selected.

Provided are the following settings:

A/N Pattern / A/N+SR+CSI Pattern....302
Number of CQI Bits....303
PUCCH Format ≥ 3 Settings....304
└ Number of A/N+SR+CSI Bits....304
└ A/N+SR+CSI Pattern....304
└ Number of Coded A/N+SR+CSI Bits....304
└ M_RB....304
└ n_oc....304
Number of Coded CQI Bits....304
CQI Pattern....305

A/N Pattern / A/N+SR+CSI Pattern
("A/N Pattern" required for PUCCH formats 1a/1b, 2a/2b; "A/N+SR+CSI Pattern" - all other PUCCH formats)

Use this parameter to set the ACK/NACK pattern for the PUCCH for the selected subframe. A "1" indicates an ACK, a "0" - a NACK

In PUCCH format 3, the bits given by the "ACK/NACK+SR Pattern" represent the $o^{\sim ACK}$ bits according to TS 36.212; these are the up to 22 bits that contain ACK/NACK information for up to two codewords and optionally SR and CSI. The number of bits used per subframe is defined by the value of the parameter "Number of A/N+SR+CSI Bits" on page 304.

To enable the generation of signals with ACK/NACK respectively ACK/NACK+SR information that varies not only per subframe but also differs over the frames, set a pattern with:

- More than 1 bit for the PUCCH formats 1a/2a
- More than 2 bits for the PUCCH formats 1b/2b
- More than "Number of A/N+SR+CSI Bits" on page 304 for PUCCH format 3

The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

Example:

"Duplexing Mode > FDD"

"Sequence Length = 4 Frames"

"Number of Configurable Subframes = 8"

"PUCCH Format = 1a or 2a"

"A/N Pattern = 01001"

The generated signal carries ACK/NACK information as shown on Figure 4-11.

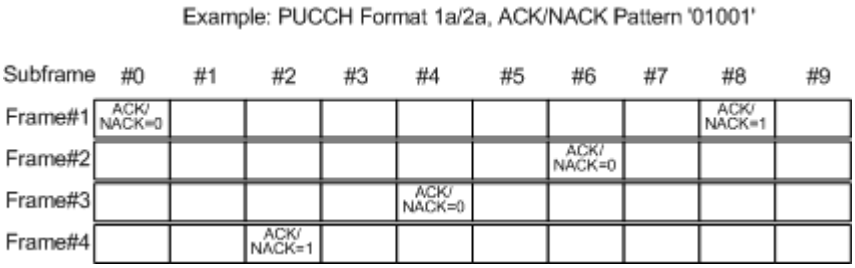


Figure 4-11: ACK/NACK information per subframe for PUCCH format 1b

By changing only the PUCCH Format to 1b or 2b, the ACK/NACK information per subframe changes, see Figure 4-12.

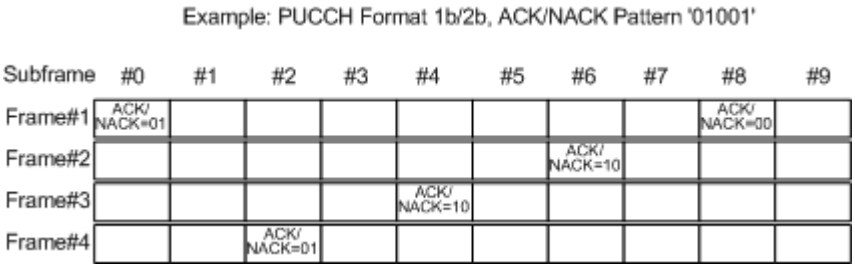


Figure 4-12: ACK/NACK information per subframe for PUCCH format 2b

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTern` on page 683

Number of CQI Bits
(PUCCH formats 2/2a/2b)

Sets the number of CQI bits before channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS
on page 684

PUCCH Format ≥ 3 Settings
The PUCCH format 3 is required for sending of the ACK/NACK messages in case DL carrier aggregation with more than two component carriers is used.

PUCCH formats 4/5 require R&S SMBV-K119

See also:
- Chapter 3.1.5, "LTE Release 10 (LTE-Advanced) Introduction", on page 44
- Chapter 4.2.2, "DL Carrier Aggregation Configuration", on page 71.

Number of A/N+SR+CSI Bits ← PUCCH Format ≥ 3 Settings
Sets the number of ACK/NACK+SR+CSI bits before channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS
on page 682

A/N+SR+CSI Pattern ← PUCCH Format ≥ 3 Settings
See "A/N Pattern / A/N+SR+CSI Pattern" on page 302.

Number of Coded A/N+SR+CSI Bits ← PUCCH Format ≥ 3 Settings
Displays the number of coded ACK/NACK+SR bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?
on page 683

M_RB ← PUCCH Format ≥ 3 Settings
Option: R&S SMBV-K119

Sets the PUCCH format 4 parameter M_RB, that defines the number of contiguous resource blocks used for the PUCCH transmission. All other PUCCH formats use one resource block.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:MRB
on page 684

n_oc ← PUCCH Format ≥ 3 Settings
Option: R&S SMBV-K119

For PUCCH format 5, sets the sequence index n_{oc} used for the generation of the demodulation reference signal (DMRS).

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NOC
on page 685

Number of Coded CQI Bits
Displays the number of coded CQI bits.

The number of coded CQI bits for PUCCH is always 20.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs? on page 683

CQI Pattern
Sets the CQI pattern for the PUCCH.

The length of the pattern is determinate by the value of the parameter Number of CQI Bits.

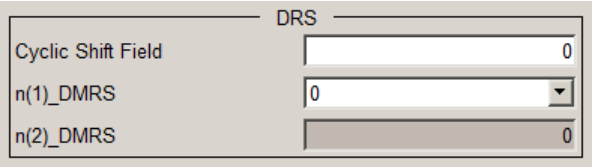
Remote command:
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern on page 684

4.14.3 Demodulation Reference Signal (DRS)

Option: R&S SMBV-K119

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".
2. Select "Frame Configuration > Subframe > Content > PUCCH".
3. Select "Enhanced Settings > Configure".
4. Select PUCCH Format > Format 4/Format 5
5. Select "DRS".



Cyclic Shift Field
Cyclic shifts are used to separate the DRS signals of different users in the time domain. This parameter sets the cyclic shift field in the uplink-related DCI formats.

The cyclic shifts and the index $n^{(1)}_{DMRS}$ are interdependent, see Table 4-23.

Table 4-23: DRS index n(1)_DMRS as function of the cyclic shifts

Cyclic Shift Field in DCI Formats	n(1)_DMRS
0	0
1	2
2	3
3	4
4	6
5	8

Cyclic Shift Field in DCI Formats	n(1)_DMRS
6	9
7	10

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CYCShift`
on page 685

n(1)_DMRS
Sets the part of the demodulation reference signal (DMRS) index $n^{(1)}_{DMRS}$.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR1`
on page 685

n(2)_DMRS
Displays the part of the demodulation reference signal (DMRS) index $n^{(2)}_{DMRS}$, set according to Table 4-24.

Table 4-24: DRS index n(2)_DMRS as function of the PUCCH format

PUCCH format	n_oc	n(2)_DMRS
Format 4	-	0
Format 5	0	0
	1	6

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR2?`
on page 686

5 Generating eMTC/NB-IoT Signals

eMTC/NB-IoT configuration requires R&S SMBV-K115.

The introduction of mobile communications extended the variety and the requirements on the way machines communicate with each other. The machine communication is known as machine type communication (MTC), the machine to machine communication (M2M) or the Internet of things (IoT).

Related 3GPP specifications

Because LTE was primarily optimized for the mobile broadband market, the specifications had to be extended to cover possible MTC solution. The following specifications specify IoT related features:

- 3GPP **LTE Rel. 12 (MTC)**
  First MTC specification, based on the existing LTE standard. Introduces new type CAT0 devices
- 3GPP **LTE Rel. 13 (eMTC or LTE-M)**
  Further development of MTC to eMTC (enhanced MTC). Introduces new type CAT-M1 devices.
- 3GPP **LTE Rel. 13 (NB-IoT)**
  First dedicated IoT specification, regarded as new radio access technology. Introduces new type CAT-NB1 devices.
- 3GPP **GERAN (EC-GSM)**
  Extension in the GSM standard

Overview of the main characteristics

	eMTC (LTE-M)	**NB-IoT**
Based on	existing LTE standard	new radio access technology
UE category	CAT0 CAT-M1	CAT-NB1
Channel bandwidth	1.4 MHz	180 KHz
Number of RB	6	1
Coverage extension (CE)	CE mode A and CE mode B	CE level 0, CE level 1 and CE level 2

LTE features not supported by eMTC or NB-IoT

Consider the following differences between eMTC and LTE/LTE-A.

- eMTC does not support:
  - Spatial multiplexing
  - Simultaneous PUCCH/PUSCH

  - Higher-order modulation schemes
  - CSI feedback
  - Transmission modes 3, 4, 8 and 10
  - PUCCH format 3, 4 and 5
  - ACK/NACK bundling multiplexing in TDD
- eMTC supports:
  - 2 HARQ processes
  - Contiguous resource allocations for UL and DL
- Among other, NB-IoT does not support:
  - Carrier aggregation
  - Home eNB, closed subscriber group (CSG)
  - Relaying
  - Dual connectivity
  - MBMS/eMBMS

Scope of this description

This section gives a brief description of the LTE Rel. 13 and somer Rel. 14 features that are related to the eMTC and NB-IoT technology. The following section list the sub-set of features that are covered by the software option R&S SMBV-K115/-K143:

- Chapter 5.1, "About eMTC", on page 308
- Chapter 5.2, "About NB-IoT ", on page 322

For an insight description of the NB-IoT features, refer to:

- White Paper 1MA266 "Narrowband Internet of Things"
- Application Note 1MA296 "Narrowband Internet of Things Measurements"

5.1 About eMTC

Short summary

eMTC is an extension of the LTE standard.

eMTC main characteristics are:

- Channel bandwidth splitting into narrowbands
  Min channel bandwidth is a narrowband with 1.4 MHz or 6 RBs. 16 narrowbands can be allocated within the 20 MHz channel bandwidth.
- Four non-overlapping consequent narrowbands can be grouped into wideband with 5 MHz carrier bandwidth or 24 RBs
- Two coverage extension (CE) modes: CEModeA and CEModeB

Coverage extension modes

CE mode	CE level	Description	Optional/mandatory
CEModeA	0, 1	Supports small number of PUSCH or PUCCH repetitions	Mandatory in eMTC Rel. 13
CEModeB	2, 3	Enables large number of PUSCH or PUCCH repetitions	Optional in eMTC Rel. 13

Overview of the physical signals and channels

Because eMTC is an extension of the LTE standard, it reuses the LTE concept, including reference signals and channels. eMTC, however, does not support MIMO and MBFSN.

eMTC uses the following signals and channels:

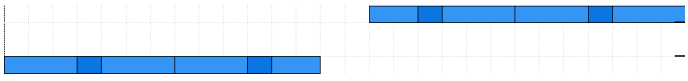
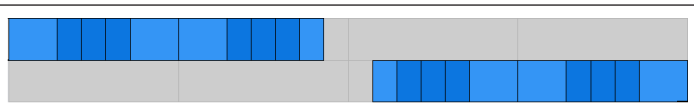
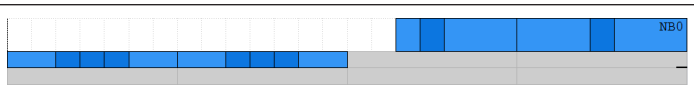
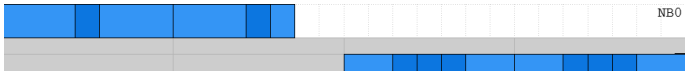
- UL reference signals: SRS, DRS
- DL physical channels:
  PDSCH, PBCH, PDCCH, and the new MPDCCH (MTC physical downlink control channel)
- UL physical channels:
  PUSCH (modulation QPSK, 16QAM, 64QAM), PUCCH, PRACH

  See:
  - Chapter 5.1.5, "PUSCH", on page 319
  - Chapter 5.1.6, "PUCCH", on page 320
  - Chapter 5.1.7, "PRACH", on page 321

Guard period for narrowband and wideband retunning

According to TS 36.211, an eMTC transmission cannot switch the used narrowband/ wideband immediately but it needs time to **retune** to the new frequency. This retuning time is referred as guard time and is defined as number of unused symbols depending on the channel type and the link direction. In any of the combinations, two symbols are left unused, see the illustrations in Table 5-1.

Table 5-1: Symbols used as guard period for retuning

Link direction	Transition	Visualization on the "Time Plan"
UL	PUSCH-to-PUSCH	
	PUCCH-to-PUCCH	
	PUCCH-to-PUSCH	
	PUSCH-to-PUCCH	

5.1.1 Physical Layer

Narrowbands

In eMTC, a narrowband is defined as a set of six non-overlapping consecutive physical resource blocks in the frequency domain. The number of narrowbands N_{NB} is calculated as follows:

$N_{NB} = N_{RB} / 6$, where N_{RB} is the number of the available resource blocks.

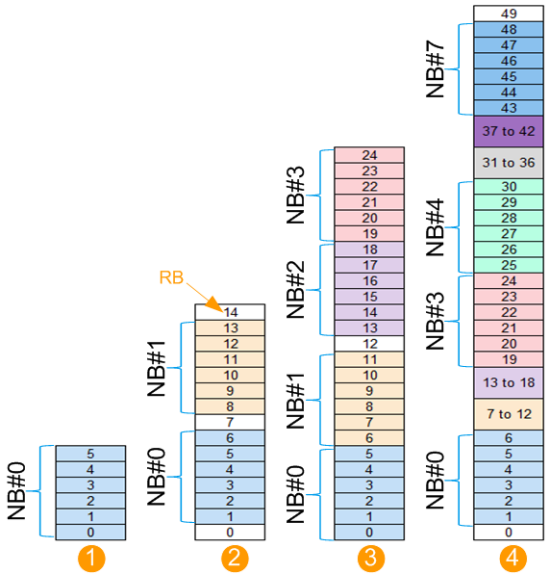


Figure 5-1: eMTC narrowbands

NB# = Narrowband number
RB = Resource block number
1 = "Channel Bandwidth = 1.4 MHz", $N_{RB} = 6$, $N_{NB} = 1$
2 = "Channel Bandwidth = 3 MHz", $N_{RB} = 15$, $N_{NB} = 2$
3 = "Channel Bandwidth = 5 MHz", $N_{RB} = 25$, $N_{NB} = 4$
4 = "Channel Bandwidth = 10 MHz", $N_{RB} = 50$, $N_{NB} = 8$
White RB = Not allocated RBs

eMTC transmission is always subframe-wise. That is, the smallest resource that can be allocated is 1 RB and one subframe.

Related settings

- Chapter 5.3.7.1, "eMTC DL Valid Subframes and Frequency Hopping", on page 394
- "Number of eMTC Narrowbands" on page 215
- "Valid Subframes" on page 219

5.1.2 PBCH

eMTC reuses the PBCH structure of LTE and is hence backward compatible. The PBCH in eMTC supports merely additional repetitions for enhanced frequency tracking. A further difference is the PBCH content (i.e. MIB), that is extended with a information regarding the scheduling of the SIB1-BR paging message.

If enabled, PBCH is repeated in subframe#0 and one additional subframe in all subframes in every 40ms cycle. The additional subframe is subframe#9 for FDD or subframe#5 for TDD.

PBCH repetition is not supported if the occupied bandwidth is 1.4 MHz.

Related settings

- Chapter 5.3.7.5, "PBCH Channel Coding and SIB-BR Configuration", on page 415

5.1.3 PDSCH

A block of N_{acc} subframes is scrambled with the PDSCH scrambling sequence. The scrambling sequence is function of the $N_{Cell}ID$ and the $N_{PDSCH,abs}$.

Where:

- $N_{PDSCH,abs}$ is the number of consecutive subframes that the PDSCH transmission spans, including the invalid subframes.
- Invalid are subframes in that the PDSCH transmission is postponed.

According to TS 36.211, N_{acc} depends on the CE mode and the frame type as listed in Table 5-2.

Table 5-2: N_{acc} depending on the CE level and frame type

CE mode	CE level	Frame type 1	Frame type 2
CEModeA	0, 1	1	1
CEModeB	2, 3	4	10

For example on the $N_{PDSCH,abs}$ calculation, see Example "Calculation of $N_{PUSCH,abs}$" on page 319. $N_{PDSCH,abs}$ is calculated similar to $N_{PUSCH,abs}$.

PDSCH start subframe

The PDSCH transmission starts two valid subframes after the end of the last repetition of the scheduling MPDCCH, see Figure 5-4.

Repetition of PDSCH not carrying SIB1-BR

The PDSCH repetition is defined as combination of cell-specific higher-level parameters `pdsch-maxNumRepetitionCEmodeA`/`pdsch-maxNumRepetitionCEmodeB` and the UE-specific parameter PDSCH repetition number. The latter is part of the DCI formats 6-1A/B or 6-2.

TS 36.211 specifies the PDSCH repetition levels for all three DCI format. Table 5-3 show an example of the DCI format 6-1A case.

Table 5-3: PDSCH repetition levels, defined with DCI format 6-1A [TS 36.211]

Higher-level parameter pdsch-maxNumRepetitionCEmodeA (cell-specific)	**PDSCH Repetition Number n1 to n4 (UE-specific)**
Not configured	1, 2, 4, 8
16	1, 4, 8, 16
32	1, 4, 16, 32

For information on the PDSCH repetitions, if PDSCH carries SIB1-BR, see "System information MIB" on page 313.

PDSCH hopping

PDSCH hopping is the process where the PDSCH changes the occupied narrowband on a per subframe basis. The occupied physical resource blocks (PRB) within the narrowband are maintained, merely changed is the narrowband.

Two hopping rules are defined depending on whether the PDSCH carries or not system information SIB1-BR:

- PDSCH **not carrying SIB1-BR**
  Information on the PRB within a narrowband on that the PDSCH is mapped in the first subframe is transmitted by the DCI.
  The hopping pattern is defined as a function of the absolute subframe number i_0 and the cell-specific higher-layer parameters $N_{NB}^{ch,DL}$, $N_{NB,hop}^{ch,DL}$ and $f_{NB,hop}^{DL}$, where:
  - $N_{NB}^{ch,DL}$ is the number of consecutive subframes during which MPDCCH or PDSCH stays at the same narrowband before hopping to another narrowband
  - $N_{NB,hop}^{ch,DL}$ is the number of narrowbands over which MPDCCH or PDSCH hops
  - $f_{NB,hop}^{DL}$ is the hopping offset, i.e. number of narrowbands between two consecutive MPDCCH or PDSCH hops

  See Example "PDSCH not carrying SIB1-BR hopping" on page 314.
- PDSCH **carrying SIB1-BR**
  PDSCH transmission is repeated periodically, every 8 radio frames. If n_f is the system frame number (SFN), a period starts at frames for that $n_f \bmod 8 = 0$.

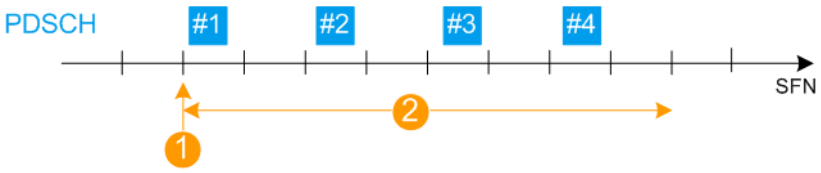


Figure 5-2: PDSCH carrying SIB1-BR transmission (Channel Bandwidth = 10 MHz)

SFN = System frame number
1 = PDSCH period starts at frames for that $n_f$mod8 = 0
2 = Period of 8 radio frames
PDSCH #1 to #4 = 4 PDSCH repetitions, configured with the parameter "eMTC > Bitmap > Schedulung Info SIB1-BR = 1", see Table 5-5.

Within each period, the PDSCH is repeated $N_{PDSCH}^{SIB1-BR}$ times, where the set of used frames and subframes n_{sf} depends on the channel bandwidth, the cell ID N_{ID}^{cell} and the frame structure type, see Table 5-4.

Table 5-4: Set of frames and subframes n_{sf} for SIB1-BR [TS 36.211]

Channel bandwidth	$N_{PDSCH}^{SIB1bis}$	N_{ID}^{cell} mod 2	Frame structure 1 n_f mod 2	Frame structure 1 n_{sf}	Frame structure 2 n_f mod 2	Frame structure 2 n_{sf}
$N_{RB}^{DL} \leq 15$	4	0	0	4	1	5
	4	1	1	4	1	5
$N_{RB}^{DL} > 15$	4	0	0	4	1	5
	4	1	1	4	1	0
	8	0	0, 1	4	0, 1	5
	8	1	0, 1	9	0, 1	0
	16	0	0, 1	4, 9	0, 1	0, 5
	16	1	0, 1	0, 9	0, 1	0, 5

System information MIB

PDSCH carries the system information SIB1-BR (`SystemInformationBlockType1-BR`). The PDSCH allocation that carries the SIB1-BR block comprises of six contiguous localized RB within a narrowband and is repeated as defined with the parameter `schedulingInfoSIB1-BR-r13`.

See:

- Table 5-5
- Figure 5-2

Table 5-5: Number of repetitions for PDSCH carrying SIB1-BR [TS 36.213]

Value of `schedulingInfoSIB1-BR-r13`	Number of PDSCH repetitions
0	SIB1-BR is not scheduled
1, 4, 7, 10, 13, 16	4
2, 5, 8, 11, 14, 17	8
3, 6, 9, 12, 15, 18	16
19 to 31	Reserved

Example: PDSCH not carrying SIB1-BR hopping

Configure for example:

- "User 1 > 3GPP Release = eMTC CE: A"
- "Channel Bandwidth = 10 MHz" or "Number of Narrowbands = 8".
- "eMTC > Narrowband > Number of Narrowbands for Hopping $N_{NB,hop}^{ch,DL}$ = 4"
- "eMTC > Narrowband > Hopping Offset $f_{NB,hop}^{DL}$ = 2"
- "eMTC > Narrowband > Hopping Interval for CE Mode A $N_{NB}^{ch,DL}$ = 4"
- "eMTC > Bitmap > Bitmap Subframes = 10" and "SF#0 to SF#9 = On".
- "eMTC > Search Space > Max. Repetition of PDSCH for CE Mode A = 32"
- "eMTC > DCI Configuration > User 1 > DCI format 6-1A > Config > PDSCH Frequency Hopping > On", "Repetition Number = 2" and "Ressource Block Assigment = 32".
  Hence, the n3 value from Table 5-3 is used and "Repetitions of PDSCH = 16".
  In this configuration, the first used narrowband is NB#1.
- "eMTC > Allocations > PDSCH > Num. Abs. SF $N_{PDSCH,abs}$ = 16", i.e. one PDSCH transmission last 16 subframes
- "eMTC > Allocations > PDSCH > Start Subframe = 3"

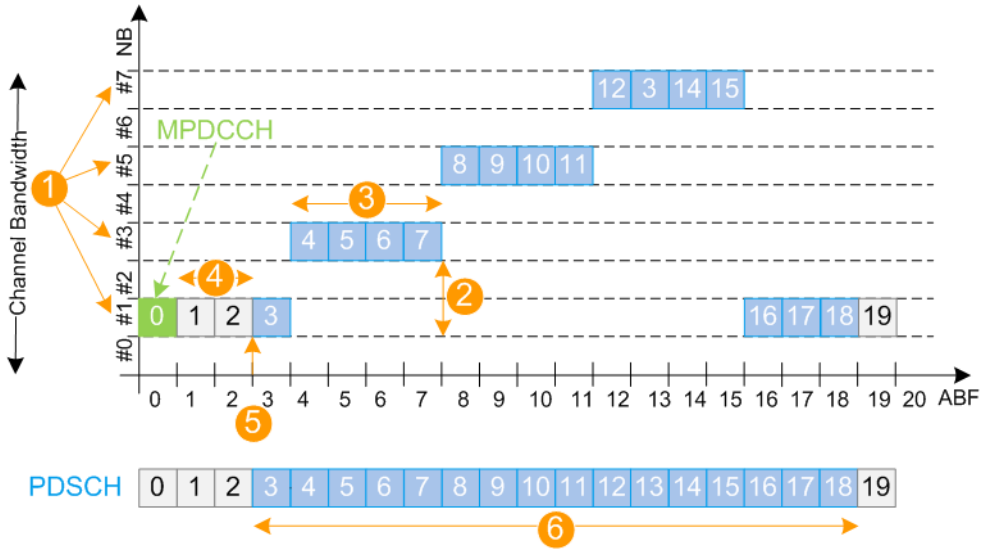


Figure 5-3: Example of PDSCH hopping

ABF = Absolute subframe number, counted from the first subframe in SFN = 0.
NB = Narrowband
#0 to #7 = Narrowband number, calculated automatically for the selected channel bandwidth
MPDCCH = One single repetition and "Start Subframe = 0"
NB#1 = "Start NB = 1", as set with the DCI field "Ressource Block Assigment".
1 = $N_{NB,hop}^{ch,DL}$ = 4
2 = $f_{NB,hop}^{DL}$ = 2
3 = $N_{NB}^{ch,DL}$ = 4

4 = PDSCH always starts 2 subframes after the last repetition of the MPDCCH the shared channel is scheduled
5 = "PDSCH Start Subframe = 3" i.e. 2 subframes after the MPDCCH transmission
6 = $N_{PDSCH,abs}$ = 16

Related settings

- "Narrowbands" on page 396
- "Max. Repetitions of PDSCH for CE Mode A/B" on page 399
- "DCI Format 6-1A/6-1B" on page 404
- Chapter 5.3.7.6, "PDSCH Channel Coding and Scrambling", on page 418
- Chapter 5.3.7.4, "eMTC Allocations (PBCH, MPDCCH, PDSCH)", on page 410

5.1.4 MPDCCH

The eMTC physical downlink shared channel MPDCCH in eMTC is similar to the LTE EPDCCH in terms of structure and purpose. In both cases, this control channel carries scheduling assignments. It is transmitted in an MPDCCH set, mapped to group of resource elements called ECCEs (enhanced control channel elements) and it can use localized or distributed transmission scheme. EPDCCH is user-specific but MPDCCH also includes common search spaces (Type1 and Type2).

Other than in LTE, in eMTC the MPDCCH set consists of 2, 4, or 6 physical resource block (PRB) pairs. There is also the additional MPDCCH format 5, see Table 5-6.

Table 5-6: MPDCCH formats and number of ECCEs for one MPDCCH N^{MPDCCH}_{ECCE} [TS 36.211]

MPDCCH format	Case A	Case B
0	2	1
1	4	2
2	8	4
3	16	8
4	32*	16*
5	24	12

*) MPDCCH format 4 is supported if distributed transmission is used.

The MPDCCH is transmitted over N_{rep}^{MPDCCH} consecutive valid downlink subframes and spans $N_{MPDCCH,abs}$ consecutive subframes, including the invalid subframes where the transmission is postponed.

MPDCCH hopping

If frequency hopping is enabled, the narrowband for the MPDCCH transmission (NB_{start}) in the first subframe is given by higher-layer; it can be different per MPDCCH set. The hopping pattern is defined as a function of the absolute subframe number i_0 and the cell-specific higher-layer parameters $N_{NB}^{ch,DL}$

(`interval-DLHoppingConfigCommon`), $N_{NB,hop}^{ch,DL}$ (`mpdcch-pdsch-HoppingNB-r13`) and $f_{NB,hop}^{DL}$ (`mpdcch-pdsch-HoppingOffset-r13`), where $N_{NB,hop}^{ch,DL}$ = 2 or 4 narrowbands.

See Example "PDSCH not carrying SIB1-BR hopping" on page 314.

Search spaces

eMTC UE monitors the following MPDCCH search spaces:

- Type 0 common search space, if configured with CE Mode A
- Type 1 common search space, used for paging
- Type 2 common search space, used for random access (RA)
- UE-specific search space

The search space defines the MPDCCH candidates that the UE has to monitor. The UE is expected to decode only the control information on an MPDCCH that is transmitted over ECCEs within the search space the UE monitors.

MPDCCH starting subframe

The MPDCCH starting subframe depends on the used search space and is calculated similar to the NPDCCH starting subframe, see "Calculating the NPDCCH starting subframe" on page 330.

MPDCCH repetition number

The number of times the MPDCCH is repeated N_{rep}^{MPDCCH} is defined as a function of the R_{max} value and the repetition level r1 to r4, where:

- R_{max} gives the maximum number of MPDCCH repetitions and is defiend per search space, see Table 5-8 and Table 5-9.
- Repetition level is set by the DCI field "Subframe Repetition Number" of the corresponding DCI format, see Table 5-7.

Table 5-7: Repetition level r1 to r4 as function of the DCI subframe repetition number field

R	r1	r2	r3	r4
"DCI Subframe Repetition Number"	0	1	2	3

Table 5-8: MPDCCH repetition number for Search Space = UE-specific or Type 0/Type 2 Common

R_{max}	r1	r2	r3	r4
1	1			
2	1	2		
4	1	2	4	
≥ 8	$R_{max}/8$	$R_{max}/4$	$R_{max}/2$	R_{max}

Table 5-9: MPDCCH repetition number for Search Space = Type 1 Common

R_{max}	r1	r2	r3	r4
1	1			
2	1	2		
4	1	2	4	
8	1	2	4	8
16	1	4	8	16
32	1	4	16	32
64	2	8	32	64
128	2	16	64	128
256	2	16	64	256

Example: MPDCCH repetitions (UE-specific search space)

Configure for example:

- "eMTC > Bitmap > Bitmap Subframes = 10" and "SF#0 to SF#9 = On".
- "eMTC > Search Space > Max. Repetition of MPDCCH Rmax (Type 2 Common) = 4".
- "User Configuration > User 1 > 3GPP Release = eMTC CE: A".
- "User Configuration > User 1 > MPDCCH Config:": "Max. Repetition of MPDCCH Rmax (User-Specific search space) = 4", "MPDCCH Hopping > On" and "Search Space Start Subframe = 1".
- "eMTC > DCI Configuration > User 1 > DCI format 6-1A > Search Space = UE-Specific" and "DCI format 6-1A > Config > DCI Subframe Repetition Number = 2". Hence the r3 value from Table 5-8 is used and "MPDCCH Repetitions = 4".
- "eMTC > Allocations > MPDCCH > Start Subframe = 1"

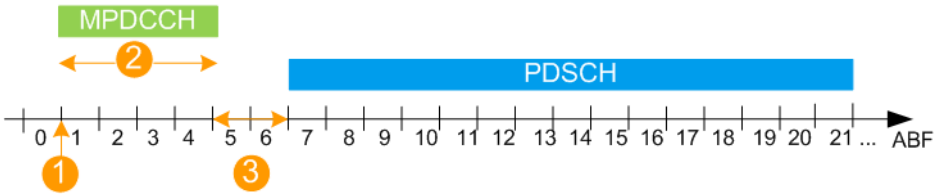


Figure 5-4: Example of MPDCCH repetitions and PDSCH cross-scheduling (UE-specific search space)

1 = MPDCCH start subframe
2 = MPDCCH Repetitions
3 = PDSCH always starts 2 subframes after the last repetition of the MPDCCH the shared channel is scheduled

DCI formats, decoding and content

Table 5-10 gives an overview of the defined DCI formats.

Table 5-10: DCI formats

DCI format	Purpose	CE Mode	"User x"/ P-RNTI/ RA-RNTI	Search space
3 3A	As in LTE Transmission of TPC Commands for MPUCCH and MPUSCH 2 bits and 1-bit power adjustment respectively	CE Mode A	"User x"	UE-specific Type 2 common
6-0A	Scheduling of PUSCH in one UL cell Resource allocation type 0	CE Mode A	"User x"	UE-specific Type 0 common
6-0B	Scheduling of PUSCH in one UL cell Resource allocation type 2, without TPC and CSI request	CE Mode B	"User x"	UE-specific
6-1A	Scheduling of one PUSCH codeword in one cell Random access procedure initiated by a PDSCH order Resource allocation type 2	CE Mode A	"User x" RA-RNTI	UE-specific Type 0 common Type 2 common
6-1B	Scheduling of one PUSCH codeword in one cell Random access procedure initiated by a PDSCH order Resource allocation with 1 bit	CE Mode B	"User x" RA-RNTI	UE-specific Type 2 common
6-2	Paging and direct indication	-	P-RNTI	Type 1 common

Table 5-11 gives the DCI formats **decoding** for MPDCCH and PDSCH.

Table 5-11: DCI decoding [TS 36.213]

MPDCCH and PDSCH configured with:	Transmission Mode	DCI format	Search space	PDSCH transmission scheme, corresponding to MPDCCH
P-RNTI	-	6-2	Type 1 common	• If number of PBCH antenna ports = 1, Single-antenna port, port 0 • Otherwise, Transmit diversity
RA-RNTI	-	6-1A 6-1B	Type 2 common	• If number of PBCH antenna ports = 1, Single-antenna port, port 0 • Otherwise, Transmit diversity
C-RNTI	Mode 1	• 6-1A • 6-1A or 6-1B	• Type 0 common • UE-specific	Single-antenna port, port 0
	Mode 2	• 6-1A • 6-1A or 6-1B	• Type 0 common • UE-specific	Transmit diversity
	Mode 6	6-1A	• Type 0 common • UE-specific	• Transmit diversity • Closed-loop spatial multiplexing, single layer transmission
	Mode 9	• 6-1A • 6-1A or 6-1B	• Type 0 common • UE-specific	• Single-antenna port, port 0 or transmitt diversity • Single-antenna port, port 7 or 8

Related settings

- Chapter 5.3.7.2, "Search Space Settings", on page 398
- Chapter 5.3.7.3, "eMTC DCI Configuration", on page 399
- Chapter 5.3.7.4, "eMTC Allocations (PBCH, MPDCCH, PDSCH)", on page 410

5.1.5 PUSCH

A block of N_{acc} subframes is scrambled with the PUSCH scrambling sequence. The scrambling sequence is function of the $N_{Cell}ID$ and the $N_{PUSCH,abs}$.

Where:

- $N_{PUSCH,abs}$ is the number of consecutive subframes that the PUSCH transmission spans, including the invalid subframes.
- Invalid are subframes in that the PUSCH transmission is postponed.

According to TS 36.211, N_{acc} depends on the CE mode and the frame type as listed in Table 5-12.

Table 5-12: N_{acc} depending on the CE level and frame type

CE mode	CE level	Frame type 1	Frame type 2
CEModeA	0, 1	1	1
CEModeB	2, 3	4	5

Example: Calculation of $N_{PUSCH,abs}$

If:

- ValidSF = 0, 2, 3, 4, 5
- $n_{invalidSF}$ = 1
- StartSF = 0
- n_{Rep}^{PUSCH} = 4

Then $N_{PUSCH,abs}$ = 4 +1 = 5

PUSCH frequency hopping

PUSCH can utilize frequency hopping.

- If hopping is disabled, the PUSCH repetitions are located in the same resource block at the same narrowband.
- If hopping is enabled, then PUSCH is transmitted in a given NB for a selected number of consecutive subframes ($N_{PUSCH,abs}$)

  The frequency-hopping pattern is calculated depending on the following:
  - Absolute subframe number (ASF) of the first UL subframe in that the PSUCH is scheduled
  - The cell-specific higher-level parameter $f_{NB,hop}$ that defines the hopping offset between the current and the subsequent narrowband

– The cell-specific higher-level parameter $N_{NB,ch}$ that set the number of subframes the hopping pattern remains in the same narrowband
– Number of absolute subframes $N_{PUSCH,abs}$

Example: PUSCH hopping

Configure, for example, the following settings:

- "ARB > Sequence Length = 10 Frames"
- In the "General UL Settings" dialog:
  – "Cell > eMTC Parameters > Valid Subframes > SF x UL > On" (all UL subframes)
  – "PUSCH Narrowband Hopping > On" and "Hopping Offset = 2" ($f_{NB,hop}$ = 2)
- "UL Frame Configuration > UE 1 > 3GPP Release > eMTC" and "UE 1 > State > On"
- In the "UE 1 > User Configuration > eMTC Allocation" dialog, configure one PUSCH transmission:
  – "Narrowband Hopping Interval = 4" ($N_{NB,ch}$ = 4)
  – "Start Subframe = 61" ("Frame = 60", "Subframe = 1"), "Repetitions = 16", "Start Narrowband = 1"

  The calculated number of absolute subframes is $N_{PUSCH,abs}$ = 16
- In the "Time Plan", select "1st Subframe = 60" and "Subframes = 20".
- To observe the unused slots at each narrowband hop at greater detail, select "1st Subframe = 61" and "Subframes = 7".
  The last and the first symbols are unused at each narrowband hop in a PUSCH-to-PUSCH transition (see also "Guard period for narrowband and wideband retunning " on page 309)

5.1.6 PUCCH

PUCCH can be transmitted once or repeated defined number of times. It is transmitted during defined number of consecutive subframes and is postponed during the invalid subframes.

PUCCH allocation in terms of resource blocks is calculated depending on the:

- Absolute subframe number (ASF) of the first UL subframe in that the PSUCH is scheduled
- The cell-specific higher-level parameter $N_{NB,ch}$ that set the number of subframes the hopping pattern remains in the same narrowband.
- Number of absolute subframes $N_{PUCCH,abs}$

For more information on the $N_{NB,ch}$, $N_{PUCCH,abs}$ and the term invalid subframes, see Chapter 5.1.5, "PUSCH", on page 319.

Example: PUCCH configuration

This example extends the configuration used in Example "PUSCH hopping" on page 320.

- In the "General UL Settings > PUCCH" dialog, select "Number of RBs used for PUCCH = 4" and "Delta Shift = 1".
- In the "UE 1 > User Configuration > eMTC Allocation" dialog, add one PUCCH transmission with "Repetitions = 8" ($n_{Rep}^{PUCCH} = 8$)
  The start subframe is set automatically.
- Observe the "Time Plan".
  - "PUCCH Region = 4 RBs" (two RBs at each channel bandwidth end)
  - $N_{NB,ch} = 4$ (PUCCH remains in the same RB four subframes)
  - StartSF = 77 (start subframe number)
  - $n_{Rep}^{PUCCH} = 8$ (PUCCH is repeated eight times)
  - $N_{PUCCH,abs} = 8$ (number of absolute subframes)

5.1.7 PRACH

As in LTE, eMTC PRACH configuration comprises cell-specific and UE-specific parameters. Different than in LTE that defines one single PRACH configuration, in eMTC there are four eMTC PRACH configurations, one per CE level.

The following cell-specific parameters define the eMTC PRACH configurations:

- PRACH hopping offset $f_{PRB,hop}^{PRACH}$ (`prach-HoppingOffset`) in terms of RBs and common for all PRACH allocations
- One PRACH configuration per CE level, configured with:
  - PRACH configuration index (`prach_ConfigurationIndex`) that selects the predefined PRACH distribution pattern
  - PRACH frequency offset ($n_{PRBoffset}^{RA}$) (`prach_FrequencyOffset`) in terms of RBs that shift the PRACH allocation in the frequency domain
    The physical RBs used for the PRACH allocation ($n_{PRBoffset}^{RA}$) depend also on the system frame number (SFN). If frequency hopping is used for frame type 2, also on the UL/DL configuration.
  - PRACH frequency hopping (`prach_HoppingConfig`)
  - Number of PRACH repetitions per attempt (N_{rep}^{PRACH})
    (`numRepetitionPerPreambleAttempt`)
    See Table 5-13
  - Optionally, PRACH starting subframe periodicity N_{start}^{PRACH}
    (`prach_StartingSubframe`)

Table 5-13: Number of PRACH repetitions per attempt depending on the PRACH format

PRACH configuration index		PRACH format	N_{rep}^{PRACH}
(Frame type 1)	(Frame type 2)		
0 to 15	0 to 19	0	≥ 1
16 to 31	20 to 29	1	≥ 1
32 to 47	30 to 39	2	≥ 1
48 to 63	40 to 47	3	≥ 1
-	48 to 57	4	1

A UE can start up to 40 preamble attempts, where each subsequent of them has to use a PRACH configuration that corresponds to a higher CE level. The frequency allocation of each preamble is retrieved from the cell-specific PRACH configuration of the selected CE level. UEs can merely postpone the preamble in time by defining the first subframe it appears. Preamble attempts do not overlap; any subsequent preamble attempt starts after the previous one is completed.

Each preamble occupies 6 consecutive resource blocks. Preambles are generated from Zadoff-Chu sequences.

5.2 About NB-IoT

Short summary

NB-IoT addresses the low-cost requirement of the IoT market. It does not support complex LTE features like carrier aggregation.

NB-IoT is new air interface with the following main characteristics:

- 180kHz carrier bandwidth (or 200 KHz channel bandwidth) in both uplink and downlink.
  This bandwidth corresponds to one resource block in LTE transmission
- Three different operating modes, see "Operating modes" on page 323
- Three kinds of coverage extension (CE) levels: CE level 0, CE level 1 and CE level 2
  Where the CE level 2 indicates the worst coverage situation
- UE that support NB-IoT are tagged with the category CAT-NB1
- NB-IoT is defined for FDD and half duplexing mode

Overview of the physical signals and channels

Defined are:

- DL narrowband primary and secondary synchronization signals (NPSS and NSSS)
  See Chapter 5.2.2, "NPSS and NSSS", on page 326.
- DL narrowband reference signals (NRS)

See Chapter 5.2.3, "NRS", on page 327

- DL physical channels:
  NPBSCH (narrowband physical broadcast channel), NPDSCH (narrowband physical downlink shared channel), NPDCCH (narrowband physical downlink control channel)

  See:
  - Chapter 5.2.4, "NPBCH", on page 328
  - Chapter 5.2.6, "NPDSCH", on page 333
  - Chapter 5.2.5, "NPDCCH", on page 329
- UL narrowband demodulation reference signals (NDRS)
  See Chapter 5.2.7, "NDRS", on page 334.
- UL physical channels:
  NPUSCH (narrowband physical uplink shared channel), NPRACH (narrowband physical uplink random access channel)

  See:
  - Chapter 5.2.8, "NPUSCH", on page 335
  - Chapter 5.2.9, "NPRACH", on page 336

5.2.1 Physical Layer

NB-IoT reuses the LTE resource grid:

- The time domain structure of LTE is reused. There are 7 OFDM symbols within a slot, as it is in the normal CP case.
- Per OFDM DL symbol, there are 12 subcarriers spaced at 15 KHz and hence occupying 180 kHz bandwidth.
- In UL, the eNB decides which of the two allowed subcarrier spacings to apply (see Table 5-14)
  For the spacing of 3.75 KHz, for instance, there are 48 subcarriers available within a resource block of 180 kHz.
- One subcarrier in one OFDM symbol is referred as a resource element.

Table 5-14: Number of subcarriers in downlink N_{SC}^{DL} and uplink N_{SC}^{UL}

Subcarrier spacing	N_{SC}^{DL}	N_{SC}^{UL}	Slot duration, ms
Δf = 3.75 KHz	-	48	2
Δf = 15 KHz	12	12	0.5

In DL, NB-IoT supports transmission over up to two antenna ports (AP2000 and AP2001), where the same transmission scheme applies for all DL physical channels

Operating modes

Figure 5-5 illustrates the three different NB-IoT operating modes.

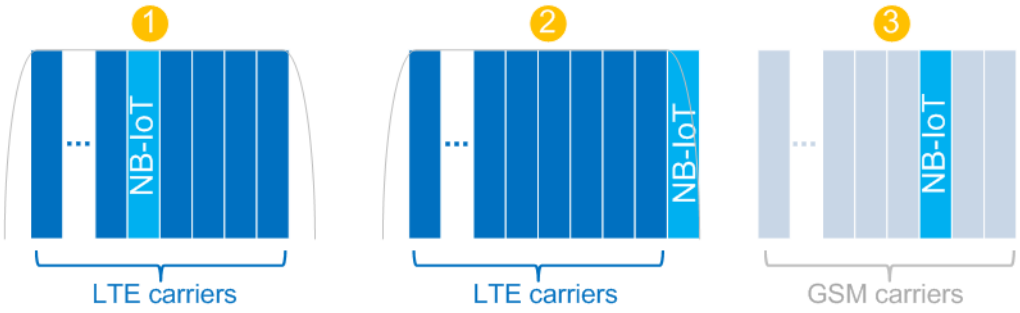


Figure 5-5: NB-IoT operating modes

1 = In-band operation by reusing free LTE resource blocks (supported in LTE bandwidths larger than 200 kHz)*
2 = Guard band operation by using the spectrum between neighboring LTE carriers (unused LTE guard band resource blocks)
3 = Standalone operation in free GSM spectrum
* = In-band operation in DL is not supported in the 1.4 MHz bandwidth

NCell ID N^{NCell}_{ID}

NB-IoT maintains the concept of up to 504 physical cell IDs (PCI). It is refereed as NCell ID or N^{Ncell}_{ID}.

Regarding the PCI, the specification defines two modes:

- **In-band operation with same PCI (N^{NCell}_{ID} = PCI)**
  Where N^{NCell}_{ID} is the NB-IoT cell ID and PCI is the physical cell ID of the LTE cell.
  In this mode, NB-IoT and LTE share the same PCI and use the same number of CRS and NRS ports:
  There can be a maximum number of two CRS ports, because the number of narrowband reference signals $N_{NRS} \leq 2$.
  (see NRS)
- **In-band different PCI operation ($N^{NCell}_{ID} \neq$ PCI)**
  The LTE cell and the NB-IoT cell operate in the same band but have a different PCI.
  The number of CRS ports could be different than the N_{NRS}

Examples

Example: Configuring an NB-IoT allocation in standalone operating mode

Standalone NB-IoT operation is the default and the only one possible mode when the channel bandwidth is set to 200 kHz.

In DL:

- Select "General DL Settings > Physical > Channel Bandwidth = 200 kHz".
- Select "NB-IoT Carrier Allocation".
  The parameter "Mode = Standalone" confirms that in the selected channel bandwidth, only NB-IoT standalone operation in possible.

In UL:

- Select "General UL Settings > Physical > Channel Bandwidth = 200 kHz".
- Select "UL Frame Configuration > UEx > 3GPP Release = NB-IoT ".
- Select "UEx > User Equipment Configuration > NB-IoT Allocation".
  The parameter "Mode = Standalone" confirms that in the selected channel bandwidth, only NB-IoT standalone operation is possible.

Example: Enabling an NB-IoT UL in-band operation

An NB-IoT in-band or guard-band operation requires channel bandwidth wider than 200 kHz, 1.4 MHz or wider for UL (and 3MHz or wider for DL). The following example shows you how to allocate the NB-IoT transmission around the DC carrier.

1. Select a channel bandwidth wider than 200 kHz and containing even number of resource blocks.
   For example "General UL Settings > Physical > Channel Bandwidth = 3 MHz".

   The 3 MHz channel bandwidth consists of 15 resource blocks.
2. Select "UL Frame Configuration > UEx > 3GPP Release = NB-IoT ".
3. Select "UEx > User Equipment Configuration > NB-IoT Allocation".
4. Select "Mode = In-band".
5. Select "Resource Block Index = 7".
6. Observe the "Time Plan".
   Use the "View Mode > Channel BW".
7. To shift the default NPUSCH allocation within the resource block, select "NB-IoT Allocation > NPUSCH#1 > Subcarrier Indication = 6".
8. In the "Time Plan", set the "View Mode = Single RB".

Example: Enabling mixed LTE and NB-IoT configuration

Extend the configuration in Example "Enabling an NB-IoT UL in-band operation" on page 325 with the following:

- Select "General > LTE/IoT Standard > LTE/eMTC/NB-IoT".
- In the "UL Frame Configuration > General" dialog, enable second UE with "3GPP Release = LTE/LTE-A".
- In the "UL Frame Configuration > Subframe" dialog, enable at least the PUSCH allocation of the LTE UE.
- Set for example:
  - "PUCCH/PUSCH > State > On"
  - "PUSCH > Set 1 No. RB = 12" to allocate the entire channel bandwidth
- Observe the time plan in both view modes.

5.2.2 NPSS and NSSS

As in the LTE, the DL primary and secondary synchronization signals (NPSS and NSSS) are used for cell search, time and frequency synchronization, and obtaining the cell ID.

The carrier on which the UE detects the NPSS/NSSS/NPBCH/SIB-NB is referred as **anchor carrier**.

The NPSS and NSSS have the following transmission patterns:

- NPSS is transmitted in the sixth subframe (SF#5) of every frame.
  It spans 11 subcarriers and uses one fixed 11-bit log Zhadof-Chu sequence.
- NSSS is transmitted in the tenth subframe (SF#9) in the even-numbered frames, that fulfill the following condition:
  n_f mod 2 = 0, where n_f is the frame number.
  NSSS spans 12 subcarriers and is generated form a 131-bit length Zhadof-Chu sequence, that is scrambled and cyclically shifted also with the NCell ID, see "NCell ID N^{Ncell}_{ID}" on page 324.

No other signals can be scheduled during the subframes NPSS or NSSS are transmitted.

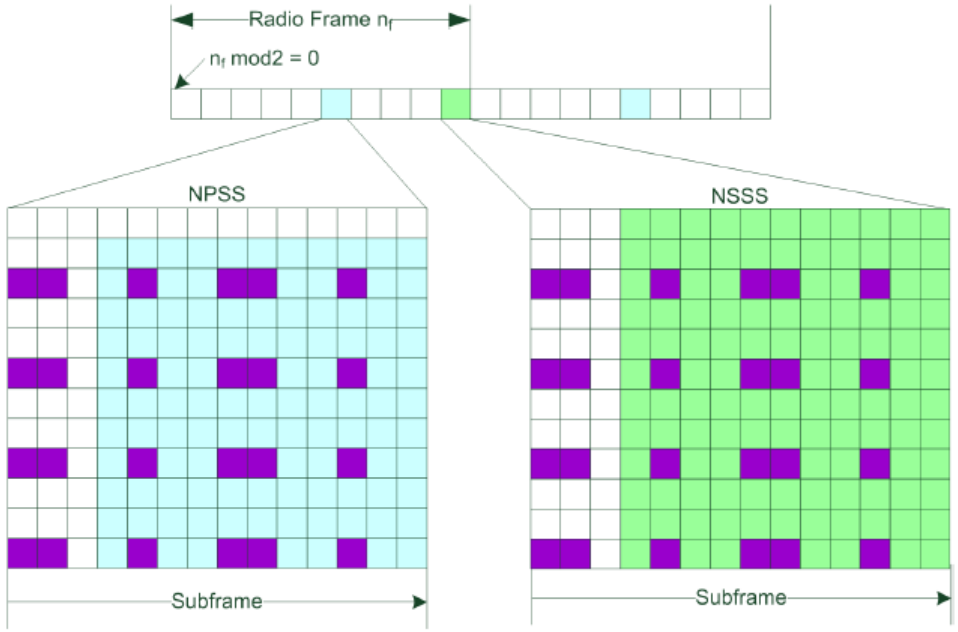


Figure 5-6: NPSS and NSSS allocation with 4 antenna port LTE CRS transmission* [1MA266]

Blue = NPSS
Green = NSSS
White = First three OFDM symbols are reserved for the LTE PDCCH and hence omitted by NB-IoT
Violet = LTE CRS; in in-band mode, all possible LTE CRS resource elements are omitted by NB-IoT
* = NRS is not transmitted in the NPSS and NSSS subframes

5.2.3 NRS

- NRS is transmitted in the last two OFDM symbols of each slot, if these slots are not used for NPSS or NSSS.
- Can be transmitted on one or two antenna ports (AP2000/AP2001), depending on the transmission scheme.
- NRS is mapped on a similar way as the RS in LTE, see Figure 5-7.
- NRS is cyclically shifted by the NCell ID

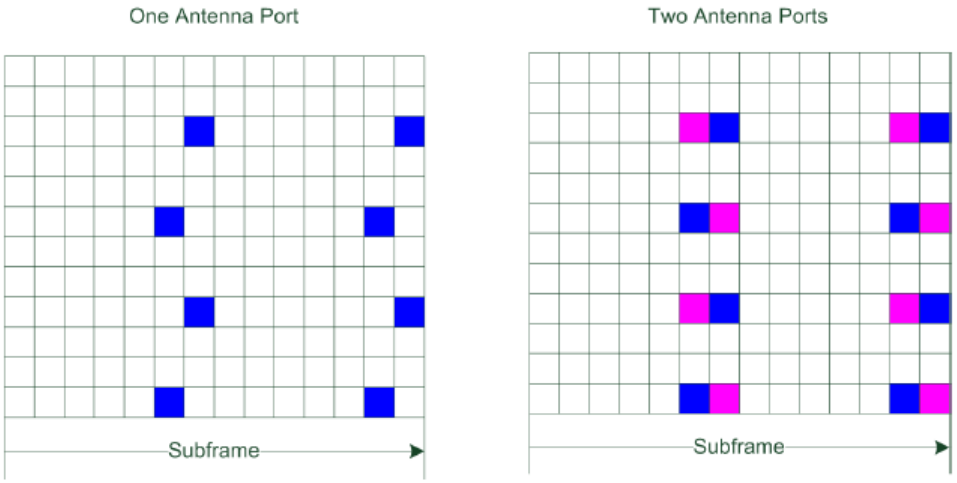


Figure 5-7: NRS mapping to the resource elements (one and two antenna ports) [1MA266]

With this structure, there is no overlap between the NRS and the LTE CRS.

The NRS position depends on the duplexing mode; in TDD mode, it depends on the special subframe configuration. Observe the timeplan for current allocation.

5.2.4 NPBCH

The narrowband physical broadcast channel (NPBCH) is QPSK modulated and carries narrowband master information block MIB-NB information.

MIB-NB

MIB-NB is scrambled with the N^{Ncell}_{ID}. It contains 34 bits and is transmitted over 64 frames. The MIB-NB is split into 8 blocks, where each block is transmitted on the first subframe (SF#0) in a frame and is repeated in the subsequent 7 frames.

MIB-NB carries important information and among other, it indicates the starting frame of SIB1-NB and repetitions, see "SIB1-NB" on page 333.

Figure 5-8 shows the subframe structure of the NPBCH.

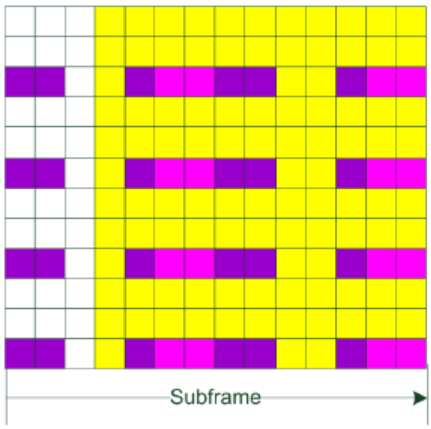


Figure 5-8: NPBCH mapping on the resource elements in SF#0 [1MA266]

Yellow = NPBCH resource elements = 100, excluding the LTE CRS and NRS symbols and the symbols in the PDCCH region
Violet = LTE CRS
Magenta = NRS
White = First three OFDM symbols are reserved for the LTE PDCCH

5.2.5 NPDCCH

The narrowband physical downlink control channel (NPDCCH) controls the data transfer between UE and eNB. It indicates the UE for that the NPDSCH carries data, the data allocation and the number of times it is repeated. NPDCCH is QPSK modulated.

NPDCCH is transmitted on an aggregation of one or two consecutive narrowband control channel elements (NCCE), distinguished by their NCCE index. Each NCCE is defined as a set of 6 subcarriers and occupies two slots. NPDCCH can occupy one or two NCCEs, where the first case is referred to as NPCCH format 0 and the later as NPDCCH format 1.

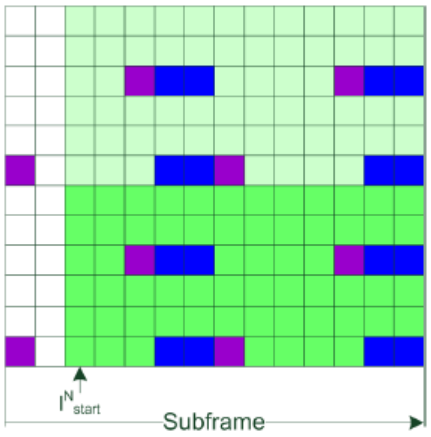


Figure 5-9: NPDCCH mapping [1MA266]

Green = NPDCCH resource elements (NCCE#0 and NCCE#1), excluding the LTE CRS and NRS symbols and the symbols in the PDCCH region
Violet = LTE CRS
Blue = NRS
White = OFDM symbols are reserved for the LTE PDCCH
$I_{NDPCCHStart}$ = Start Symbol

Search spaces

NPDCCH is grouped into three search spaces:

- Type 1 common search space, used for paging
- Type 2 common search space, used for random access
- UE-specific search space

The search space defines the NPDCCH candidates that the UE has to monitor. The UE can decode only the control information on an NPDCCH that is transmitted over NCCEs within the search space the UE monitors.

An NPDCCH search space is defined at aggregation level (L) and as a set of NPDCCH candidates. Each candidate is repeated R times over consecutive NB-IoT downlink subframes, where:

- SFs used for the transmission of system messages are omitted.
- The starting subframe is calculated to fulfill the conditions listed in "Calculating the NPDCCH starting subframe" on page 330.
- The aggregation level L = {0, 1} defines the number of NCCEs allocated for the NPDCCH (see also Figure 5-9)
- The repetition R is selected per search space type from:
  - Table 5-15 and
  - Table 5-16

Calculating the NPDCCH starting subframe

Possible values are calculated automatically to fulfill the:

- Validity of the subframes, see "Valid Subframes" on page 345
- Configured NB-IoT allocations, see Chapter 5.3.2, "NPBCH, NPDCCH and NPDSCH Settings", on page 347
- NPDCCH condition, per search space type, as defined in :
  - Type 1 common
    Determined form locations of NB-IoT paging opportunity subframe
  - Type 2 common and UE-Specific
    $(10n_f + floor(n_s/2))modT = alpha_{offset}.T$
    $T = G.R_{max} \geq 4$

  Where:
  - n_f is the system frame number SFN
  - n_s is the slot number
  - G is search space start subframe
  - R_{Max} is max number of NPDCCH repetitions

– $alpha_{offset}$ is the search space offset

G, R_{Max} and $alpha_{offset}$ are search space-specific value, set with the following settings:

– UE-Specific, see "UE-Specific Search Space" on page 350
– Type 2 common, see "Common Search Space" on page 350

Table 5-15: Type 1 common search space NPDCCH candidates [TS 36.213]

R_{Max}	R								NCCE indices of monitored NPDCCH candidates L = 2
"Repetitions of DCI"	000	001	010	011	100	101	110	111	
1	1								{0,1}
2	1	2							{0, 1}
4	1	2	4						{0, 1}
8	1	2	4	8					{0, 1}
16	1	2	4	8	16				{0, 1}
32	1	2	4	8	16	32			{0, 1}
64	1	2	4	8	16	32	64		{0, 1}
128	1	2	4	8	16	32	64	128	{0, 1}
256	1	4	8	16	32	64	128	256	{0, 1}
512	1	4	16	32	64	128	256	512	{0, 1}
1024	1	8	32	64	128	256	512	1024	{0, 1}
2048	1	8	64	128	256	512	1024	2048	{0, 1}

Table 5-16: UE-specific and Type 2 common search space NPDCCH candidates

R_{Max}	R	"Repetitions of DCI"	NCCE indices of monitored NPDCCH candidates L = 2	UE-specific search space only NCCE indices of monitored NPDCCH candidates L = 1
1	1	00	{0,1}	{0}, {1}
2	1	00	{0, 1}	{0}, {1}
2	2	01	{0, 1}	-
4	1	00	{0, 1}	-
4	2	01	{0, 1}	-
4	4	10	{0, 1}	-
≥8	$R_{Max}/8$	00	{0, 1}	-
≥8	$R_{Max}/4$	01	{0, 1}	-
≥8	$R_{Max}/2$	10	{0, 1}	-
≥8	R_{Max}	11	{0, 1}	-

DCI formats, decoding and content

Table 5-17 gives an overview of the defined DCI formats.

Table 5-17: DCI formats

DCI format	Size, bits	Purpose	User / RNTI	Search space
N0	23	Scheduling of NPUSCH in one UL cell	User x (C-RNTI)	UE-specific Type 2 common
N1	23	Scheduling of one NPUSCH codeword in one cell Random access procedure initiated by an NPUSCH order	User x (C-RNTI) RA-RNTI	UE-specific Type 2 common
N2	15	Paging and direct indication	P-RNTI	Type 1 common

The DCI formats decoding is as follows:

- Scrambling with P-RNTI: DCI format N2
- Scrambling with RA-RNTI: DCI format N1
- Scrambling with C-RNTI: evaluated is the first bit called flag for format N0/format N1 differentiation:
  - First bit = 0: N0
  - First bit = 1: N1

Among other, the DCIs carry information on scheduling delay I_{Delay}, where scheduling delay is the time between the NPDCCH end and the NPDSCH or NPUSCH start.

When signaled over DCI format N0 and N1:

- $I_{Delay}^{NPDSCH} \geq 5$ SFs
- $I_{Delay}^{NPUSCH} \geq 8$ SFs

In DCI format N2, $I_{Delay}^{NPDSCH} = 5$ SFs

Example: NPDCCH candidates calculation

- Current frame $n_f = 16$ and subframe = 0 (16, 0)
- $R_{Max} = 4$
- $G = 4$
- $\alpha_{offset} = 1/8$
- $T = G*R_{Max} = 16$
- $(10n_f + \lfloor n_s/2 \rfloor) \bmod T = \alpha_{offset}.T = 2$

The following starting subframes fullfill the condition:

- For R = 1: (16, 2), (16, 3), (16, 4) and (16, 6)
- For R = 2: (16, 2), (16, 4)
- For R = 4: (16, 2)

Example: NPDCCH scheduling based on DCI format N1

- "Search Space = UE-specific"
  - R_{max} = 4
  - G = 1.5
  - α_{offset} = 1/8
- "Repetitions of DCI Subframes = 2" and therefore R = 4
- NPDCCH "Start Subframe = 2"
  (See also Example "NPDCCH candidates calculation" on page 332)

NPDCCH is transmitted in four subframes, where the first subframe is subframe 2.

Observe the configuration on the "Timeplan".

NPDCCH is not allocated in subframe#4 because this subframe is reserved for the SIB1-NB transmission over NPDSCH.

For details, observe the NB-IoT allocation information in NB-IoT Allocation dialog.

5.2.6 NPDSCH

The narrowband physical downlink shared channel (NPDSCH) transmits signal information other than MIB. The channel is QPSK modulated, has the same structure as the NPDCCH (see Figure 5-9) and the same conditions apply for the $I_{NDPSCHStart}$.

NPDSCH is mapped to N_{SF}^{NPDSCH} number of subframes, where each mapped subframe is repeated N_{Rep}^{NPDSCH} times. One NPDSCH transmission lasts $N_{SF}^{NPDSCH}*N_{Rep}^{NPDSCH}$ subframes. NPDSCH transmission starts at least 5 subframes after the NPDCCH and can be additionally delayed by number of subframes k_0, where k_0 is referred as scheduling delay. The maximum transport block size TBS is 680 bits.

SIB1-NB

NPDSCH carries the system information SIB1-NB. The message is repeated 4, 8 or 16 times, has a period of 256 frames and predefined TBS of up to 680 bits. It is transmitted on subframe SF#4 of every second frame in a number of consecutive frames, depending on the selected repetition interval.

SIB1-NB can be modified at each modification period of 4096 frames, where the modification is indicated in DCI format N2.

NPDSCH scheduling

Scheduling and TBS depend on whether the NPDSCH carries SIB1-NB message or not:

- No SIB1-NB
  The N_{SF}, N_{Rep} and k_0 values are defined with the "Resource Assignment I_{SF}", "Repetition Number I_{Rep}" and "Scheduling Delay I_{Delay}" fields in the DCI format.
  See Table 5-26, Table 5-27 and Table 5-25 for the corresponding mapping.
- SIB1-NB

- NPDSCH number of repetitions N_{Rep}^{NPDSCH} is set with the `schedulingInfoSIB1` parameter of MIB-NB.
- The starting frame in that the SIB1-NB (i.e. NDPSCH) is transmitted is defined as function of the N_{Rep}^{NPDSCH} and the NCell ID N_{ID}^{Cell}.

Example: NPDSCH scheduling based on DCI format N1

This example extends the configuration described in Example "NPDCCH scheduling based on DCI format N1" on page 333.

- "Search Space = UE-specific" with $R_{max} = 4$
- DCI format N1 configuration:
  - $I_{SF}^{NPDSCH} = 2$ therefore $N_{SF} = 3$
  - $I_{Rep}^{NPDSCH} = 2$ therefore $N_{Rep} = 4$
  - $I_{Delay} = 2$ therefore $k_0 = 8$

NPDSCH is transmitted over $N_{SF}^{NPDSCH} * N_{Rep}^{NPDSCH} = 12$ consecutive subframes, where the first NPDSCH subframe is 5 + 8 = 13 subframes after the NPDCCH transmission.

In TDD duplexing mode, NPDSCH is transmitted in the downlink or in the DwPTS symbols. Observe the timeplan for current allocation.

5.2.7 NDRS

The narrowband demodulation reference signals (NDRS) are transmitted in the resources units containing data transmission. NDRS uses the same modulation as the associated data. All transmissions use a single antenna port, because MIMO is not defined for the UL direction.

The NDRS allocation, both as slot assignment and duration, depends on the used NPUSCH format and subcarrier spacing, see Table 5-18.

Table 5-18: NDRS duration and symbol assignment depending on the NPUSCH format and subcarrier spacing [TS 36.211]

NPUSCH format	NDRS duration (symbol per slot)	Symbol assignment for subcarrier spacing Δf = 3.75 KHz	Symbol assignment for subcarrier spacing Δf = 15 KHz	Number of subcarriers
F1	1	4	3	1 (@3.75kHz) 1, 3, 6, 12 (@15kHz)
F2	3	0, 1, 2	2, 3, 4	1

The NDRS is generated form a base sequence that is frequency shifted by a phase factor. If NDRS is transmitted with NPUSCH format F2, the NDRS is spread with the sequence known from LTE PUCCH formats 1, 1 and 1b.

5.2.8 NPUSCH

Other that in LTE, the NPUSCH carries the UL data, including UL control information (UCI). There is no channel like the LTE PUCCH channel defined in NB-IoT .

Resource units (RU)

In NB-IoT , the resource units (RU) are used to describe the mapping of the NPUSCH to resource element.

NPUSCH formats

TS 36.211 specifies two NPUSCH formats, each transporting the following information:

- F1: UL channel data over UL-SCH
- F2: UL control information UCI, restricted to acknowledgment of a DL transmission

For overview information of the NPUSCH formats and the number of used UL carriers per resource unit (RU), see Table 5-19.

Table 5-19: NPUSCH formats [TS 36.211]

NPUSCH format	Subcarrier spacing Δf	Number of subcarriers N_{SC}^{RU}	Number of slots N_{slots}^{UL}	RU duration, ms	Modulation	Resource elements per RU	Bits per RU
F1	3.75 KHz	1	16	32	π/2-BPSK π/4-QPSK	96	96 192
	15 KHz	1	16	8	QPSK	96	96 192
		3	8	4	QPSK	144	288
		6	4	2	QPSK	144	288
		12	2	1	QPSK	144	288
F2	3.75 KHz	1	4	8	π/2-BPSK	16	16
	15 KHz	1	4	2	π/2-BPSK	16	16

In the time domain, the NPUSCH transmission is defined as NPUSCH format, number of RU (N_{RU}), number of repetitions (N_{rep}^{NPUSCH}), and scheduling delay. An NPUSCH allocation is then $N_{rep}^{NPUSCH} N_{RU} N_{slots}^{UL}$ long. After the transmission of 256 ms, the NPUSCH transmission is postponed for 40 ms, see Table 5-20.

Table 5-20: NPUSCH gap duration expressed as number of slots

Subcarrier spacing	Slot length, ms	256 ms expressed as number of slots	40 ms expressed as number of slots
3.75 kHz	2	128	20
15 kHz	0.5	512	80

The RU size is not constant (Table 5-19). It is signaled with the DCI format N0, that carries also information on the NPUSCH start time, number of NPUSCH repetitions N_{Rep}^{PUSCH} and subcarrier indication field (I_{SC}).

See:

- "DCI formats, decoding and content" on page 332
- "DCI Format N0" on page 355

Physical dimension of the NPUSCH allocation

Table 5-19 lists also the resource elements and the resulting physical bits per RU, depending on the modulation. This information is required for the calculation of the total physical bits per NPUSCH allocation.

The following applies:

- Resource elements per RU = Resource elements per slot per subcarrier * N_{slots}^{UL} * N_{SC}^{RU}

  Where:

  – For F1: Resource elements per slot per subcarrier = 6
  – For F2: Resource elements per slot per subcarrier = 4
- Number of bits per RU = {Resource elements per RU (for BPSK); 2 * Resource elements per RU (for QPSK)}
- Total number of physical bits per NPUSCH allocation = N_{RU} * Number of bits per RU

  Where N_{RU} is set with the parameter "NB-IoT Allocation > Allocation# > Resource Units" and displayed with the parameter "Enchanced Settings > Config > Number of RU".

5.2.9 NPRACH

The NPRACH channel is used during the random access procedure. One random access channel spans one subcarrier within a symbol group.

Symbol group

The term symbol group describes the set of subcarriers reserved for the narrowband random access preamble. A symbol group comprises of a cyclic prefix and five identical symbols. Four consecutive symbol groups that are repeated defined number of times (N_{rep}^{NPRACH}) build a preamble.

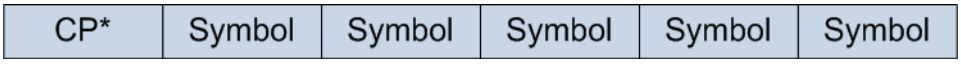


Figure 5-10: Random access symbol group

CP = Cyclic prefix (variable length)
Symbol = Sequence of five identical symbols

NPRACH configuration

The NPRACH configuration `NPRACH-ConfigSIB-NB-r13` is signaled by higher levels with the SIB2-NB.

NPRACH is configured per coverage level and is based on the following parameters:

- NPRACH configuration index: indicates the coverage level
- NPRACH preamble format: two formats with different cyclic prefix length, where the second is four times longer than the first one.
- $N_{periodicity}^{NPRACH}$: NPRACH resource periodicity (`mprach-periodicity-r13`)
- NPRACH starting time (`nprach-StartTime-r13`)
- N_{rep}^{NPRACH}: number of NPRACH repetitions per preamble attempt (`maxNumPreambleAttemptCE-r13`)
- Number of NPRACH subcarriers N_{sc}^{NPRACH} (`nprach-NumSubcarrierres-r13`)
- $N_{scoffset}^{NPRACH}$: frequency location of the first NPRACH subcarrier (`nprach-SubcarrierrOffset-r13`)

NPRACH allocation

Depending on the preamble format, the symbol group duration is as follows:

- Preamble format 0: 1.4 ms
- Preamble format 1: 1.6 ms

The signaled parameters are sufficient to calculate the location of the first symbol group. Locations of the subsequent symbol groups are frequency hopped (shifted) versions of the first one. Their location is derived according to a predefined algorithm, that assures that hopping patterns do not overlap. The frequency hopping is applied within 12 subcarriers ($N_{SC}^{RA} = 12$).

The location of the first symbol group is given by the NPRACH starting time and the parameter n_{start}, calculated from the subcarrier index n_{int}. The subcarrier index is the resource block index for the 3.75 KHz subcarrier spacing case.

The frequency allocation of the group is calculated as follows:

- $n_{sc}^{RA}(i) = n_{start} + \tilde{n}_{SC}^{RA}(i)$

  Where:

  - $n_{start} = N_{scoffset}^{NPRACH} + [n_{int}/N_{sc}^{RA}].N_{SC}^{RA}$
  - $\tilde{n}_{SC}^{RA}(0) = n_{int} mod N_{sc}^{RA}$
  - $\tilde{n}_{SC}^{RA}(i) = f(\tilde{n}_{SC}^{RA}(i-1); k_h)$
    Where $k_h = \{ +1, -1, +6, -6\}$ is a hopping index that describes the frequency hopping pattern.
    For details, see TS 36.211.

Example: NPRACH configuration

The following is an example on the NPRACH allocation calculation.

1. Select "UL General Settings > PRACH" and configure:
   - NPRACH "Preamble Format = 0"
   - NPRACH "Starting Time = 8 ms"
   - "NPRACH Configuration = 0" with:
     - $N_{rep}^{NPRACH} = 2$
     - $N_{sc}^{NPRACH} = 24$
     - $N_{scoffset}^{NPRACH} = 2$
   - $N_{SC}^{RA} = 12$
2. Select "UL Frame Configuration > UE1 > 3GPP Release = NB-IoT ".
3. Select "UE1 Settings > Common > Mode = PRACH".
4. In the "NPRACH" dialog, select $n_{int} = 13$.
5. Open the "UL Frame Configuration > Time Plan".

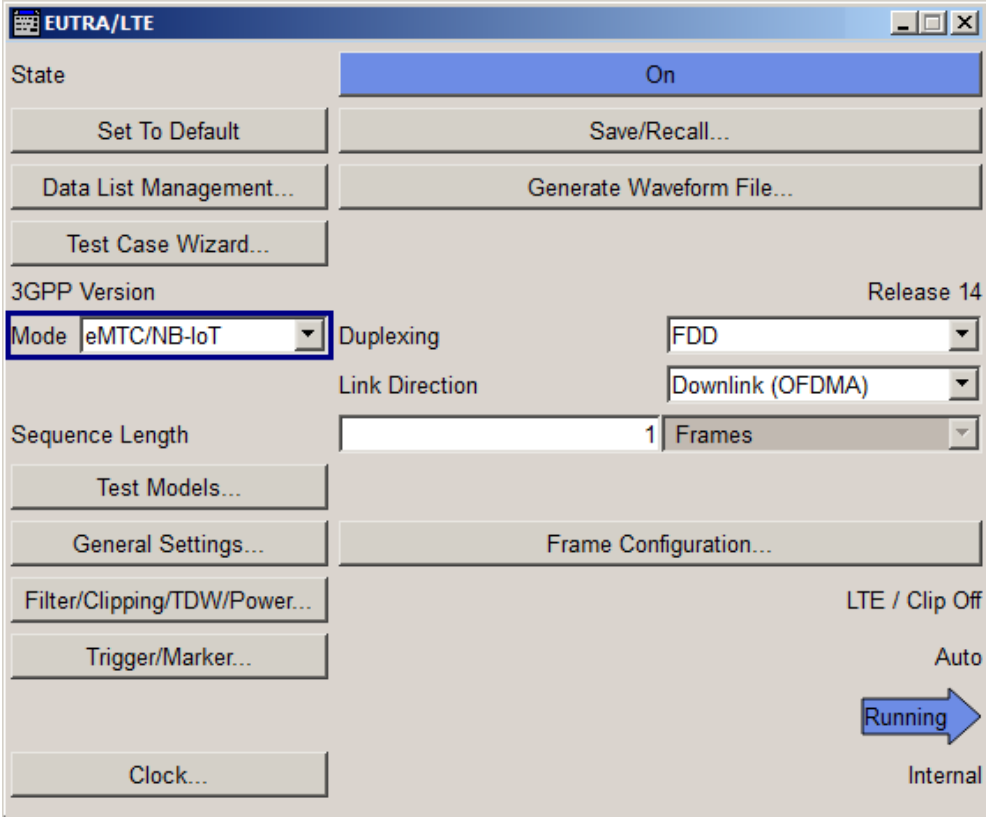
   The NPRACH configuration calculation in the first repetition is as follows:
   - First symbol group (i = 0):
     - $\tilde{n}_{sc}^{RA}(0) = 13 \bmod 12 = 1$
     - $n_{start} = 2 + [13/12].12 = 2 + 12 = 14$
     - $n_{sc}^{RA}(0) = 14 + 1 = 15$
   - Second symbol group (i = 1):
     - $\tilde{n}_{sc}^{RA}(1) = 1 - k_h = 1 - 1 = 0$ (for details, see TS 36.211)
     - $n_{sc}^{RA}(1) = 14 + 0 = 14$
   - Third symbol group (i = 2):
     - $\tilde{n}_{sc}^{RA}(2) = 0 + 6 = 0$
     - $n_{sc}^{RA}(2) = 14 + 6 = 20$
   - Fourth symbol group (i = 3):
     - $\tilde{n}_{sc}^{RA}(3) = 6 + 1 = 7$
     - $n_{sc}^{RA}(3) = 14 + 7 = 21$

   Set the "UL General Settings > PRACH > Preamble Format = 1" and observe the changed symbol length in the "Time Plan".

5.3 eMTC/NB-IoT-Specific Configuration and Settings

Access:

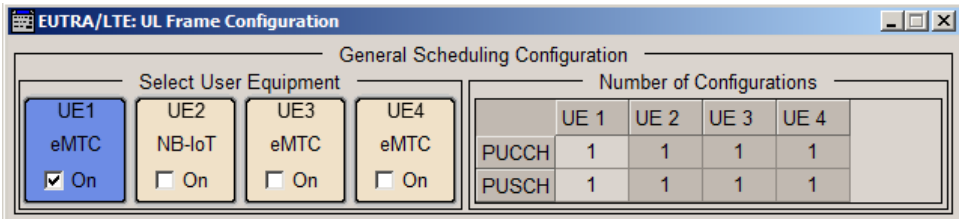
1. In the "EUTRA/LTE > General" dialog, select **"Mode > eMTC/NB-IoT"**.



2. **To access the physical and cell-related DL settings**:
   a) Select "Link Direction > Downlink"
   b) Select "General Settings"
3. **To access the DL User-specific settings**:
   a) Select "Link Direction > Downlink"
   b) Select "Frame Configuration > General".
   c) To access the configure the allocation of the NB-IoT DL channels, **select the "NB-IoT DCI Config" and "NB-IoT Allocation"**.

   Other than in LTE, the NB-IoT allocations are not defined on a per subframe basis. The settings in the "Subframe" tab apply to LTE channels and are required only if you generate mixed LTE and IoT signals.
4. **To access the physical and cell-related UL settings**:
   a) Select "Link Direction > Uplink"
   b) Select "General Settings"
5. **To access the UL UE-specific settings**:
   a) Select "Link Direction > Uplink"

b) Select "Frame Configuration > General".



c) To access the settings of the individual UEs, **click the "UE x" block**.

You can enable up to 4 UEs, where each UE can work in a different mode, as set with the parameter 3GPP Release.
Other than in LTE, the eMTC/NB-IoT allocations are dedicated UE-specific settings. They are not defined on a per subframe basis.
If you are familiar with the LTE implementation or generate mixed LTE and IoT signals, you may find it useful to accesses the settings also from the "Subframe" tab.

This section lists the **eMTC/NB-IoT-specific settings**. The settings that eMTC/NB-IoT reuse from LTE are described in:
Chapter 4, "EUTRA/LTE User Interface", on page 60.

The remote commands required to define the eMTC/NB-IoT settings are described in Chapter 9.27, "eMTC/NB-IoT Commands", on page 757.

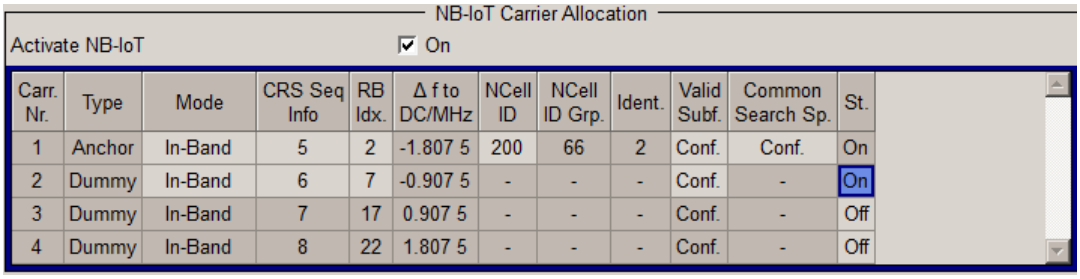
- NB-IoT Carrier Allocation....340
- NPBCH, NPDCCH and NPDSCH Settings....347
- FRC Settings....374
- NDRS Settings....377
- NPUSCH Settings....379
- NPRACH Settings....389
- eMTC DL Allocations Settings....394
- eMTC PUSCH Settings....423
- eMTC PUCCH Settings....435
- eMTC PRACH Settings....441

5.3.1 NB-IoT Carrier Allocation

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "General > Duplexing > FDD".
3. Select "General DL Settings > NB-IoT".

   With these settings, you configure the **anchor carrier** used by all NB-IoT channels.


NB-IoT Carrier Allocation

Activate NB-IoT ☑ On

Carr. Nr.	Type	Mode	CRS Seq Info	RB Idx.	Δ f to DC/MHz	NCell ID	NCell ID Grp.	Ident.	Valid Subf.	Common Search Sp.	St.
1	Anchor	In-Band	5	2	-1.807 5	200	66	2	Conf.	Conf.	On
2	Dummy	In-Band	6	7	-0.907 5	-	-	-	Conf.	-	On
3	Dummy	In-Band	7	17	0.907 5	-	-	-	Conf.	-	Off
4	Dummy	In-Band	8	22	1.807 5	-	-	-	Conf.	-	Off

4. Define the anchor carrier in terms of operating mode, allocated resource block, used NB-IoT cell ID and valid subframes.
5. To configure the subframes that are enabled for NB-IoT transmission:
   a) Select "Valid Subframes > Config"
   b) For in-band operation, select, for example "Bitmap Subframes = 40"
   c) Select a subframe (SF) to enable it for NB-IoT transmission.

   Suframes in that the NPBCH, NPSS or NSSS are transmitted can not be used for other NB-IoT DL channels.
   NB-IoT transmission is postponed during invalid subframes.
6. Set the "State = On" to enable each of the up to 3 **secondary carriers**.
7. Set **"Activate NB-IoT = On"** to activate the configuration.
8. To observe the NB-IoT carrier allocations, open the "Time Plan".

   In standalone and in-band modes, the "Time Plan" indicates the anchor carrier.
   In in-band mode, activated secondary carriers and the LTE synchronization signals PSS/SSS are also indicated.
9. To observe the anchor carrier in greater detail, set "View Mode = Single RB".

Settings:

Activate NB-IoT....342
LTE Cell....342
Gap Configuration....342
Gap Threshold....342
Gap Periodicity....342
Gap Duration Coefficient....342
Puncture LTE at Inband Carriers....342
Carrier Number....343
Type....343
Mode....343
CRS Sequence Info....343
RB Index....344
Delta Frequency to DC, MHz....344
NCell ID....345
NCell ID Group....345
Identity....345
Valid Subframes....345
└ Mode....346

└ Bitmap Subframes 346
└ Select All/Deselect All 346
State 347

Activate NB-IoT
For "Physical > Channel Bandwidth ≥ 3 MHz", enables the NB-IoT anchor carrier and generally the NB-IoT channels.

If disabled, all downlink NB-IoT allocations are deactivated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:STATe` on page 789

LTE Cell
In "General DL Settings > NB-IoT > Mode > In-Band" operation, defines how the LTE channels are handled.

If enabled, all LTE channels are deactivated. However, LTE reference signals are still transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:LTECell:STATe` on page 783

Gap Configuration
If activated, a gap between the NPDCCH and NPDSCH with the specified duration is applied.

The gap (`DL-GapConfig`) is applied to all NPDCCH and NPDSCH transmission but BCCH, as defined in TS 36.331.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:CONFig:STATe` on page 784

Gap Threshold
If Gap Configuration > "On", sets the gap threshold, as defined in TS 36.331.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:THReshold` on page 784

Gap Periodicity
If Gap Configuration > "On", sets the number of subframes after that the configured gap is repeated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:PERiodicity` on page 784

Gap Duration Coefficient
If Gap Configuration > "On", sets the gap duration coefficient, as defined in TS 36.331.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:DURation:COEFficent` on page 784

Puncture LTE at Inband Carriers
In mixed LTE and IoT mode ("LTE > Mode > LTE/eMTC/NB-IoT") and in in-band or guard band operation ("General DL Settings > NB-IoT > Mode > In-Band/Guard Band"), punctures the LTE signal at the NB-IoT carriers.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PUNCture on page 783

Carrier Number
Indicates the NB-IoT carrier.

Remote command:
n.a.

Type
The first carrier is the anchor carrier.

Anchor carrier is the carrier where the UE assumes that NPSS/NSSS, NPBCH and SIB1-NB are transmitted.

In in-band and guard band operation, you can enable and configure up to 3 secondary carriers. The secondary carriers are filled in with dummy data.

DL NB-IoT carriers span one resource block. To observe their allocation, use the "Time Plan" with "View Mode = Single RB".

Remote command:
n.a.

Mode
Selects the operating mode, see Figure 5-5.

See also Example "Configuring an NB-IoT allocation in standalone operating mode" on page 325.

"Standalone" Available if "Physical > Channel Bandwidth = 200 kHz".
All LTE allocations are automatically disabled.

"In-band/ Guardband" Available if "Physical > Channel Bandwidth ≥ 3MHz".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:MODE on page 785

CRS Sequence Info
For "Mode > In-Band/Guardband", sets the `eutra-CRS-SequenceInfo` parameter of the MIB-NB message.

It indicates the carrier containing NPSS/NSSS/NPBCH, where the value gives the LTE RB index.

The parameters CRS Sequence Info and RB Index are interdependent. Their values are calculated automatically according to TS 36.213.

Example: CRS sequence info and RB index values for 5MHz channel bandwidth

The following applies for example for "Physical > Channel Bandwitth = 5 MHz".

"CRS Sequence Info"	"RB Index"
5	2
6	7

"CRS Sequence Info"	"RB Index"
7	17
8	22

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CRSSeq` on page 785

RB Index

Sets the resource block number in that the NB-IoT transmissions are allocated.

The available resource blocks depend on the used "Channel Bandwidth" (or "Number of Available Resource Blocks") and the operating "Mode".

Table 5-21: Resource block index value ranges

Operation mode	Resource block allocation	Value range
In-band	Within the "Channel Bandwidth"	See Table 5-22
Guard band	Left guard band	< 0
	Right guard band	> "Number of Available Resource Blocks"

Table 5-22: RB indexes allowed for NB-IoT synchronization in in-band operation

LTE system bandwidth	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
RB index	2, 12	2, 7, 17, 22	4, 9, 14, 19, 30, 35, 40, 45	2, 7, 12, 17, 22, 27, 32, 42, 47, 52, 57, 62, 67, 72	4, 9, 14, 19, 24, 29, 34, 39, 44, 55, 60, 65, 70, 75, 80, 85, 90, 95

The parameters CRS Sequence Info and RB Index are interdependent. Their values are calculated automatically according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:RBIDx` on page 785
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:GBRBidx` on page 787

Delta Frequency to DC, MHz

In "Mode > In-band/Guard Band", indicates the delta frequency with that the NB-IoT carrier is offset form the LTE center frequency.

The value depends on "RB Index" and in in-band mode and per default in the guard-band mode it is calculated as follows:

"Delta Frequency to DC" = $\Delta f_{NB\text{-}IoT}$*("RB Index"*N_{SC}^{RB} - floor(N_{RB}^{DL}*N_{SC}^{RB}/2) + N_{SC}^{RB}/2) ± 7500

Where:

- $\Delta f_{NB\text{-}IoT}$ = 15 kHz is the NB-IoT subcarrier spacing
- N_{RB}^{DL} is the "Number of Resource Blocks per Slot"
- N_{SC}^{RB} = 12 is the number of subcarrier per RB
- ± 7500 is a frequency shift of half subcarrier bandwidth to avoid the center frequency

Thus, the possible values for the center frequencies of the NB-IoT channels are at 180 kHz offset to each other. In guard band mode, the you can change this spacing and set different "Delta Frequency to DC". If the set value does not correspond to a valid RB index, than the "RB Index = User".

According to the specification, the center frequencies of the NB-IoT channels in guard band mode must satisfy the following conditions:

- The first allocated NB-IoT RB must be orthogonal to the LTE RBs, whereas the following NB-IoT can be at 180 kHz or 15 kHz offset.
- The center frequencies of the NB-IoT carriers must satisfy the EARFCN conditions and hence be an integer multiple of 100 kHz; a raster of ±2.5 kHz and ±7.5 kHz is allowed, too.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:DFReq` on page 785

NCell ID
Sets the narrowband physical cell identifier, N^{NCell}_{ID}.

Defined are 504 unique physical layer cell identities (NCell ID), where the NSSS carries the N^{NCell}_{ID} value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CELL` on page 786

NCell ID Group
Indicates the physical cell identity group.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CIDGroup` on page 786

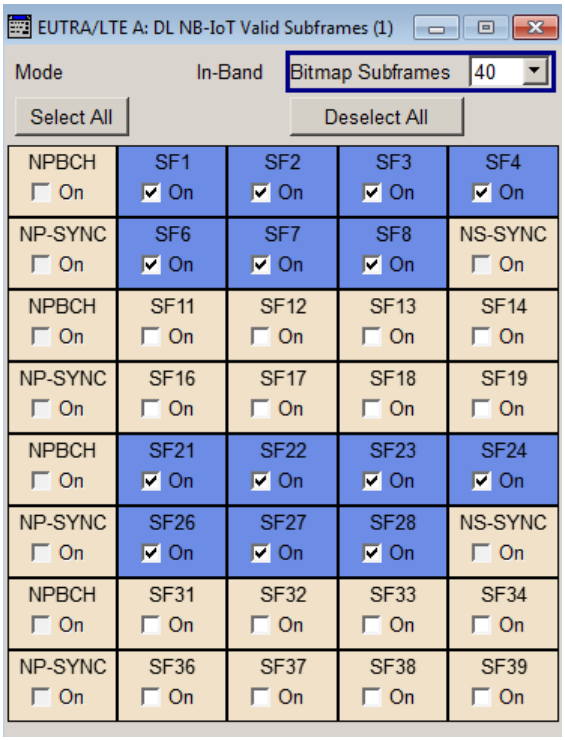
Identity
Indicates the identity of the physical layer within the "NCell ID Group".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ID?` on page 786

Valid Subframes
Sets the subframes bitmap carried by SIB1-NB (`downlinkBitmap-r13`) and defines the valid subframes (SF) that can be used for NB-IoT transmission.

If an SF is set to invalid or it contains NPSS, NSSS, NPBCH, or SIB1-NB, the NB-IoT transmission is postponed during this SF.

The selected subframes influence the scheduling of the NB-IoT transmissions.



According to TS 36.213, the valid SF in the secondary carriers (`DL-CarrierConfigDedicated-NB-r13`) can be defined in one of the following ways:

- No bitmap defined means that all DL subframes are valid
- To apply the bitmap of the anchor carrier
- To define an explicit bitmap configuration per secondary carrier.

In this implementation, the valid subframes in the secondary carriers are set individually.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSF` on page 786
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SF<st0>:VALSf` on page 787

Mode ← Valid Subframes
Indicates the operation mode of the selected carrier.

Bitmap Subframes ← Valid Subframes
Sets the valid subframes configuration over 10ms or 40ms (`subframePattern10-r13, subframePattern40-r13`), where 40ms configuration is available in the in-band mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSF` on page 786

Select All/Deselect All ← Valid Subframes
Sets all SFs to valid or invalid SFs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFALl on page 787
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFNN on page 787

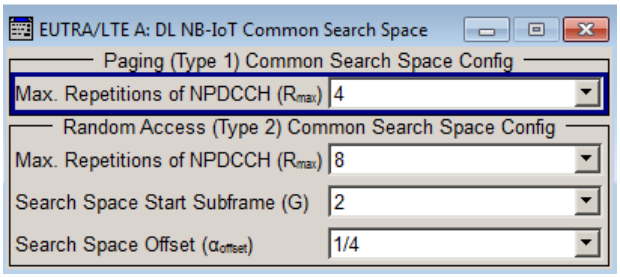
State
Enables secondary NB-IoT carrier.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:STATe on page 789

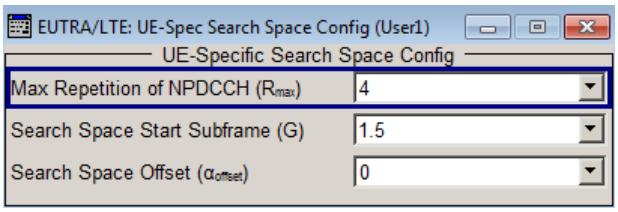
5.3.2 NPBCH, NPDCCH and NPDSCH Settings

Access:

1. Select "General > Link Direction > Downlink".
2. To configure the **common and UE-specific search spaces**:
   a) Select "General DL Settings > NB-IoT Carrier Allocation > Common Search Space".

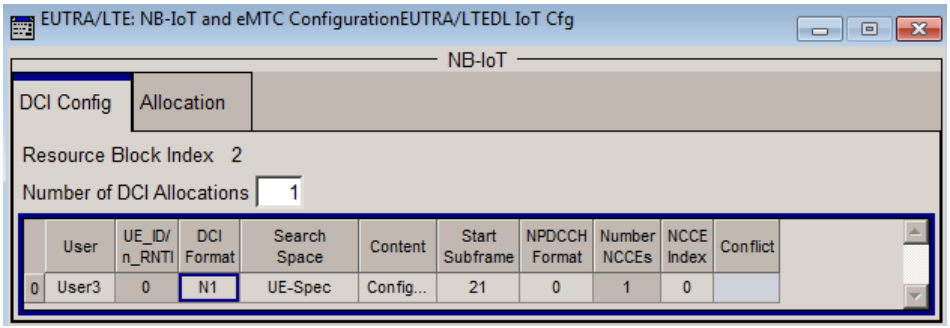


   b) Select "Frame Configuration > General > User Configuration > UEx > Search Space > Config".



3. Enable at least one NB-IoT UE, i.e. select "Frame Configuration > General > General > Configure User > User 3" > **"3GPP Release = NB-IoT"**.
4. To adjust the **DCI content** for example to configure the **NPDSCH and NPDCCH scheduling**:
   a) Select "Frame Configuration > Configure NB-IoT and eMTC > NB-IoT > DCI Configuration".
   b) Select "Number of DCI Allocations = 1".

c) Configure the DCI allocations, for example the DCI of one of the NB-IoT UEs: "User > User 3", "DCI Format = N1", "Search Space = UE-Specific".



d) Select "Content > Config".

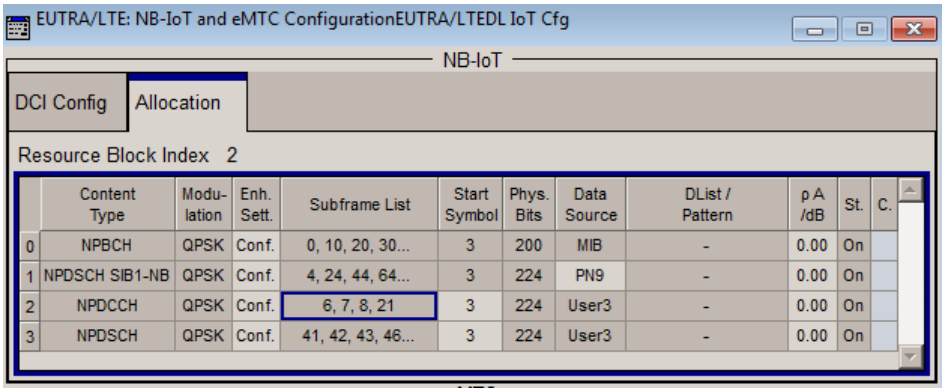
e) In the "DCI Format Configuration" dialog, set "Repetitions of DCI Subframe = 2", $I_{SF}^{NPDSCH} = 2$, $I_{Rep}^{NPDSCH} = 2$ and $I_{Delay} = 2$

f) Observe the information on the resulting configuration:
"Repetitions of NPDCCH (R) = 4", "Repetitions of NPDSCH (N_{Rep}) = 4", "Number of NPDSCH Subframes (N_{SF}) = 4"

g) In the "NB-IoT > DCI Configuration" dialog, set a "Start Subframe".

5. To display the automatically configured **NPBCH, NPDCCH and NPDSCH allocations in the anchor carrier** according to the current DCI configuration:

a) Select "Frame Configuration > Configure NB-IoT and eMTC > NB-IoT > Allocation".

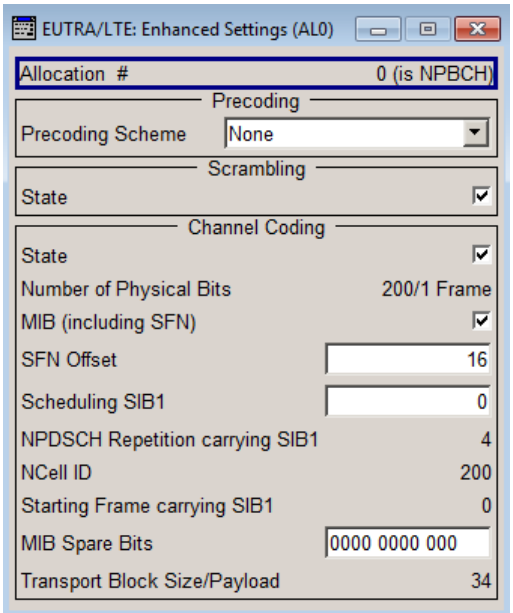


b) For the NPDCCH and NPDSCH allocations, observe the subframes displayed in the "Subframe List".

6. Observe the NB-IoT channels and signals on the "Time Plan".

The time plan confirms the NPDCCH start subframe and the subframes in that NPDCCH is transmitted.
It also confirms the that the NPDSCH allocation starts with the defined sheduling delay after the NPDCCH allocation and spans the configured number of subframes.

7. To change information in the **MIB-NB**, like for example the **SIB1-NB scheduling**, select "NPBCH > Enchanced Settings > Config".



See Chapter 5.3.2.4, "NPBCH Channel Coding and MIB-NB Configuration", on page 369.

Settings:

- Search Space Settings....349
- NB-IoT DCI Configuration....351
- NB-IoT Allocations (NPBCH, NPDCCH, NPDSCH)....364
- NPBCH Channel Coding and MIB-NB Configuration....369
- NPDSCH and NPDCCH Channel Coding and Scrambling....372

5.3.2.1 Search Space Settings

Access:

1. Select "General > Link Direction > Downlink".
2. Select "General DL Settings > NB-IoT Carrier Allocation > Common Search Space".
3. Select "Frame Configuration > General > User Configuration > UEx > Search Space > Config"

Settings:

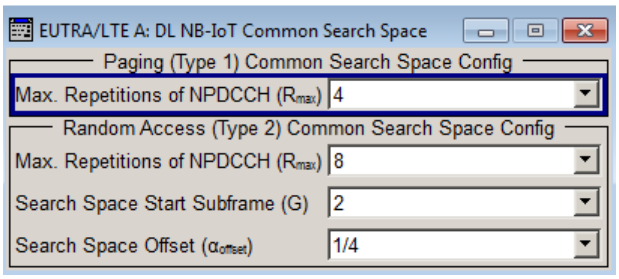
Common Search Space....350
- Max. Repetitions of NPDCCH (Rmax) for Type 1 common search space....350
- Max. Repetitions of NPDCCH (Rmax) for Type 2 common search space....350
- Search Space Start Subframe (G)....350
- Search Space Offset (α_{offset})....350

UE-Specific Search Space....350

└ Max. Repetitions of NPDCCH (Rmax) (UE-specific search space)..... 351
└ Search Space Start Subframe (G)..... 351
└ Search Space Offset (α_{offset})..... 351

Common Search Space
Configures the Type 1 (paging) and Type 2 (random access) common search space.

The common search space defines the NPDCCH candidates that the UE has to monitor, see "Search spaces" on page 330.



Max. Repetitions of NPDCCH (Rmax) for Type 1 common search space ← Common Search Space
Sets the maximum number NPDCCH is repeated R_{Max} (`npdcch-NumRepetitionPaging-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PAG:RMAX` on page 788

Max. Repetitions of NPDCCH (Rmax) for Type 2 common search space ← Common Search Space
Sets the maximum number NPDCCH is repeated R_{Max} (`npdcch-NumRepetitions-RA-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:RMAX` on page 788

Search Space Start Subframe (G) ← Common Search Space
Sets the start SF for the random access common search space (`npdcch-StartSF-CSS-RA-r13`).

The following applies:

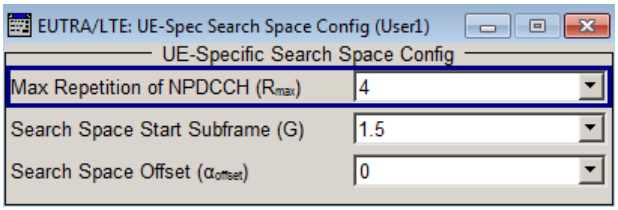
$G*R_{Max} \geq 4$

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:STSFrame` on page 789

Search Space Offset (α_{offset}) ← Common Search Space
Shifts the search space start (`npdcch-Offset-RA-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:SSOFfset` on page 789

UE-Specific Search Space
Configures the user-specific search space.



Max. Repetitions of NPDCCH (Rmax) (UE-specific search space) ← UE-Specific Search Space
Sets the maximum number NPDCCH is repeated R_{Max} (`npdcch-NumRepetitions-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:RMAX` on page 814

Search Space Start Subframe (G) ← UE-Specific Search Space
Sets the start SF for the random access common search space (`npdcch-StartSF-USS-r13`).

The following applies:

$G*R_{Max} \geq 4$

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:STSFrame` on page 814

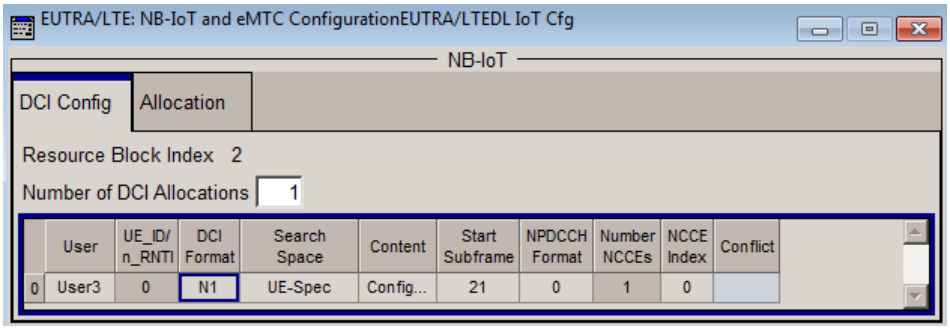
Search Space Offset (α_{offset}) ← UE-Specific Search Space
Shifts the search space start (`npdcch-Offset-USS-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:SSOFfset` on page 814

5.3.2.2 NB-IoT DCI Configuration

Access:

1. Select "General > Link Direction > Downlink".
2. Enable at least one NB-IoT UE, i.e. select "Frame Configuration > General > General > Configure User > User 3" > **"3GPP Release = NB-IoT"**.
3. Select "Frame Configuration > Configure NB-IoT and eMTC > NB-IoT > DCI Configuration".



4. Select "Number of DCI Allocations = 1".
5. Configure the DCI allocations, e.g. select "User > User 3" and select "Start Subframe = 6"
6. For each DCI, select "Content > Config".

Settings:

Resource Block Index 352
Number of DCI Allocations 352
Allocation Wrap-around 353
User 353
UE_ID/n_RNTI 353
DCI Format 353
Search Space 354
DCI Content Configuration 354
- Bit Data 354
- DCI Format N0 355
- DCI Format N1 357
- DCI Format N2 360
- Distance from NPDCCH to NPDSCH 362
- Transport Block Size 362
- Number of Resource Units (N_{RU}) 362
- Number of NPDSCH Subframes (N_{SF}) 363
- Repetitions of NPDSCH (N_{Rep}) 363
- Repetitions of NPDCCH (R) 363

Start Sufbframe 363
NPDCCH Format 363
Number NCCEs 364
NCCE Index 364
Conflict 364

Resource Block Index
Indicates the resource block number of the anchor NB-IoT carrier.

The value is set with the parameter RB Index.

Number of DCI Allocations
Sets up to 100 configurable DCIs.

There is one table row per DCI in the DCI table.

The default "Number of DCI Allocations" value depends on the availability of NB-IoT users:

- 0: if all "User" are set to eMTC.
  Changing the value to "Number of DCI Allocations = 1", enables you to configure P-RNTI or RA-RNTI DCIs.
- 1: if there is at least one "User" with "3GPP Release = NB-IoT".

Set "Number of DCI Allocations = 0" to disable the DCI-based NB-IoT configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:NALLoc` on page 795

Allocation Wrap-around
An NPDCCH can schedule a NPDSCH outside of the selected "ARB Sequence Length".

Enable this parameter to ensure a consistent signal, where the NPDSCH allocations are relocated at the beginning of the ARB sequence.

`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:AWARound` on page 795

User
Selects the user the DCI is dedicated to. The available DCI formats depend on the value of this parameter.

Other than in LTE, there is no NPDCCH indication of the system information (SI-RNTI).

"User x" Selects one of the four users with "3GPP Release = NB-IoT", as configured in the "Frame Configuration > General > General > Configure User" dialog.

"P-RNTI/RA-RNTI"
A group of users is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:USER` on page 795

UE_ID/n_RNTI
Displays the UE_ID of the "User x" or the n_RNTI for the selected DCI.

The UE_ID is set with the parameter "Frame Configuration > General > User Configuration > User x" > UE ID/n_RNTI.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:UEID?` on page 795

DCI Format
Sets the DCI format for the selected allocation.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in the UL and DL direction. It carries scheduling information and uplink power control commands.

Depending on the DCI message usage, they are categorized into three different formats: N0, N1 and N2.

See "DCI formats, decoding and content" on page 332.

To configure the parameters per DCI format, select "Content > Config".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:FMT on page 796

Search Space
Defines the search space for the selected DCI.

The search space defines the NPDCCH candidates that the UE has to monitor. The UE can decode only the control information on an NPDCCH that is transmitted over NCCEs within the search space the UE monitors.

Table 5-23 lists different scheduling situations and the required configuration of "Search Space" and DCI Format.

Table 5-23: Scheduling situation

Situation	"DCI Format"	"Search Space"
NPDCCH and NPDSCH configured by P-RNTI	N2	Type 1 common
NPDCCH and NPDSCH configured by RA-RNTI	N1	Type 2 common
NPDCCH and NPDSCH configured by C-RNTI	N1	UE-specific by C-RNTI
NPDCCH and NPDSCH configured by temporary C-RNTI and/or C-RNTI during random access procedure	N1	Type 2 common
NPDCCH and NPUSCH configured by C-RNTI	N0	UE-specific by C-RNTI
NPDCCH configured as "PDCCH order" to initiate random access procedure	N1	UE-specific by C-RNTI
NPDCCH and NPUSCH configured by temporary C-RNTI and/or C-RNTI during random access procedure	N0	Type 2 common

"UE-spec" Non-common DCIs are mapped to the UE-specific search space. Each UE has multiple UE-specific search spaces, determined as a function of the UE ID and the subframe.

"Type 1 Common/Type 2 Common"
The DCI is mapped to the common search space, where Type 1 common search space is used for paging and Type 2 for random access. A common search space is used to address all or a group of UEs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SSP on page 796

DCI Content Configuration
Configure the parameters per DCI format.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification.

The resulting "Bit Data", N_{SF}, N_{Rep} and R values are displayed.

Bit Data ← DCI Content Configuration
Displays the resulting bit data as selected with the DCI format parameters.

The first bit in DCI formats N0 and N1 is used as flag to distinguish between the two formats. It is set as follows:

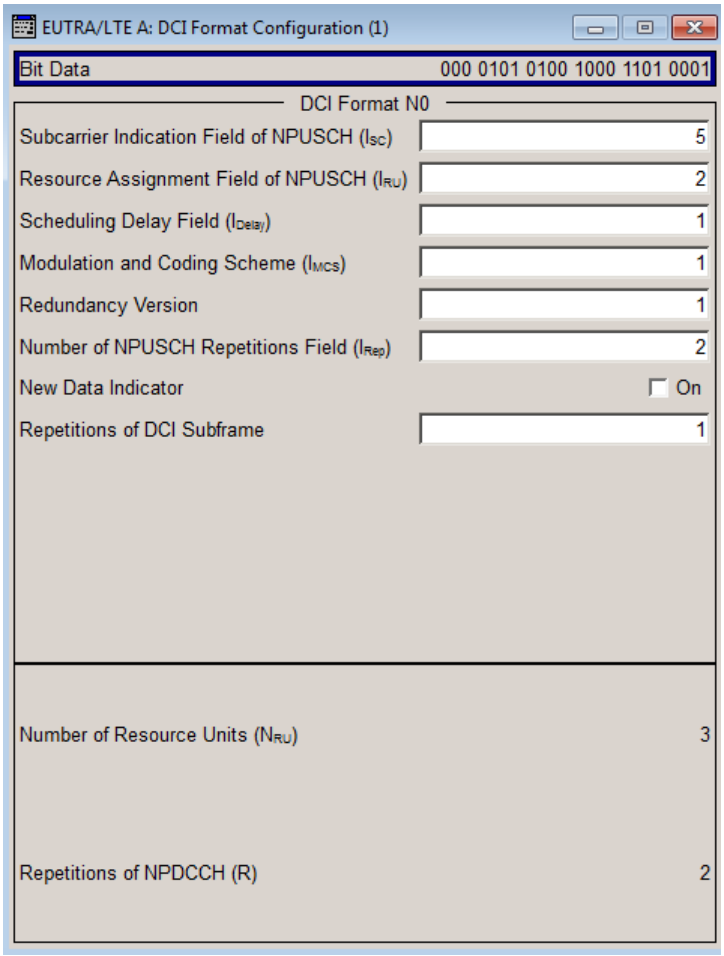
- DCI format N0: First bit = 0
- DCI format N1: First bit = 1

Mapping of the information bits is according to TS 36.212.

See also "DCI formats, decoding and content" on page 332.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:BITS?` on page 798

DCI Format N0 ← DCI Content Configuration
The DCI format N0 is 23-bits long and used for scheduling of NPUSCH in one UL cell.



DCI format N0 and transmits the following information.

"Subcarrier Identification Field of NPUSCH (I_{SC})"
6 bits
Define the starting frequency and resource unit of the NPUSCH allocation, see Table 5-36.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SCINd` on page 803

"Resource Assignment Field of NPUSCH (I_{RU})"

3 bits

The resulting number of resource units for NPUSCH N_{RU}^{NPUSCH} is indicated by the parameter Number of Resource Units (N_{RU}).

I_{RU}	0	1	2	3	4	5	6	7
N_{RU}	1	2	3	4	5	6	8	10

See also "Number of Resource Units N_{RU}" on page 384.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IRU` on page 798

"Scheduling Delay Field (I_{Delay})"

2 bits

Determines the number of DL subframes with that the NPDSCH is delayed after the NPDCCH transmission.

Table 5-24: Number of subframes NPDSCH is delayed (k_0 for DCI format N0)

I_{Delay}	k_0
0	8
1	16
2	32
3	64

See also Chapter 5.2.6, "NPDSCH", on page 333.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDELay` on page 798

"Modulation and Coding Scheme (I_{MSC})"

4 bits

Define the modulation order Q_m and the transport block index I_{TBS}.
The TBS is set automatically for Q_m = 2 according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:MCSCheme` on page 799

"Redundancy Version"

1 bit

Sets if the transmission start with RV0 or RV2.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:RVERsion` on page 803

"Number of NPUSCH Repetition Fields (I_{Rep})"

3 bits

Gives number of times NPUSCH is repeated N_{Rep}^{NPUSCH}.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPUSch:IREP`
on page 801

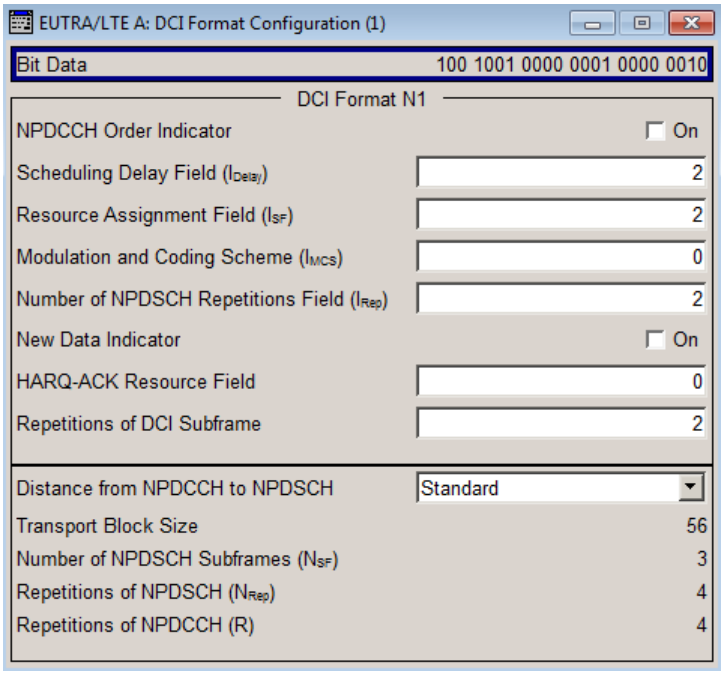
"New Data Indicator"
1 bit
As in LTE.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd on page 799

"Repetitions of DCI Subframes"
2 bits
Used to configure the NPDCCH mapping, see Table 5-16.
The resulting number of repetitions $N_{RepNPDCCH}$ (R) is indicated by the parameter Repetitions of NPDCCH (R).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SFRPt on page 803

DCI Format N1 ← DCI Content Configuration
The DCI format N1 is used for scheduling of one NPUSCH codeword in one cell and random access procedure initiated by an NPUSCH order.



DCI format N1 is 23-bits long and transmits the following information.

"NPDCCH Order Indicator"
1 bit

- 0: indicates scheduling one NPDSCH codeword in one cell
- 1: indicates random access procedure initiated by an NPDCCH order
  The remaining bits are set to 1.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:OIND
on page 799

"Starting Number of NPRACH Repetitions (I_{Rep})"

2 bits
Used if "NPDCCH Order Indicator = 1" and DCI format N1 CRC is scrambled with C-RNTI
Defines the number of NPRACH repetitions N_{Rep} following a PDCCH order.

I_{Rep}	0	1	2	3
N_{Rep}^{NPRACH}	R1	R2	R3	reserved

Where R1 < R2 < R3 and N_{Rep} = {1, 2, 4, 8, 16, 32, 64, 128}, see "Number of Repetitions" on page 391.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SNUMber` on page 801

"Subcarrier Indication Field of NPRACH (I_{SC})"

6 bits
Used if "NPDCCH Order Indicator = 1" and DCI format N1 CRC is scrambled with C-RNTI
Indicates the subcarrier allocated for NPRACH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SCINd` on page 801

"Scheduling Delay Field (I_{Delay})"

2 bits
Determines the number of DL subframes with that the NPDSCH is delayed after the NPDCCH transmission. This delay is added to the minimum delay of 5 subframes.

Table 5-25: Number of subframes NPDSCH is delayed (k_0 for DCI format N1 depending on R_{max})

I_{Delay}	R_{max} < 128	R_{max} > 128
0	0	0
1	4	1
2	8	32
3	12	64
4	16	128
5	32	256
6	64	512
7	128	1024

See also Chapter 5.2.6, "NPDSCH", on page 333.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDELay` on page 798

"Resource Assignment Field (I_{SF})"

3 bits

Defines the number of subframes of NPDSCH (N_{SF}^{NPDSCH}). The resulting value is indicated by the parameter Number of NPDSCH Subframes (N_{SF}).

Table 5-26: Number of subframes N_{SF}^{NPDSCH} for NPDSCH

I_{SF}	0	1	2	3	4	5	6	7
N_{SF}^{NPDSCH}	1	2	3	4	5	6	8	10

Remote command:

`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:ISF` on page 800

"Modulation and Coding Scheme (I_{MSC})"

4 bits

Define the modulation order Q_m and the transport block index I_{TBS}. The TBS is set automatically for Q_m = 2 according to TS 36.213.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:MCSCheme` on page 799

"Number of NPDSCH Repetition Fields (I_{Rep})"

4 bits

Defines the number of times NPDSCH is repeated N_{Rep}^{NPDSCH}. The resulting value is indicated by the parameter Repetitions of NPDSCH (N_{Rep}).

Table 5-27: Number of repetitions N_{Rep}^{NPDSCH} for NPDSCH

I_{Rep}	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N_{Rep}^{NPDSCH}	1	2	4	8	16	32	64	128	192	256	284	512	768	1024	1536	2048

Remote command:

`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:IREP` on page 800

"New Data Indicator"

1 bit; as in LTE.

Field is reserved, if DCI format N1 CRC is scrambled with RA-RNTI.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd` on page 799

"HARQ-ACK Resource Field"

4 bits
Field is reserved, if DCI format N1 CRC is scrambled with RA-RNTI.
Defines the subcarrier and the subframe number ($n+k_0-1$) used by the NPUSCH that carries the ACK/NACK acknowledgment of the NPDSCH reception.

Where:
- n is the end subframe of the NPDSCH
- k_0 is the delay selected depending on the "HARQ-ACK Resource Field" value and the UL subcarrier spacing

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:HACK` on page 798

"Repetitions of DCI Subframes"

2 bits
Used to configure the NPDCCH mapping, see Table 5-16.
The resulting number of repetitions $N_{RepNPDCCH}$ (R) is indicated by the parameter Repetitions of NPDCCH (R).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SFRPt` on page 803

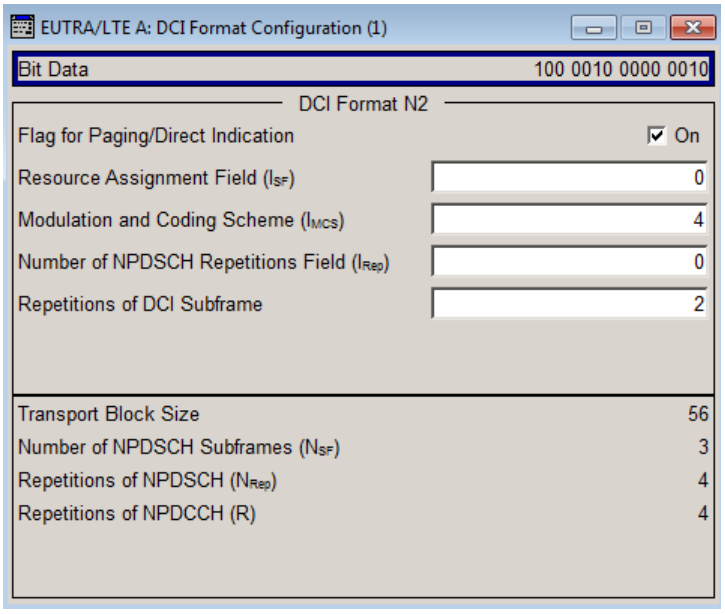
"Transport Block Size"

Indicates the TBS, calculated for the selected "Modulation and Coding Scheme (I_{MSC})" and "Resource Assignment Field (I_{SF})".
The TBS is set automatically for $Q_m = 2$ according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:TBSZ?` on page 804

DCI Format N2 ← DCI Content Configuration

The DCI format N2 is used for paging and direct indication. It is available for "User = P-RNTI".



DCI format N2 is 15-bits long and transmits the following information.

"Flag for Paging/Direct Indication"
1 bit

- 1: Paging
- 0: Direct indication
  8 bits that provide direct indication of system information update and other fields;
  Direct indication information is transmitted on NPDCCH using P-RNTI but without an associated paging message.

Bit (in LSB order)	Field in direct indication information
1	"System Info Modification"
2	"System Info Modification - Extended Discontinuous Reception"
3 to 8	not used

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:PAG` on page 802

"System Info Modification - Extended Discontinuous Reception"
1 bit (`systemInfoModification-eDRX`)
Used if "Flag for Paging/Direct Indication = 1" and DCI format N2
CRC is scrambled with P-RNTI

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SIME` on page 803

"System Info Modification"
1 bit (`systemInfoModification`)
Used if "Flag for Paging/Direct Indication = 1" and DCI format N2
CRC is scrambled with P-RNTI

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SINF` on page 804

"Resource Assignment Field (I_{SF})"
3 bits
Defines the number of subframes of NPDSCH, see Table 5-26.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:ISF`
on page 800

"Modulation and Coding Scheme (I_{MSC})"
4 bits
Define the modulation order Q_m and the transport block index I_{TBS}.
The TBS is set automatically for Q_m = 2 according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:MCSCheme` on page 799

"Number of NPDSCH Repetition Fields (I_{Rep})"

4 bits
Defines the number of times NPDSCH is repeated N_{Rep}, see Table 5-27.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:IREP` on page 800

"Repetitions of DCI Subframes"

2 bits
Used to configure the NPDCCH mapping, see Table 5-15.
The resulting number of repetitions $N_{RepNPDCCH}$ (R) is indicated by the parameter Repetitions of NPDCCH (R).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SFRPt` on page 803

Distance from NPDCCH to NPDSCH ← DCI Content Configuration
For "DCI Format = N1", sets how the distance between the NPDCCH to NPDSCH is determined.

"Standard" NPDSCH starts at least five subframes after NPDCCH, i.e. there is a gap of 4 subframes between both channels.

"Minimum" In subframes without synchronization signals, PBCH or SIB transmissions, NPDSCH starts in the first valid subframe right after the NPDCCH.

"Zero" Disables the NPDSCH SIB1-NR and NPUCCH transmissions. The NPDSCH is transmitted immediately after the NPDCCH.
Use this value to increase the number of NPDSCH allocations.
To observe the allocated subframes, select "DL frame Configuration > NB-IoT > Allocation" > Suframe List.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:DIST` on page 804

Transport Block Size ← DCI Content Configuration
Indicates the TBS, calculated for the selected "Modulation and Coding Scheme (I_{MSC})" and "Resource Assignment Field (I_{SF})".

The TBS is set automatically for Q_m = 2 according to TS 36.213.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:TBSZ?` on page 804

Number of Resource Units (N_{RU}) ← DCI Content Configuration
Displays the resulting number of NPUSCH resource units N_{RU}^{NPUSCH}, retrieved from the selected "Resource Assignment Field of NPUSCH (I_{RU})".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NRUNits?` on page 802

Number of NPDSCH Subframes (N_{SF}) ← DCI Content Configuration
Displays the resulting number of NPDSCH subframes (N_{SF}), see Table 5-26.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NSF?`
on page 801

Repetitions of NPDSCH (N_{Rep}) ← DCI Content Configuration
Displays the resulting number of NPDSCH repetitions (N_{Rep}), see Table 5-27.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NREP?`
on page 800

Repetitions of NPDCCH (R) ← DCI Content Configuration
Displays the resulting number of NPDCCH repetitions (R), depending on:
- "Search Space" on page 354
- R_{max}, set per search space in the dialogs Common Search Space and UE-Specific Search Space
- "Repetitions of DCI Subframes" DCI field of corresponding DCI format.

See:
- Table 5-15
- Table 5-16

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:REP?`
on page 799

Start Sufbrame
Sets the next valid starting subframe for the particular NPDCCH, see "Calculating the NPDCCH starting subframe" on page 330.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:STSFrame` on page 796

NPDCCH Format
Sets the NPDCCH format.

Table 5-28: NPDCCH formats

NPDCCH format	Number of NCCEs	Search space
0	1	UE-specific
1	2	UE-specific Type 1 common Type 2 common

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:FMT`
on page 796

Number NCCEs
NPDCCH is transmitted on an aggregation of one or two consecutive narrowband control channel elements (NCCE), see Figure 5-9.

The value is calculated from the selected "NPDCCH Format" and "NCCE Index", see Table 5-28.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CCES?` on page 797

NCCE Index
For UE-specific search space, sets the NCCE start index.

NCCE index	Occupied subcarriers per subframe
0	0 to 5
1	6 to 11

See also Figure 5-9.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDCCe` on page 797

Conflict
Indicates a conflict between two DCI formats, for example if they have the same NCCE index and start subframe.

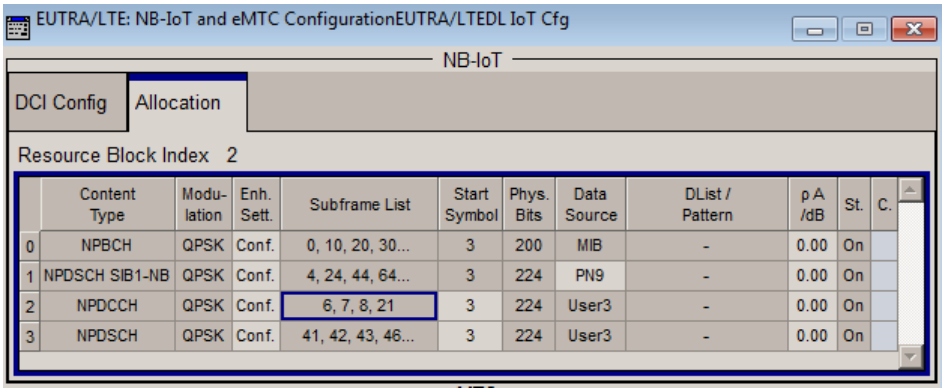
Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CONFlict?`
on page 797

5.3.2.3 NB-IoT Allocations (NPBCH, NPDCCH, NPDSCH)

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > General > NB-IoT Allocation".
3. Select "ρ A" to boost the power of a particular allocation.

   The dialog displays the NB-IoT allocations in the **anchor carrier**.



	Content Type	Modu-lation	Enh. Sett.	Subframe List	Start Symbol	Phys. Bits	Data Source	DList / Pattern	ρ A /dB	St.	C.
0	NPBCH	QPSK	Conf.	0, 10, 20, 30...	3	200	MIB	-	0.00	On	
1	NPDSCH SIB1-NB	QPSK	Conf.	4, 24, 44, 64...	3	224	PN9	-	0.00	On	
2	NPDCCH	QPSK	Conf.	6, 7, 8, 21	3	224	User3	-	0.00	On	
3	NPDSCH	QPSK	Conf.	41, 42, 43, 46...	3	224	User3	-	0.00	On	

The NPBCH allocation and the SIB1-NB transmissions are configured automatically, but can be changed. See Chapter 5.3.2.4, "NPBCH Channel Coding and MIB-NB Configuration", on page 369.
The NPDSCH and NPDCCH allocations are configured according to the current DCI configuration, see Chapter 5.3.2.2, "NB-IoT DCI Configuration", on page 351.

Settings:

Resource Block Index 365
Allocation number 365
Content Type 365
Modulation 366
Enhanced Settings > Config 366
Suframe List 366
Start Symbol 366
Phys. Bits 367
Data Source 368
ρ A 368
State 368
Conflict 368

Resource Block Index
Indicates the resource block number of the anchor NB-IoT carrier.

The value is set with the parameter RB Index.

Allocation number
Consecutive number of the allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:NALLoc?` on page 805

Content Type
Indicates the channel type.

Allocation number	Channel	Description
0	NPBCH	Narrowband broadcast channel
1	• NPDSCH SIB1-NB • NPDCCH • NPDSCH	• If MIB (including SFN) > "On", one NPDSCH that carries the SIB1-NB message is automatically configured If MIB (including SFN) > "Off", NPDCCH is configured • If Distance from NPDCCH to NPDSCH > "Zero", because NPDSCH SIB1-NB and NPDCCH are not transmitted
> 1	• NPDCCH • NPDCCH and NPSCH	Allocated automatically, depending on the current DCI configuration, Chapter 5.3.2.2, "NB-IoT DCI Configuration", on page 351: • One narrowband DL control channel per active NB-IoT user, see "Configure User" > 3GPP Release • One pair per paging and random access RNTI

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONType?` on page 805

Modulation
All DL NB-IoT channels are QPSK modulated.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:MODulation?` on page 805

Enhanced Settings > Config
Accesses the precoding, scrambling and channel coding settings of the selected channel, see:
- Chapter 5.3.2.4, "NPBCH Channel Coding and MIB-NB Configuration", on page 369
- Chapter 5.3.2.5, "NPDSCH and NPDCCH Channel Coding and Scrambling", on page 372

Suframe List
Indicates the subframes in that the channel is allocated.

The subframes are calculated depending on the duplexing mode, the channel type, the number of repetitions and the valid subframes, see "Valid Subframes" on page 345.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SFList?` on page 806

Start Symbol
Indicates the first symbol (I_{Start}) in a subframe where NB-IoT channels can be allocated.

Table 5-29: Start symbol I_{Start}

Channel	Data	Start symbol $I_{NDPCCHStart}$	Mode
NPBCH	MIB	• 3 *)	• Regardless
NPDCCH	any	• 1, 2, 3 • 0	• "In-band" • "Guard Band"/ "Standalone"
NPDSCH	• SIB1-NB • other	• 3 *) • 1, 2, 3 0	• Regardless • "In-band" "Guard Band"/ "Standalone"

*) To avoid collisions with control information in the LTE system, NPBCH and NPDSCH carrying SIB-NB are allocated after the LTE PDCCH control region.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STSYmbol` on page 806

Phys. Bits
Displays the allocation size in bits ($N_{PhysBits}$).

For QPSK modulation, the allocated number of bits is calculated as follows:

Number of Physical Bits = 2*Number of RE per PRB or

$N_{PhysBits} = 2*N_{RE}$

Where:
- N_{RE} are number of available resource elements RE per resource blocks PRB after the "Start Symbol" and excluding reference RE reserved for LTE CRS and NRS.
- For NPDSCH, N_{RE} is N_{RE}^{NPDSCH} is selected form Table 5-30.
- For NPDCCH format 0 with one NCCE, N_{RE} is $2*N_{RE}^{NPDCCH,0} = N_{RE}^{NPDSCH}$
- For NPDCCH format 1 with two NCCEs), N_{RE} is $N_{RE}^{NPDCCH,1} = N_{RE}^{NPDSCH}$

Table 5-30: Number of available resource elements RE per resource blocks PRB (N_{RE}) after the Start Symbol $I_{NDPCCHStart}$

Mode	Number of NB APs (NB-IoT MIMO Configuration)	Number of LTE APs ("Global MIMO Configuration")	$I_{NDPCCHStart} = 0$	$I_{NDPCCHStart} = 1$	$I_{NDPCCHStart} = 2$	$I_{NDPCCHStart} = 3$
Guard Band/ Standalone	1 2	0	160 152	-	-	-
In-band	1	1	-	142	130	118
	1	2	-	136	124	112
	1	4	-	128	120	108
	2	1	-	134	122	110
	2	2	-	128	116	104
	2	4	-	120	112	100

NPBCH carries 200 bits per frame.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PHYSbits? on page 806

Data Source
Indicates the data source depending on the "Content Type".

The data source can be changed in the following cases:
- For NPDSCH allocations that are configured for "NB-IoT DCI Config > User = P-RNTI or RA-RNTI"
- If "NPBCH > Enhanced Settings > Config > Channel Coding = Off"
- For the NPDSCH SIB1-NB allocation
  Use this function to load data lists as source for the SIB messages.

The following standard data sources are available:
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DATA on page 807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DSELect on page 807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PATTern on page 807

ρ A
Sets the power P_{NPBCH}, P_{NPDCCH} or P_{NPDSCH} (ρ A) of the selected allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:POWer on page 807

State
Indicates that the allocation is active.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STATe? on page 808

Conflict
Indicates a conflict between allocations.

If conflict occurs, change used NCCE index and the change starting subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONFlict?` on page 808

5.3.2.4 NPBCH Channel Coding and MIB-NB Configuration

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > NB-IoT Allocation".
3. Select "NPBCH > Enchanced Settings > Config".

NPBCH can be generated in one of the following modes:

- Without channel coding, if "Channel Coding > State > Off"
  Dummy data or user-defined data lists are used.
- Channel coding with arbitrary transport block content
  If channel coding is activated ("Channel Coding > State > On") and parameter "MIB (including SFN) > Off"
- Channel coding with real data (MIB-NB) including SFN
  If channel coding and "MIB (including SFN)" are activated
  This mode is required for the generation of SIB1-NB message.

Settings:

Precoding settings....369
└ Precoding Scheme....369
└ Number of Layers....370
Scrambling settings....370
└ NPBCH Symbol Rotation....370
Channel coding settings....370
└ Channel Coding State....370
└ Number of Physical Bits....370
└ MIB (including SFN)....370
└ SFN Offset....370
└ Scheduling SIB1....371
└ NPDSCH repetition carrying SIB1....371
└ NCell ID....371
└ Starting Frame carrying SIB1....371
└ MIB Spare Bits....372
└ Transport Block Size/Payload (DL)....372

Precoding settings
Access: select "Frame Configuration > NB-IoT Allocation > NPBCH > Enchanced Settings > Config > Precoding".

Precoding Scheme ← Precoding settings
Selects the precoding scheme.

"None" Disables precoding.

"Tx Diversity"

If NB-IoT MIMO Configuration = "2 Tx Antennas", select precoding for transmit diversity.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:SCHeme
on page 809

Number of Layers ← Precoding settings
Displays the number of layers for the selected allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:NOLayers?
on page 809

Scrambling settings
Access: select "Frame Configuration > NB-IoT Allocation > NPBCH > Enchanced Settings > Config > Scrambling".

NPBCH Symbol Rotation ← Scrambling settings
Enables NPBCH scrambling with symbol rotation, as specified in LTE Rel. 13.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:SROT
on page 810

Channel coding settings
Access: select "Frame Configuration > NB-IoT Allocation > NPBCH > Enchanced Settings > Config > Channel Coding".

Channel Coding State ← Channel coding settings
Enables channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:STATe
on page 810

Number of Physical Bits ← Channel coding settings
Indicates the calculated number of physical bits; resembles the information displayed with parameter Phys. Bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PHYSbits? on page 806

MIB (including SFN) ← Channel coding settings
Enables transmission of real MIB (master information block) data. The SFN (system frame number) is included as well.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MIB on page 812

SFN Offset ← Channel coding settings
By default, the counting of the SFN (system frame number) starts with 0. This parameter sets a different start SFN value.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SOFFset on page 813

Scheduling SIB1 ← Channel coding settings
Sets the parameter schedulingInfoSIB1 that defines the NPDSCH number of repetitions N_{Rep}^{NPDSCH}, see NPDSCH repetition carrying SIB1.

Table 5-31: Number of repetitions N_{Rep}^{NPDSCH} for NPDSCH carrying SIB1-NB

schedulingInfoSIB1	0	1	2	3	4	5	6	7	8	9	10	11	12 to 15
N_{Rep}^{NPDSCH}	4	8	16	4	8	16	4	8	16	4	8	16	reserved

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SIB on page 813

NPDSCH repetition carrying SIB1 ← Channel coding settings
Indicates the number of NPDSCH repetitions, if this NPDSCH carries SIB1-NB (see Table 5-31).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:RSIB? on page 812

NCell ID ← Channel coding settings
Indicates the NCell ID N_{ID}^{Cell}, as selected with the parameter NCell ID.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:NCID? on page 812

Starting Frame carrying SIB1 ← Channel coding settings
Indicates the first frame in that the NPDSCH transmission carrying SIB1-NB is allocated.

The value is calculated for the selected NPDSCH repetition carrying SIB1 and NCell ID.

N_{Rep}^{NPDSCH}	N_{ID}^{Cell}	Starting frame for SIB1-NB repetitions
4	N_{ID}^{Cell} mod 4 = 0	0
4	N_{ID}^{Cell} mod 4 = 1	16
4	N_{ID}^{Cell} mod 4 = 2	32
4	N_{ID}^{Cell} mod 4 = 3	48
8	N_{ID}^{Cell} mod 2 = 0	0
8	N_{ID}^{Cell} mod 2 = 1	16
16	N_{ID}^{Cell} mod 2 = 0	0
16	N_{ID}^{Cell} mod 2 = 1	1

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:STFSib1? on page 813

MIB Spare Bits ← Channel coding settings
Sets the 11 spare bits in the NPBCH transmission.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MSPare on page 812

Transport Block Size/Payload (DL) ← Channel coding settings
Displays the size of the transport block/payload in bits.

For NPBCH, the transport block size is always 34 bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSize?
on page 811

5.3.2.5 NPDSCH and NPDCCH Channel Coding and Scrambling

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > NB-IoT Allocation".
3. Select "NPDSCH/NPDCCH > Enchanced Settings > Config".

   Access settings of "Precoding", "Scrambling" and "Channel Coding".

Settings:

Precoding settings....372
└ Precoding Scheme....372
└ Number of Layers....373
Scrambling settings....373
└ Scrambling State....373
└ UE ID/n_RNTI....373
Channel coding settings....373
└ Channel Coding State....373
└ Number of Physical Bits....373
└ Number of NPDSCH Subframes (N_{SF})....374
└ Resource Assignment Field (I_{SF})....374
└ Transport Block Size Index (I_{TBS})....374
└ Transport Block Size/Payload (DL)....374

Precoding settings
Access: select "Frame Configuration > NB-IoT Allocation > NPDSCH > Enchanced Settings > Config > Precoding".

Precoding Scheme ← Precoding settings
Selects the precoding scheme.

"None" Disables precoding.

"Tx Diversity" If NB-IoT MIMO Configuration = "2 Tx Antennas", select precoding for transmit diversity.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:SCHeme
on page 809

Number of Layers ← Precoding settings
Displays the number of layers for the selected allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:NOLayers?
on page 809

Scrambling settings
Access: select "Frame Configuration > NB-IoT Allocation > NPDSCH > Enchanced Settings > Config > Scrambling".

Scrambling State ← Scrambling settings
Enables scrambling.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:STATe
on page 809

UE ID/n_RNTI ← Scrambling settings
Indicates the user equipment identifier (n_RNTI) or UE ID of the user to which the NPDSCH transmission is intended. The displayed "UE ID/n_RNTI" value is used to calculate the scrambling sequence.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:UEID?
on page 810

Channel coding settings
Access: select "Frame Configuration > NB-IoT Allocation > NPDSCH > Enchanced Settings > Config > Channel Coding".

Channel Coding State ← Channel coding settings
Enables channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:STATe
on page 810

Number of Physical Bits ← Channel coding settings
Indicates the calculated number of physical bits; resembles the information displayed with parameter Phys. Bits.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PHYSbits? on page 806

Number of NPDSCH Subframes (N_{SF}) ← Channel coding settings
Indicates the value calculated from the current DCI configuration.

See:
- "NPDSCH scheduling" on page 333
- E.g. "DCI Format N1" on page 357

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:NSF?` on page 811

Resource Assignment Field (I_{SF}) ← Channel coding settings
Indicates the value calculated from the current DCI configuration.

See:
- "NPDSCH scheduling" on page 333
- E.g. "DCI Format N1" on page 357

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:ISF?` on page 810

Transport Block Size Index (I_{TBS}) ← Channel coding settings
Sets the transport block size index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSI` on page 811

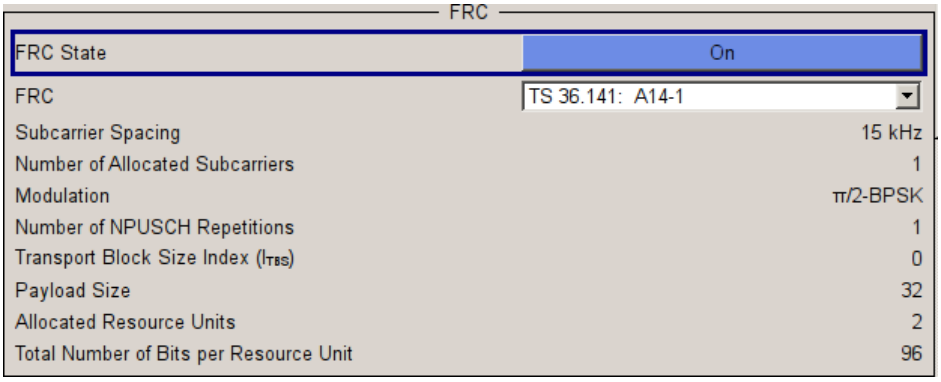
Transport Block Size/Payload (DL) ← Channel coding settings
Displays the size of the transport block/payload in bits for the current Transport Block Size Index (I_{TBS}).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSize?`
on page 811

5.3.3 FRC Settings

Access:

1. Select "General > UL Frame Configuration > UE x > 3GPP Release = NB-IoT".
2. Select "UE x > FRC".



This dialog provides a quick configuration of the predefined fixed reference channels (FRC) according to:

- TS 36.141, Annex A "Reference measurement channels"
- TS 36.521, Annex A "Measurement channels".

If "FRC" is enabled, several parameters are predefined and their values are displayed as read-only values.

Settings:

FRC State 375
FRC 375
Subcarriers Spacing 376
Number of Allocated Subcarriers 376
Modulation 376
Number of NPUSCH Repetitions 376
Transport Block Size Index I_{TBS} 376
Payload Size 376
Allocated Resource Units 377
Total Number of Bits per Resource Unit 377

FRC State
Enables FRC configuration.

If "FRC" is enabled, several parameters are predefined and their values are displayed as read-only values. To reconfigure any of these parameters, disable the FRC configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:STATe` on page 860

FRC
Selects a predefined fixed reference channel according to TS 36.141 or to TS 36.521.

3GPP specifies the FRCs for a specific channel bandwidth (i.e. number of resource blocks). Depending on the current configuration, some FRCs are not listed.

Table 5-32: Supported FRCs from 3GPP TS 36.141

FRC	Description
A14_1 to A14_4	FRC for NB-IOT reference sensitivity (π/2 BPSK, R=1/3)
A15_1 to A15_2	FRC for NB-IoT dynamic range (π/4 QPSK, R=2/3)
A16_1 to A16_5	FRC for NB-IoT NPUSCH format 1

Table 5-33: Supported FRCs from 3GPP TS 36.521-1

FRC (Duplexing = FDD)	FRC (Duplexing = TDD)	Description
A.2.4	-	Reference channels for category NB1

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TYPE` on page 860

Subcarriers Spacing
Displays the subcarrier spacing.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:SCSPacing?` on page 862

Number of Allocated Subcarriers
Displays the number of the allocated subcarriers.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NOSCarriers?` on page 861

Modulation
Displays the modulation for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:MODulation?` on page 861

Number of NPUSCH Repetitions
Displays the number of NPUSCH repetitions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NNPRep` on page 861

Transport Block Size Index I_{TBS}
Displays the transport block size index I_{TBS}.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TBSSindex?` on page 862

Payload Size
Displays the payload size for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:PASize?` on page 861

Allocated Resource Units
Displays the total number of physical bits available for the NPUSCH allocation per resource unit.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:ALResunits?` on page 860

Total Number of Bits per Resource Unit
Displays the total number of physical bits available for the NPUSCH allocation per resource unit.

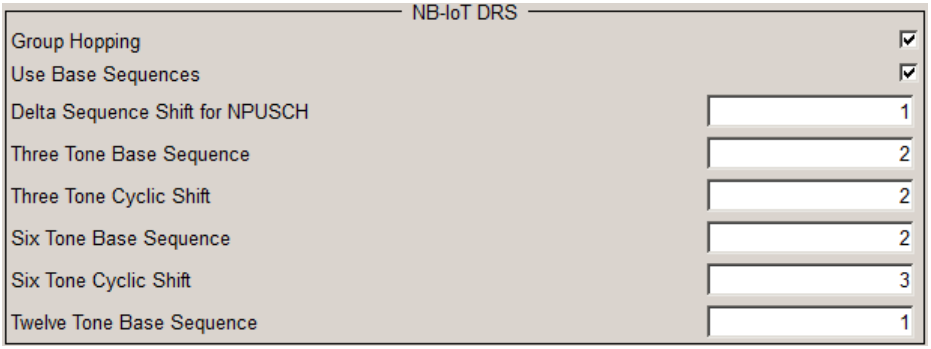
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:BPResunit?` on page 860

5.3.4 NDRS Settings

Access:

1. Select "General > General UL Settings > Signals".

   The NDRS settings are grouped in the "NB-IoT DRS" section.



2. To configure the NDRS setting per UE, select "EUTRA/LTE > Frame Configuration > General > UE1".
3. Select "User Equipment Configuration > NDRS".

   You can boost the NDRS signal compared to the NPUSCH allocation and disable the NPUSCH group hopping for a particular UE.

   The NDRS allocation, both as slot assignment and duration, depends on the NPUSCH allocation of the particular UE. In particular, it depends on the NPUSCH format per allocation and the subcarrier spacing.
   - To configure the NPUSCH allocation, select "User Equipment Configuration > NB-IoT Allocation".
   - To observe the NDRS allocation, including duration and slot assignment, select "EUTRA/LTE > Frame Configuration > Time Plan".
     Select "View Mode = Single RB" and select the resource block index used in the "NB-IoT Allocation" dialog.

NDRS settings:

NB-IoT DRS general settings....378
└ Group Hopping....378
└ Delta Sequence Shift for NPUSCH....378
└ Three/Six-Tone Cyclic Shift....378
└ Use Base Sequences....378
└ Three/Six/Twelve-Tone Base Sequence....378
UE-specific NDRS settings....379
└ Disable Group Hopping....379

NB-IoT DRS general settings
The following are the NDRM settings, common to all UEs. They are related to NDRS generation and hopping.

Group Hopping ← NB-IoT DRS general settings
Enables group hopping (`groupHoppingEnabled`) for the uplink demodulation reference signal (DRS).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:GHOPping` on page 845

Delta Sequence Shift for NPUSCH ← NB-IoT DRS general settings
Sets the delta sequence shift α for NPUSCH required for the calculation of the group hopping pattern.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:DSEQshift` on page 845

Three/Six-Tone Cyclic Shift ← NB-IoT DRS general settings
Sets the higher layer parameters `threeTone-CyclicShift` and `sixTone-CyclicShift`.

In combination with the base sequence, these parameters define the sequence with which the demodulation reference signal (NDRS) is transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTCShift` on page 846
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STCShift` on page 846

Use Base Sequences ← NB-IoT DRS general settings
Enables using base sequences for the generation of the NB-IoT DRS sequence hopping pattern.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:USEBase` on page 846

Three/Six/Twelve-Tone Base Sequence ← NB-IoT DRS general settings
Sets the higher layer parameters `threeTone-BaseSequence`, `sixTone-BaseSequence`, and `twelveTone-BaseSequence`. They define the base sequence with which the demodulation reference signal (NDRS) is transmitted.

Each of the three sequences is used in case the signal is modulated onto three, six or 12 carriers.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTBSequence on page 846
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STBSequence on page 847
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TWBSequence on page 847

UE-specific NDRS settings
With the provided settings, you can boost the NDRS signal compared to the NPUSCH allocation or disable the NPUSCH group hopping for the particular UE.

Disable Group Hopping ← UE-specific NDRS settings
NDRS group hopping is not applied for the selected UE.

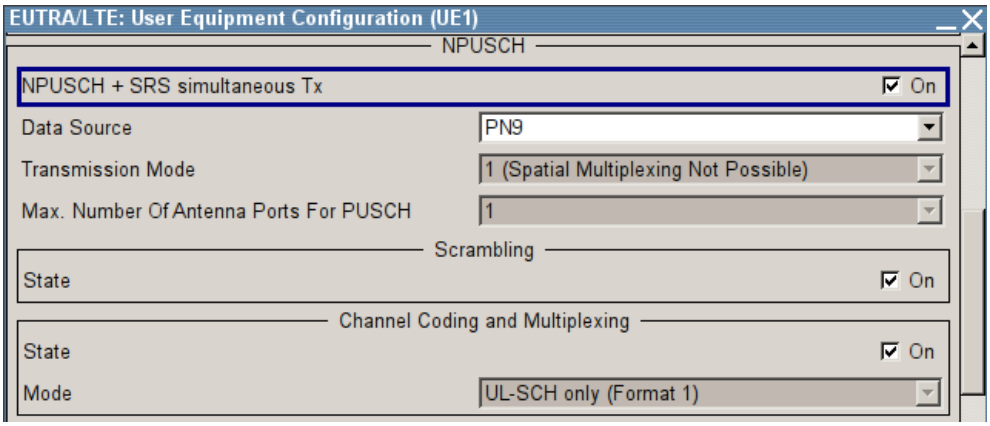
This parameter works like sending the higher-level parameter `groupHoppingDisabled`.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:GHDisable on page 852

5.3.5 NPUSCH Settings

Access:

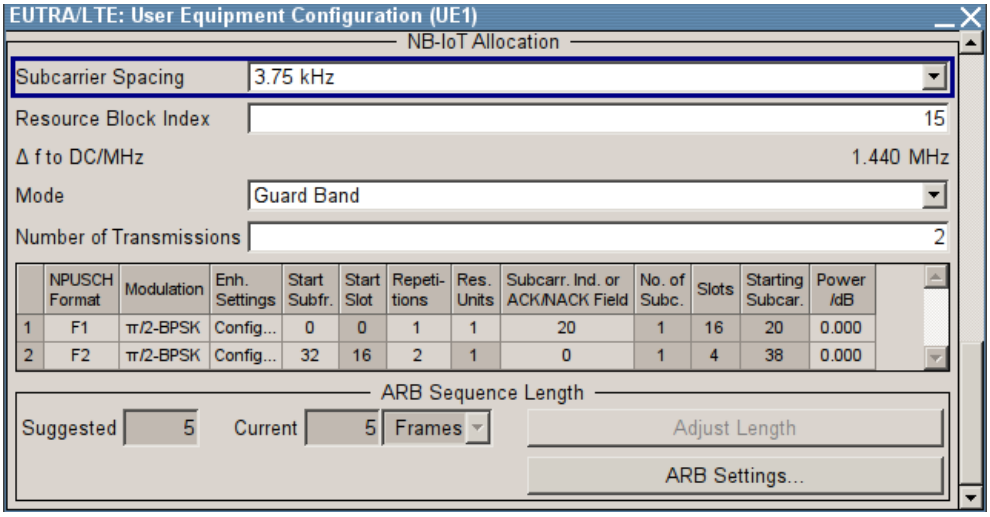
1. Select "General > UL Frame Configuration > UE x > 3GPP Release = NB-IoT".
2. Select "UE x > NPUSCH".



The provided settings are the same as for LTE, expect that NB-IoT does not support MIMO.
Hence, the "Transmission Mode = TM 1" and "Max. Number of AP for PUSCH = 1".
You can enable NPUSCH scrambling and channel coding and multiplexing, where the multiplexing mode is selected automatically, depending on the NPUSCH format. (See "NPUSCH formats" on page 335).

3. To configure the **NPUSCH transmission per UE**, select "Frame Configuration > UE x > NB-IoT Allocation"

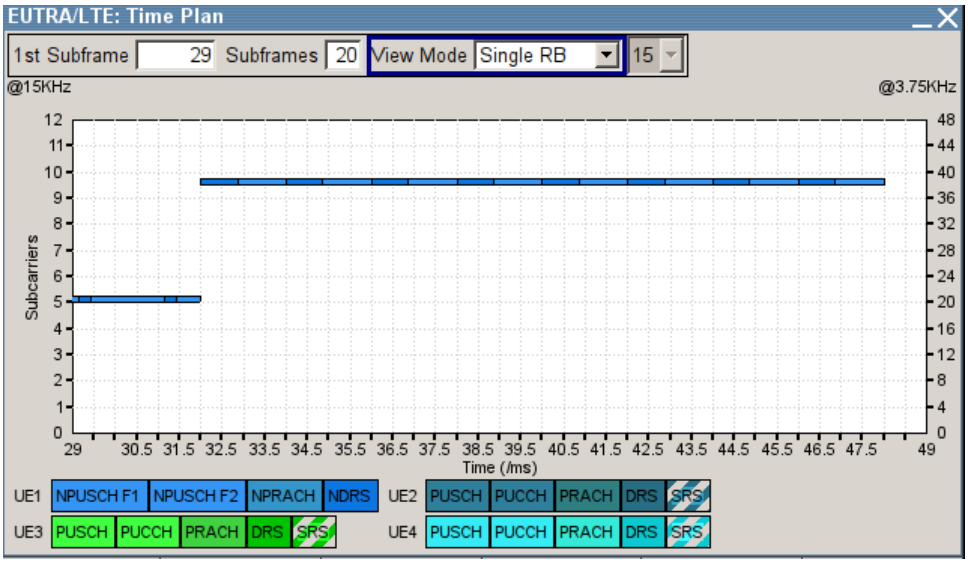
   Other than in LTE, in NB-IoT the NB-IoT allocations (NPUSCH and NDRS) are configured per UE.



The NB-IoT allocation is individual per UE, in terms of subcarrier spacing, operating mode and used resource block. There can be up to 10 NPUSCH transmissions per UE, each of them using different NPUSCH format and occupying different resources in the time and in the frequency domain.

4. In the "NB-IoT Allocation" table, select "Transmission # > Enhanced Settings > Config" to configure the channel coding and multiplexing of an NB-IoT allocation.
See Chapter 5.3.5.2, "NPUSCH Enhanced Settings", on page 386.

5. To observe the NPUSCH allocations, select "EUTRA/LTE > Frame Configuration > Time Plan".
To zoom in and display a particular resource block, select "View Mode = Single RB".
Select the resource block index used in the "NB-IoT Allocation" dialog.

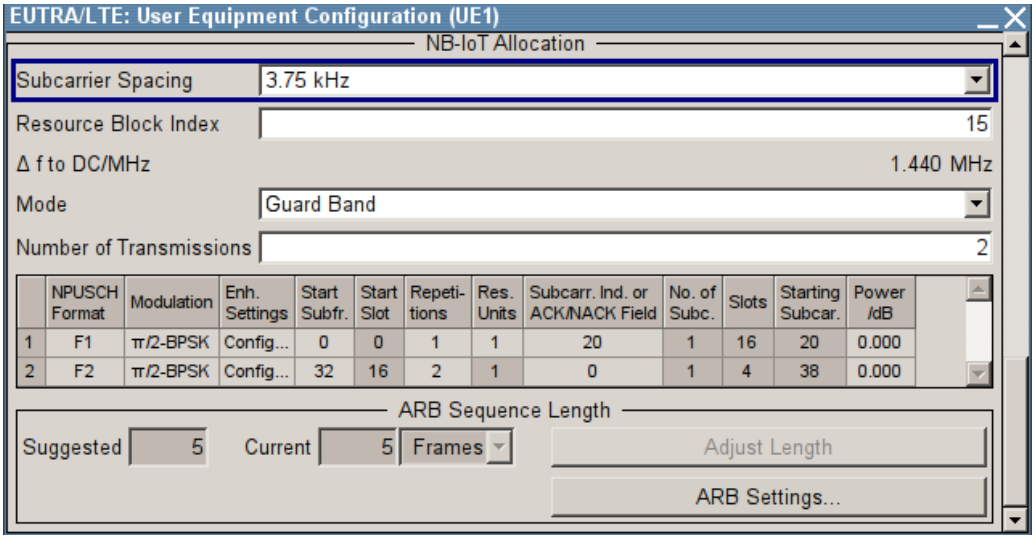


Settings:

- NB-IoT Allocation Settings 381
- NPUSCH Enhanced Settings 386

5.3.5.1 NB-IoT Allocation Settings

Access: see Chapter 5.3.5, "NPUSCH Settings", on page 379.



Settings:

Subcarrier Spacing 382
Resource Block Index 382
Delta Frequency to DC, MHz 382
Mode 383
Number of Transmissions 383
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Starting Subframe (SF) 383
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Repetitions 384
Number of Resource Units N_{RU} 384
Subcarrier Indication or ACK/NACK Resource Field 384
Number of Subcarriers 384
Slots 385
Starting Subcarrier 385
Power, dB 385
ARB Sequence Length 385
- Suggested 385
- Current 386
- Adjust Length 386
- ARB Settings 386

Subcarrier Spacing
Sets the subcarrier spacing Δf per UE.

See also Table 5-14.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:SCSPacing` on page 853

Resource Block Index
Sets the resource block number in that the NB-IoT transmissions are allocated.

The available resource blocks depend on the used "Channel Bandwidth" (or "Number of Available Resource Blocks") and the operating "Mode".

Table 5-34: Resource block index value ranges

Operation mode	Resource block allocation	Value range
In-band	Within the "Channel Bandwidth"	0 to "Number of Available Resource Blocks"
Guard band	Left guard band	< 0
	Right guard band	> "Number of Available Resource Blocks"

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:RBINdex` on page 853

Delta Frequency to DC, MHz
In "Mode > In-band/Guardband", indicates the delta frequency with that the NB-IoT carrier is offset form the LTE center frequency.

The value depends on "Resource Block Index" and in in-band mode and per default in the guardband mode it is calculated as follows:

"Delta Frequency" = $\Delta f_{NB\text{-}IoT}$*("RB Index"*N_{SC}^{RB} - floor(N_{RB}^{UL}*N_{SC}^{RB}/2) + N_{SC}^{RB}/2)

Where:
- $\Delta f_{NB\text{-}IoT}$ = "Subcarrier Spacing" = 15 kHz or 3.75 kHz is the NB-IoT subcarrier spacing
- N_{RB}^{UL} is the "Number of Resource Blocks per Slot"
- N_{SC}^{RB} = 12 is the number of subcarriers per RB

Thus, the possible values for the center frequencies of the NB-IoT channels are at 180 kHz offset to each other. In guard band mode, the you can change this spacing and set different "Delta Frequency to DC". If the set value does not correspond to a valid RB index, than the "RB Index = User".

According to the specification, the center frequencies of the NB-IoT channels in guard band mode must satisfy the following conditions:
- The first allocated NB-IoT RB must be orthogonal to the LTE RBs, whereas the following NB-IoT can be at 180 kHz or 15 kHz offset.
- The center frequencies of the NB-IoT carriers must satisfy the EARFCN conditions and hence be an integer multiple of 100 kHz; a raster of ±2.5 kHz and ±7.5 kHz is allowed, too.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:DFReq` on page 853

Mode
Selects the operating mode, see Figure 5-5.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:MODE on page 853

Number of Transmissions
Enables up to 20 individual NPUSCH transmissions, where each transmission is configured in a separate row in the NPUSCH allocation table.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:NTRansmiss on page 854

NPUSCH Format
Sets the NPUSCH transmission format.

See "NPUSCH formats" on page 335.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:FORMat on page 854

Modulation
Selects the modulation scheme for the NPUSCH transmission.

The available modulation schemes depend on the NPUSCH format, see Table 5-19.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:MODulation
on page 854

Enhanced Setting > Config
Access dialogs with further channel coding and multiplexing settings.

The displayed settings depend on the selected NPUSCH format, see Chapter 5.3.5.2, "NPUSCH Enhanced Settings", on page 386

Starting Subframe (SF)
Sets the first subframe in that the NPUSCH transmission occurs and defines the NPUSCH position in the time domain.

Per default, each subsequent NPUSCH transmission of the same UE is allocated in the first possible SF following the end of the previous transmission. The following applies:

$StartSF_{NPUSCH,i+1} = StartSF_{NPUSCH,i} + (N_{Rep}^{NPUSCH,i} * N_{RU}^{NPUSCH,i} * N_{slot}^{RU}) + 1$

Use the "Time Plan" to observe the NPUSCH allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSFrame
on page 854

Starting Slot
Indicates the starting slot of the first subframe in that the NPUSCH transmission occurs.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSLot?
on page 856

Repetitions
Sets how many times an NPUSCH transmission is repeated (N_{Rep}^{NPUSCH}).

N_{Rep}^{NPUSCH} = {1, 2, 4, 8, 16, 32, 64, 128}

The value is set automatically, if an FRC is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:REPetitions
on page 855

Number of Resource Units N_{RU}
Sets the number of allocated resource units (N_{RU}^{NPUSCH}):

- For "NPUSCH Format = F1", N_{RU}^{NPUSCH} = {1, 2, 3, 4, 5, 6, 8, 10}
- For "NPUSCH Format = F2", N_{RU}^{NPUSCH} = 1

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NRUNits
on page 855

Subcarrier Indication or ACK/NACK Resource Field
Sets the parameter that defines the NPUSCH position in the frequency domain, see Table 5-35.

Table 5-35: Parameter name and value range as function of NPUSCH format and subcarrier spacing

NPUSCH format	Parameter	Δf = 3.75 kHz	Δf = 15 kHz
F1	Subcarrier indication field I_{SC}	0 to 47	0 to 18
F2	ACK/NACK resource field	0 to 15	0 to 15

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:SIRF on page 855

Number of Subcarriers
Display the allocated number of subcarriers (N_{SC}^{RU}).

- For "NPUSCH Format = F2" and for "NPUSCH Format = F1" with Δf = 3.75 kHz, n_{SC} = 1
- For "NPUSCH Format = F1" with Δf = 15 kHz, n_{SC} is calculated from the Subcarrier Indication Field I_{SC}.
  See Table 5-36

Table 5-36: Number of subcarriers (N_{SC}^{RU}) [TS 36.211]

Subcarrier indication field I_{SC}	Set of allocated subcarriers n_{SC}
0 to 11	I_{SC}
12	{0, 1, 2}

Subcarrier indication field I_{sc}	Set of allocated subcarriers n_{sc}
13	{3, 4, 5}
14	{6, 7, 8}
15	{9, 10, 11}
16	{0, 1, 2, 3, 4, 5}
17	{6, 7, 8, 9, 10, 11}
18	{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11}
19 to 63	reserved

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NSCarriers?`
on page 855

Slots
Indicates the allocated number of slots per RU N_{slot}^{RU}.

See Table 5-19.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NSLTs?` on page 856

Starting Subcarrier
Indicates the subcarrier number of the first subcarrier in the NPUSCH transmission.

The value is calculated automatically for the allocated "Number of Subcarriers" and according to Table 5-36.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSCarrier?`
on page 856

Power, dB
Sets the power of the NPUSCH transmission P_{NPUSCH} relative to the UE power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:POWer` on page 856

ARB Sequence Length
Comprises setting for automatic adjustment of the ARB sequence length.

Suggested ← ARB Sequence Length
- NB-IoT allocations:
  Indicates the ARB sequence length that is required for the selected NPUSCH transmissions.
- eMTC allocations:
  Number of frames required for the one complete transmission.
  The value is calculated as the sum of the Start_SF and n_{abs_SF}.

Use the "Adjust Length" function to apply the suggested value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:ARB:SUGGested?` on page 857
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:ARB:SUGGested?` on page 871

Current ← ARB Sequence Length
Indicates the current ARB sequence length.

Adjust Length ← ARB Sequence Length
Sets the ARB sequence length to the suggested value.

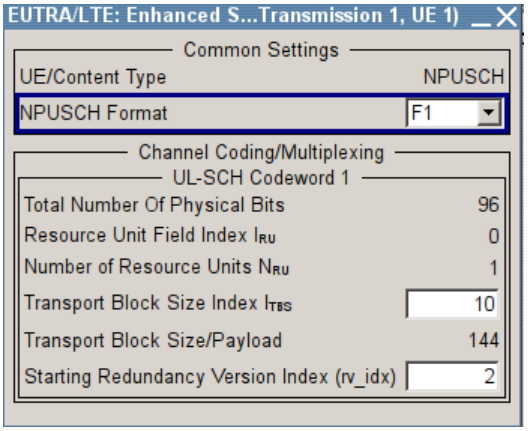
ARB Settings ← ARB Sequence Length
Opens the ARB dialog.

5.3.5.2 NPUSCH Enhanced Settings

Common....386
UL-SCH....386
└ Total Number of Physical Bits....387
└ Resource Unit Field Index I_{RU}....387
└ Number of Resource Units N_{RU}....387
└ Transport Block Size Index I_{TBS}....387
└ Transport Block Size/Payload....388
└ Starting Redundancy Version Idex (rv_ix)....388
Channel Coding / Multiplexing....388
└ Number of A/N Bits....388
└ ACK/NACK Pattern....388
└ Number of Coded A/N Bits....388

Common
The "Common" settings dialog indicates the type of the selected channel and allows you to set the NPUSCH format, see "NPUSCH Format" on page 383.

UL-SCH
For "NPUSCH Format = F1", the "UL-SCH" dialog comprises settings concerning the transport block size.



Total Number of Physical Bits ← UL-SCH
Indicates the number of physical bits of the selected NPUSCH transmission.

The value is calculated as described in "Physical dimension of the NPUSCH allocation" on page 336.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:PHYSbits?`
on page 858

Resource Unit Field Index I_{RU} ← UL-SCH
Indicates the resource unit (RU) field index I_{RU} selected depending on the used Number of RU N_{RU}^{NPUSCH}, see Table 5-37.

Table 5-37: RU field index [TS 36.213]

I_{RU}	N_{RU}^{NPUSCH}
0	1
1	2
2	3
3	4
4	5
5	6
6	8
7	10

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:RUINdex?`
on page 858

Number of Resource Units N_{RU} ← UL-SCH
Sets the number of allocated resource units (N_{RU}^{NPUSCH}):

- For "NPUSCH Format = F1", N_{RU}^{NPUSCH} = {1, 2, 3, 4, 5, 6, 8, 10}
- For "NPUSCH Format = F2", N_{RU}^{NPUSCH} = 1

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NRUNits`
on page 855

Transport Block Size Index I_{TBS} ← UL-SCH
Sets the transport block size index I_{TBS}.

The value is used to retrieve the Transport Block Size/Payload.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:TBINdex`
on page 859

Transport Block Size/Payload ← UL-SCH
Indicates the transport block size.

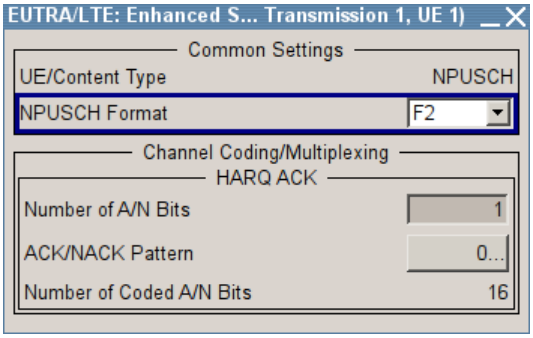
The value is retrieved form the selected I_{RU} (Resource Unit Field Index I_{RU}) and I_{TBS} (Transport Block Size Index I_{TBS}), as defined in TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:TBSize?`
on page 859

Starting Redundancy Version Idex (rv_ix) ← UL-SCH
Sets the starting redundancy version index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:RVINdex`
on page 859

Channel Coding / Multiplexing
For "NPUSCH Format = F2", the "Channel Coding / Multiplexing" dialog displays the predefined ACK/NACK configuration.



Number of A/N Bits ← Channel Coding / Multiplexing
NPUSCH format F2 uses 1 ACK/NACK bit.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:BITS?`
on page 857

ACK/NACK Pattern ← Channel Coding / Multiplexing
Set the ACK/ANCK pattern as a sequence of 0 and 1.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:PATTern`
on page 858

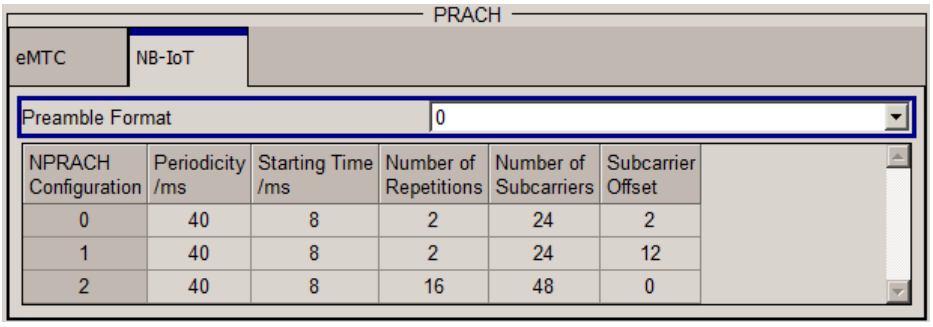
Number of Coded A/N Bits ← Channel Coding / Multiplexing
For NPUSCH format F2, the number of coded bits is 16.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:CBITs?`
on page 858

5.3.6 NPRACH Settings

Access:

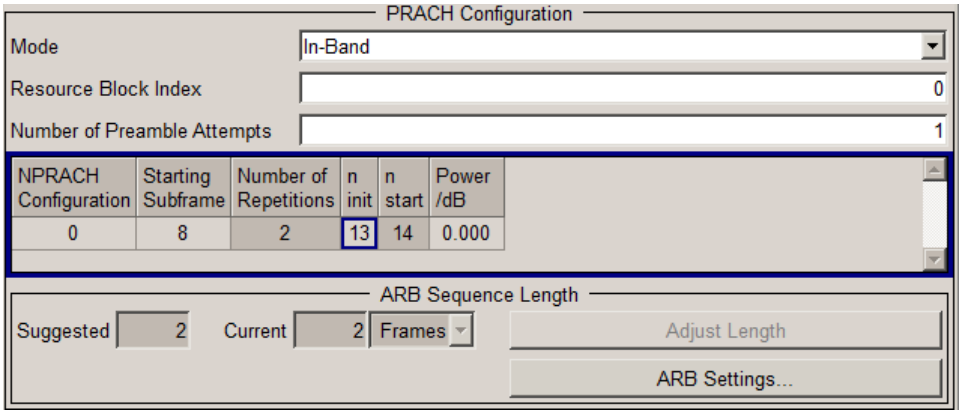
1. In the "General" dialog, select "Mode > eMTC/NB-IoT".
2. Select "Link Direction > Uplink (SC-FDMA)".
3. Select "General > General UL Settings > PRACH > NB-IoT".



NPRACH Configuration	Periodicity /ms	Starting Time /ms	Number of Repetitions	Number of Subcarriers	Subcarrier Offset
0	40	8	2	24	2
1	40	8	2	24	12
2	40	8	16	48	0

With the provided settings, you can configure three NPRACH configurations for the different coverage levels.
For description of the related settings, see "NB-IoT NPRACH configurations" on page 390.

4. To allocate the NPRACH for a specific UE, use the following parameters:
   a) Select "UL Frame Configuration > UE1 > 3GPP Release = NB-IoT".
   b) Select "UE1 > Settings > Common > Mode = PRACH".
   c) Select "NPRACH".



NPRACH Configuration	Starting Subframe	Number of Repetitions	n init	n start	Power /dB
0	8	2	13	14	0.000

You can change the number of preamble attempts, select one of the three NPRACH configurations and set the parameter n_{int} to define the start of the first symbol group.
For description of the related settings, see "NB-IoT NPRACH allocation per UE" on page 391.

5. If necessary, use the "Adjust Length" function to enable larger number of frames automatically so that the NPRACH frequency hopping pattern is completed.

6. Open the "Time Plan" to visualize the NPRACH allocation:
   a) Select "UL Frame Configuration > Time Plan".
   b) Select "View Mode > Single RB".
   c) Select the resource block index as configured in the "NPRACH" dialog. For example, select "RB = 24".
   d) Configure the subframes to be displayed, for example "1st Subframe = 0" and "Subframes = 20".

   The "Time Plan" shows the NPRACH.

NPRACH settings:

NB-IoT NPRACH configurations 390
└ Preamble Format 390
└ NPRACH configuration 391
└ Periodicity, ms 391
└ Starting Time, ms 391
└ Number of Repetitions 391
└ Number of Subcarriers 391
└ Subcarrier Offset 391
NB-IoT NPRACH allocation per UE 391
└ Mode 391
└ Resource Block Index 392
└ Delta Frequency to DC, MHz 392
└ Number of Preamble Attempts 392
└ NPRACH Configuration 393
└ Starting Subframe 393
└ Number of Repetitions 393
└ n_{int} 393
└ n_{start} 393
└ Power 393
ARB Sequece Length > Sugested 394

NB-IoT NPRACH configurations
Use the provided settings to configure three NPRACH configurations for the different coverage levels (CE).

See also:
- "NPRACH configuration" on page 337
- Example "NPRACH configuration" on page 338

The following parameters are specified in TS 36.211 as part of the SIB2-NB message:

Preamble Format ← NB-IoT NPRACH configurations
Select the preamble format.

The preamble formats use different cyclic prefix length, which results in different symbol group lengths.

To observe the influence of this parameter, use the "Time Plan".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:PFMT` on page 847

NPRACH configuration ← NB-IoT NPRACH configurations
Displays the NPRACH configuration number.

There are three NPRACH configurations, one per CE level. Each configuration is described with its time and frequency allocation and periodicity of occupancy.

Periodicity, ms ← NB-IoT NPRACH configurations
Sets the parameter $N_{periodicity}^{NPRACH}$ (`mprach-periodicity`).

It defines how often the NPRACH is scheduled. Available are periodicities between 40 ms and 2.56 s

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:PERD` on page 847

Starting Time, ms ← NB-IoT NPRACH configurations
Define the start time of the specific NPRACH configuration (`nprach-StartTime`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:STTM` on page 848

Number of Repetitions ← NB-IoT NPRACH configurations
Indicates the number of NPRACH repetitions per preamble attempt N_{rep}^{NPRACH} (`maxNumPreambleAttemptCE-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:REP` on page 848

Number of Subcarriers ← NB-IoT NPRACH configurations
Sets the number of NPRACH subcarriers N_{sc}^{NPRACH} (`nprach-NumSubcarrierres`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SUBC` on page 848

Subcarrier Offset ← NB-IoT NPRACH configurations
Sets the parameter $N_{scoffset}^{NPRACH}$ (`nprach-SubcarrierrOffset`) and defines the frequency location of the first NPRACH subcarrier.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SCOF` on page 848

NB-IoT NPRACH allocation per UE
Use this setting to can change the NPRACH allocation per UE, for example:
- The number of preamble attempts
- To select one of the three NPRACH configurations
- To set the parameter n_{int} to define the start of the first symbol group.

See also:
- "NPRACH configuration" on page 337
- Example "NPRACH configuration" on page 338

Mode ← NB-IoT NPRACH allocation per UE
Selects the operating mode, see Figure 5-5.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:MOD on page 862

Resource Block Index ← NB-IoT NPRACH allocation per UE
Defines the resource block in that the NPRACH is allocated.

The number of resource blocks depends on the selected "Channel Bandwidth" and is indicated with the parameter "UL General Settings > Physical > Number of Resource Blocks per Slot".

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:RBID on page 863

Delta Frequency to DC, MHz ← NB-IoT NPRACH allocation per UE
In "Mode > In-band/Guardband", indicates the delta frequency with that the NB-IoT carrier is offset form the LTE center frequency.

The value depends on "Resource Block Index" and in in-band mode and per default in the guardband mode it is calculated as follows:

"Delta Frequency" = $\Delta f_{NB\text{-}IoT}$*("RB Index"*N_{SC}^{RB} - floor(N_{RB}^{UL}*N_{SC}^{RB}/2) + N_{SC}^{RB}/2)

Where:
- $\Delta f_{NB\text{-}IoT}$ = "Subcarrier Spacing" = 15 kHz or 3.75 kHz is the NB-IoT subcarrier spacing
- N_{RB}^{UL} is the "Number of Resource Blocks per Slot"
- N_{SC}^{RB} = 12 is the number of subcarriers per RB

Thus, the possible values for the center frequencies of the NB-IoT channels are at 180 kHz offset to each other. In guard band mode, the you can change this spacing and set different "Delta Frequency to DC". If the set value does not correspond to a valid RB index, than the "RB Index = User".

According to the specification, the center frequencies of the NB-IoT channels in guard band mode must satisfy the following conditions:
- The first allocated NB-IoT RB must be orthogonal to the LTE RBs, whereas the following NB-IoT can be at 180 kHz or 15 kHz offset.
- The center frequencies of the NB-IoT carriers must satisfy the EARFCN conditions and hence be an integer multiple of 100 kHz; a raster of ±2.5 kHz and ±7.5 kHz is allowed, too.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:DFReq on page 863

Number of Preamble Attempts ← NB-IoT NPRACH allocation per UE
Sets the parameter N_{rep}^{NPRACH} (`maxNumPreambleAttemptCE-r13`) to define how many times a preamble is repeated.

Each attempt can use different NPRACH configuration and different NPRACH time and frequency allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:PRATtempts on page 862

NPRACH Configuration ← NB-IoT NPRACH allocation per UE
For each preamble attempt, selects one of the NPRACH configurations configured in the NB-IoT NPRACH configurations dialog.

Any subsequent preamble attempt must use an equal or bigger NPRACH configuration number as the previous one.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:CONFig` on page 863

Starting Subframe ← NB-IoT NPRACH allocation per UE
For each preamble attempt, select the subframe (SF) number the first NPRACH symbol group appears for the first time.

The available subframes depend on the selected NPRACH Configuration in the current and the previous preamble attempts.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:SFSTart` on page 864

Number of Repetitions ← NB-IoT NPRACH allocation per UE
Indicates the number of NPRACH repetitions per preamble attempt N_{rep}^{NPRACH} (`maxNumPreambleAttemptCE-r13`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:REP` on page 848

n_{int} ← NB-IoT NPRACH allocation per UE
For each preamble attempt, sets the subcarrier index n_{int}, see "NPRACH allocation" on page 337.

The available subcarriers depend on the number of subcarriers in the selected "NPRACH Configuration", see "Number of Subcarriers" on page 391.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:INIT` on page 864

n_{start} ← NB-IoT NPRACH allocation per UE
Indicates the value n_{start}, calculated as function of the selected n_{int}.

To observe the influence of this parameter, use the "Time Plan".

See "NPRACH allocation" on page 337 for details on the calculation and information on all related parameters.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:STRT?` on page 864

Power ← NB-IoT NPRACH allocation per UE
Sets the preamble attempt power relative to the UE power.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:POWer
on page 864

ARB Sequece Length > Sugested
Indicates the ARB sequence length that is required for the NPRACH configuration.

Use the "Adjust Length" function to apply the suggested value.

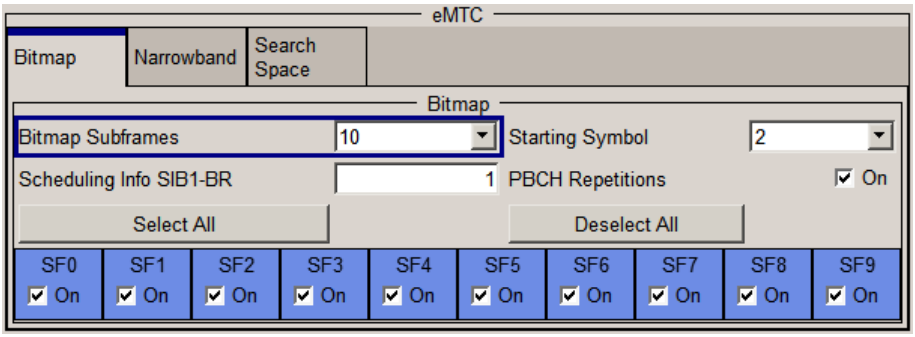
Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:ARB:SUGGested?
on page 865

5.3.7 eMTC DL Allocations Settings

5.3.7.1 eMTC DL Valid Subframes and Frequency Hopping

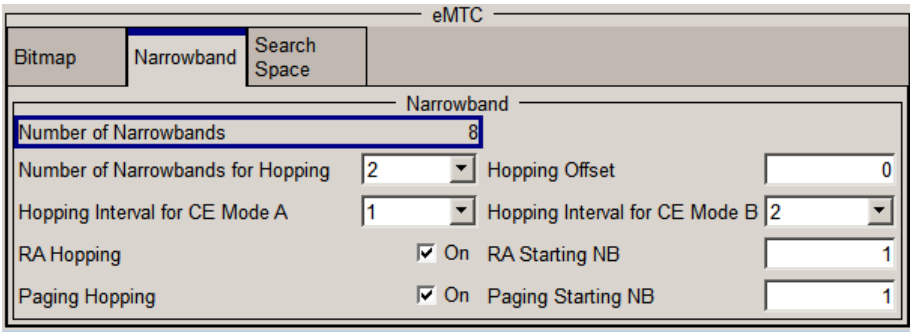
Access:

1. Select "General > Link Direction > Downlink".
2. Select "General > Duplexing > FDD".
3. Select "General DL Settings > eMTC > Bitmap".



4. To configure the subframes in that eMTC transmission can be allocated, select:
   a) "Bitmap Subframes = e.g. 10"
   b) A subframe (SF) to enable it for eMTC transmission.

   eMTC transmission is postponed during invalid subframes.
5. To define the cell-specific frequency hopping patterns of PDSCH and MPDCCH, select "eMTC > Narrowbands".



For description of the common search space settings, see Chapter 5.3.7.2, "Search Space Settings", on page 398.

Settings:

Bitmap....395
└ Bitmap Subframes....395
└ Starting Symbol....395
└ Scheduling Info SIB1-BR....396
└ PBCH Repetition....396
└ Select All/Deselect All....396
└ SF State....396
Narrowbands....396
└ Number of eMTC Narrorbands....396
└ Number of Narrowbands for Hopping....397
└ Hopping Offset....397
└ Hopping Interval for CE Mode A/B....397
└ RA Hopping....397
└ RA Starting NB....397
└ Paging Hopping....397
└ Paging Starting NB....397

Bitmap
Comprises general eMTC configuration settings, like defining the valid subframes (SF) that can be used for eMTC transmission, reserving a number of symbols for the LTE control region, enabling PBCH repetition.

Bitmap Subframes ← Bitmap
Sets the valid subframes configuration over 10ms or 40ms (`subframePattern10-r13, subframePattern40-r13`).

The selected subframes influence the scheduling of the eMTC transmissions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrames` on page 790

Starting Symbol ← Bitmap
Defines the first symbol within a frame that can be used for eMTC. The parameter is used to protect the LTE control region.

The LTE control region length and thus the eMTC start symbol depends on the channel bandwidth:

- For "Channel Bandwidth ≥ 3MHz": 1, 2 or 3 symbols
- For "Channel Bandwidth = 1.4 MHz": 2, 3 or 4 symbols

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:STARt` on page 790

Scheduling Info SIB1-BR ← Bitmap
Sets the higher-level parameter `schedulingInfoSIB1-BR-r13` and defines the number of times the PDSCH allocation carrying the SIB1-BR is repeated, see Table 5-5.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SIBBr` on page 791

PBCH Repetition ← Bitmap
For "Channel Bandwidth ≥ 3MHz", configures the cell for PBCH repetition.

If enabled, the PBCH is repeated as defined in TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:PBCHrep` on page 791

Select All/Deselect All ← Bitmap
Sets all SFs to valid or invalid SFs.

SF State ← Bitmap
Sets a SF as valid or invalid.

If TDD duplexing is used, the UL subframes cannot be used for eMTC transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrame<ch0>` on page 790

Narrowbands
Comprises settings for frequency hopping configuration.

Number of eMTC Narrorbands ← Narrowbands
Option: R&S SMBV-K115

This parameter is **dedicated to eMTC** and available if "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected.

It indicates the number of eMTC narrowbands N_{RB}^{DL} available within the selected channel bandwidth.

The value is calculated as follows:

"Number of Narrorbands" = "Number of Resource Blocks" / 6

For more information, see "Narrowbands" on page 310.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NNBands?` on page 781

Number of Narrowbands for Hopping ← Narrowbands
Set the parameter `mpdcch-pdsch-HoppingNB-r13` ($N_{NB,hop}^{ch,DL}$) and defines the number of narrowbands (2 or 4) over which MPDCCH or PDSCH hops.

See also "PDSCH hopping" on page 312.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOPPing` on page 791

Hopping Offset ← Narrowbands
Set the parameter `mpdcch-pdsch-HoppingOffset-r13` ($f_{NB,hop}^{DL}$) and defines the number of narrowbands between two consecutive MPDCCH or PDSCH hops.

See also "PDSCH hopping" on page 312.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOFFset` on page 791

Hopping Interval for CE Mode A/B ← Narrowbands
Set the parameter `interval-DLHoppingConfigCommon` ($N_{NB}^{ch,DL}$) and defines the number of consecutive subframes during which MPDCCH or PDSCH stays at the same narrowband before hopping to another narrowband.

Table 5-38: Hopping interval $N_{NB}^{ch,DL}$ value range per CE Mode

Duplexing	CE Mode A	CE Mode B
FDD	1, 2, 4, 8	2, 4, 8, 16
TDD	1, 5, 10, 20	5, 10, 20, 40

See also "PDSCH hopping" on page 312.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLA` on page 792
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLB` on page 792

RA Hopping ← Narrowbands
Enables hopping for the random access.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RHOPpping` on page 792

RA Starting NB ← Narrowbands
If "RA Hopping > On", sets the first used narrowband.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RSTNb` on page 792

Paging Hopping ← Narrowbands
Enables paging hopping.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PHOPping` on page 792

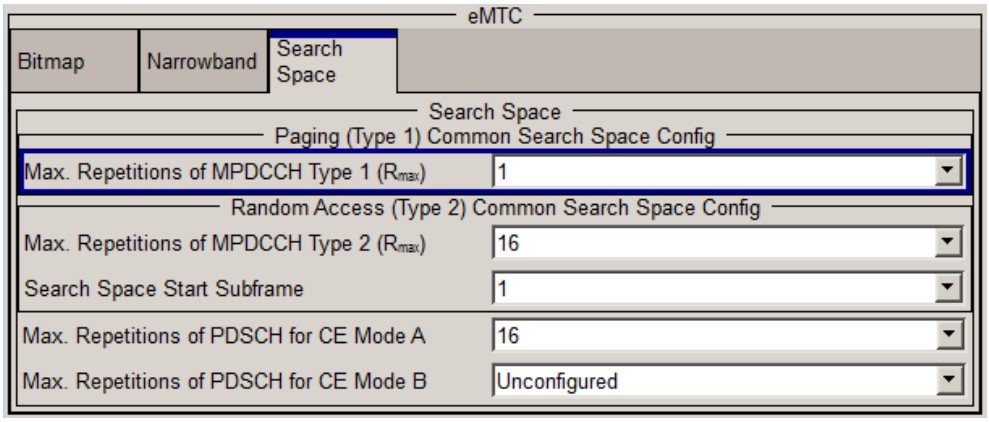
Paging Starting NB ← Narrowbands
If "Paging Hopping > On", sets the first used narrowband.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PSTNb on page 792

5.3.7.2 Search Space Settings

Access:

1. Select "General > Link Direction > Downlink".
2. Select "General DL Settings > eMTC > Search Space".
3. Select "Frame Configuration > General > General > Configure User > UEx > Search Space > Config".



Settings:

Common Search Space 398
└ Max. Repetitions of MPDCCH (Rmax) for Type 1 common search space ... 398
└ Max. Repetitions of MPDCCH (Rmax) for Type 2 common search space ... 399
└ Search Space Start Subframe 399
└ Max. Repetitions of PDSCH for CE Mode A/B 399

Common Search Space
Configures the Type 1 (paging) and Type 2 (random access) common search space.

The common search space defines the MPDCCH candidates that the UE has to monitor.

Max. Repetitions of MPDCCH (Rmax) for Type 1 common search space ← Common Search Space
Sets the maximum number MPDCCH is repeated R_{Max} (`mpdcch-NumRepetitionPaging-r13`).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD1 on page 793

Max. Repetitions of MPDCCH (Rmax) for Type 2 common search space ← Common Search Space
Sets the maximum number MPDCCH is repeated R_{Max} (`mpdcch-NumRepetitions-RA`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD2` on page 793

Search Space Start Subframe ← Common Search Space
Sets the start SF for the random access common search space (`mpdcch-StartSF-CSS-RA`).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:STSF` on page 793

Max. Repetitions of PDSCH for CE Mode A/B ← Common Search Space
Sets the cell-specific higher-layer parameter `pdsch-maxNumRepetitionCEmodeA`/ `pdsch-maxNumRepetitionCEmodeB` that defines the PDSCH subframe assignment, if the MPDCCH with DCI format 6-1A/6-1B/6-2 is detected.

- DCI format 6-1A: `pdsch-maxNumRepetitionCEmodeA` = {Unconfigured, 16, 32}
- DCI format 6-1B/6-2: `pdsch-maxNumRepetitionCEmodeB` = {Unconfigured, 192, 256, ..., 2048}

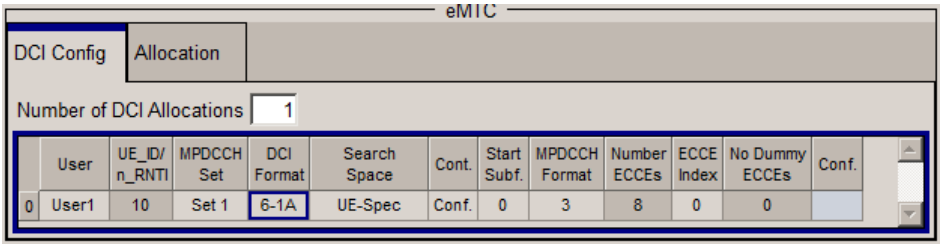
These parameters together with the DCI field PDSCH repetition number define the PDSCH repetitions, see "Repetition of PDSCH not carrying SIB1-BR" on page 311.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSA` on page 793
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSB` on page 793

5.3.7.3 eMTC DCI Configuration

Access:

1. Select "General > Link Direction > Downlink".
2. Enable at least one eMTC UE, i.e. select "Frame Configuration > General > General > Configure User > User 1" > **"3GPP Release = eMTC CE: A/B"**.
3. Select "Frame Configuration > Configure NB-IoT and eMTC > eMTC > DCI Configuration".
4. Select "Number of DCI Allocations = 1".
5. Configure the DCI allocations, e.g. select "User > User 1", "DCI Format = 6-1A" and "Start Subframe = 0".



6. For each DCI, select "Content > Config".

Settings:

Number of DCI Allocations....400
Allocation Wrap-around....401
User....401
UE_ID/n_RNTI....401
MPDCCH Set....401
DCI Format....401
Search Space....402
DCI Content Configuration....402
└ Bit Data....402
└ DCI Format 3/3A....402
└ DCI Format 6-0A/6-0B....403
└ DCI Format 6-1A/6-1B....404
└ DCI Format 6-2....407
└ Transport Block Size....408
└ Repetitions of MPDCCH....409
└ Repetitions of PDSCH....409
└ PDSCH Hopping....409
└ Starting Redundancy Version....409
Start Sufbrame....409
MPDCCH Format....409
Number ECCEs....409
ECCE Index....410
No. Dummy ECCEs....410
Conflict....410

Number of DCI Allocations
Sets up to 100 configurable DCIs.

There is one table row per DCI in the DCI table.

The default "Number of DCI Allocations" value depends on the availability of eMTC UEs:

- 0: if all "User" are set to NB-IoT.
  Changing the value to "Number of DCI Allocations = 1", enables you to configure P-RNTI or RA-RNTI DCIs.
- 1: if there is at least one "User" with "3GPP Release = eMTC CE: A/B".

Set "Number of DCI Allocations = 0" to disable the DCI-based eMTC configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:NALLoc` on page 816

Allocation Wrap-around
An MPDCCH can schedule a PDSCH outside of the selected "ARB Sequence Length".

Enable this parameter to ensure a consistent signal, where the PDSCH allocations are relocated at the beginning of the ARB sequence.

`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:AWARound` on page 816

User
Selects the user the DCI is dedicated to. The available DCI formats depend on the value of this parameter.

"User x" Selects one of the four users with "3GPP Release = eMTC CE: A/B", as configured in the "Frame Configuration > General > General > Configure User" dialog.

"P-RNTI/RA-RNTI"
A group of users is selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:USER` on page 816

UE_ID/n_RNTI
Displays the UE_ID of the "User x" or the n_RNTI for the selected DCI.

The UE_ID is set with the parameter "Frame Configuration > General > General > Configure User > User x" > UE ID/n_RNTI

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEID?` on page 816

MPDCCH Set
Selects the MPDCCH set by which the DCI is carried.

To enable the second set for "User = User x":
- Select "Frame Configuration > General > General > Configure User > User x > EPDCCH/MPDCCH > Config"
- Set "Set 2 > State > On".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MPDCchset`
on page 817

DCI Format
Sets the DCI format for the selected allocation.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in the UL and DL direction. It carries scheduling information and uplink power control commands.

Depending on the DCI message usage, they are categorized into the following formats: 3/3A, 6-0A/6-0B, 6-1A/6-1B, 6-2.

See Table 5-10.

To configure the parameters per DCI format, select "Content > Config".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:FMT` on page 817

Search Space
Defines the search space for the selected DCI.

The search space defines the MPDCCH candidates that the UE has to monitor. The UE can decode only the control information on an MPDCCH that is transmitted over ECCEs within the search space the UE monitors.

"UE-spec" Non-common DCIs are mapped to the UE-specific search space. Each UE has multiple UE-specific search spaces, determined as a function of its UE ID.

"Type 0 Common/Type 1 Common/Type 2 Common"
The DCI is mapped to the common search space, where:
- Type 1 common search space is used for paging
- Type 2 for random access
- Type 0 common search space is available for "User x > 3GPP Release = eMTC CE-Mode A".

A common search space is used to address all or a group of UEs.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SSP` on page 817

DCI Content Configuration
Configure the parameters per DCI format.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification.

The resulting Transport Block Size, Repetitions of MPDCCH, Repetitions of PDSCH, PDSCH Hopping and Starting Redundancy Version values are displayed.

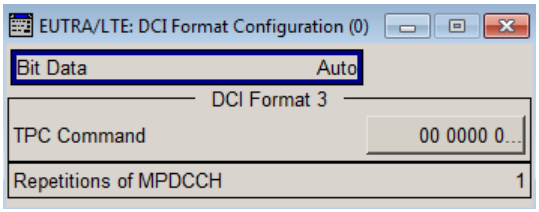
Bit Data ← DCI Content Configuration
Displays the resulting bit data as selected with the DCI format parameters.

The first bit in DCI formats pairs 6-0A and 6-1A, and 6-0B and 6-1B is used as flag to distinguish between the two formats in a pair. It is set as follows:
- DCI format 6-0A/6-0B: First bit = 0
- DCI format 6-1A/6-1B: First bit = 1

Mapping of the information bits is according to TS 36.212.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:BITS?` on page 819

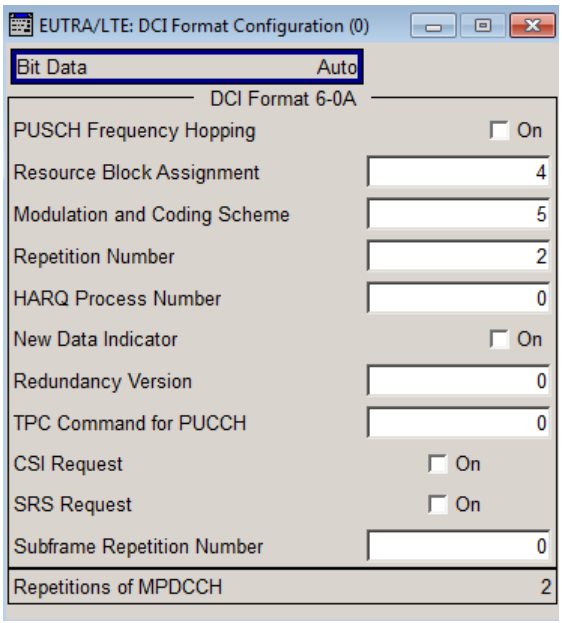
DCI Format 3/3A ← DCI Content Configuration
The DCI Format 3/3A is used for the transmission of TPC Commands for MPUCCH and PUSCH with 2-bit and a single bit power adjustment respectively.



The "TPC Command" is set as a bit pattern.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TCMD on page 821

DCI Format 6-0A/6-0B ← DCI Content Configuration
The DCI formats 6-0A and 6-0B are used for scheduling of PUSCH in one UL cell, where the formats are used in CE Mode A and CE Mode B respectively.



DCI format 6-0A and 6-0B transmit the information listed in Table 5-39.

Among other, these DCIs carry information on:

- "PUSCH Frequency Hopping": sets the hopping dynamically on a per transmission basis.
  This filed has higher priority as the cell-specific hopping configuration, see Chapter 5.3.8.1, "Cell-Specific eMTC PUSCH Settings", on page 426.
- "Repetition Number": sets the PUSCH repetition level (n_1 to n_4 or n_8 in DCI formats 6-0A and 6-0B)
- "DCI Subframe Repetition Number": sets the MPDCCH repetition level (r_1 to r_4), see "MPDCCH repetition number" on page 316.

Table 5-39: DCI format 6-0A and 6-0B control information fields

Control Information Field	SCPI command	Dependencies
"PUSCH Frequency Hopping"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PFRHopp on page 821	DCI Format 6-0A
"Resource Block Assignment"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA on page 821	See Table 5-40.
"Modulation and Coding Scheme"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MCS on page 822	
"Repetition Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NREP on page 822	"DCI Format 6-0A": 0 to 3 "DCI Format 6-0B": 0 to 7

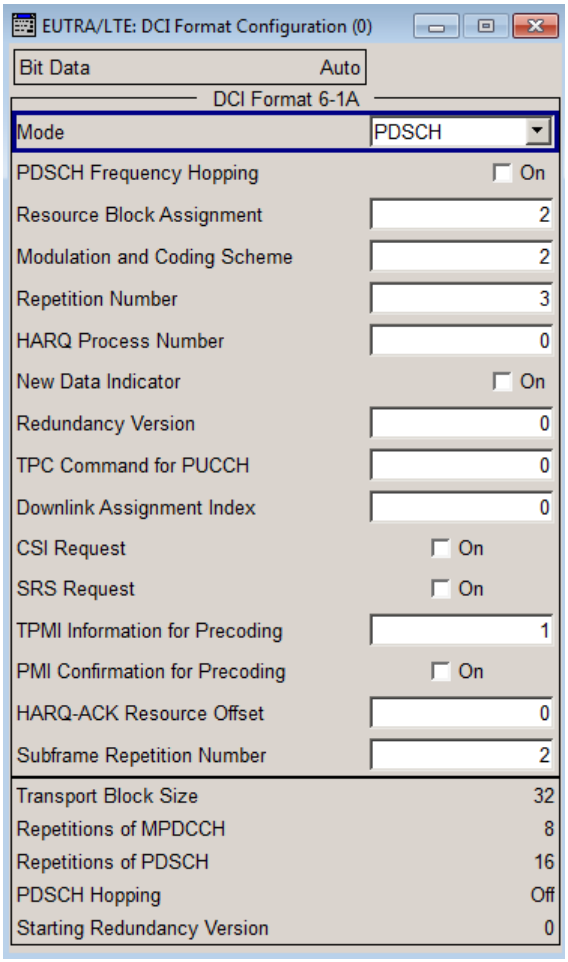
Control Information Field	SCPI command	Dependencies
"HARQ Process Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HARQ on page 822	"DCI Format 6-0A": 0 to 7 "DCI Format 6-0B": 0 to 1
"New Data Indicator"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDINd on page 823	
"Redundancy Version"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RVER on page 823	DCI Format 6-0A
"TPC Command for Scheduled PUSCH"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPCPusch on page 823	DCI Format 6-0A
"UL Index"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:ULINdex on page 824	DCI Format 6-0A TDD mode and "UL/DL Configuration = 0"
"Downlink Assignment Index (DAI)"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DAINdex on page 824	DCI Format 6-0A TDD mode and "UL/DL Configuration = 1 to 6"
"CSI Request"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CSIRequest on page 824	DCI Format 6-0A
"SRS Request"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SRSRequest on page 825	DCI Format 6-0A
"DCI Subframe Repetition Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SFRNumber on page 825	For "MPDCCH > Max. Repetitions for MPDCCH Rmax ≥ 2"

Table 5-40: Control information field Resource Block Assignment value range

Channel Bandwidth	DCI Format 6-0A	DCI Format 6-0B
1.4 MHz	0 to 31	0 to 7
3 MHz	0 to 63	0 to 15
5 MHz	0 to 127	0 to 31
10 MHz	0 to 255	0 to 63
15/20 MHz	0 to 511	0 to 127

In certain cases defined in TS 36.212, zeros are appended to the DCI format 6-0B until its payload size is equal to the size of DCI format 6-0A.

DCI Format 6-1A/6-1B ← DCI Content Configuration
DCI formats 6-1A and 6-1B are used for the compact scheduling of one PDSCH codeword in one cell and random access procedure initiated by a PDCCH order. The two formats are used in CE Mode A and CE Mode B respectively.



DCI format 6-1A and 6-1B transmit the information listed in Table 5-41 and Table 5-42, for PDSCH or PRACH mode respectively.

In certain cases defined in TS 36.212, zeros are appended to:

- DCI format 6-1A until its payload size is equal to the size of DCI format 6-0A
- DCI format 6-1B until its payload size is equal to the size of DCI format 6-0B.

Among other, these DCIs carry information on:

- "PDSCH Frequency Hopping": sets the hopping dynamically on a per transmission basis.
  This filed has higher priority as the cell-specific hopping configuration.
- "Repetition Number": sets the PDSCH repetition level (n_1 to n_4 or n_8 in DCI formats 6-0A and 6-0B), see "Repetition of PDSCH not carrying SIB1-BR" on page 311.
- "DCI Subframe Repetition Number": sets the MPDCCH repetition level (r_1 to r_4), see "MPDCCH repetition number" on page 316.
- "Resource Block Assignment": defines the PDSCH Start NB and No. RB

Table 5-41: Control information fields in Mode = PDSCH

Control Information Field	SCPI command	Dependencies
"Mode"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEMode on page 825	
"Frequency Hopping"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PFRHopp on page 821	DCI Format 6-1A
"Resource Block Assignment"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA on page 821	See Table 5-43.
"Modulation and Coding Scheme"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MCS on page 822	• DCI Format 6-1A: 0 to 15 • DCI Format 6-1B: 0 to 10
"Repetition Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NREP on page 822	
"HARQ Process Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HARQ on page 822	"User x" • FDD: 0 to 7 • TDD: 0 to 15
"New Data Indicator"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDINd on page 823	"User x"
"Redundancy Version"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RVER on page 823	DCI Format 6-1A
"TPC Command for PUCCH"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPCPusch on page 823	DCI Format 6-1A
"Downlink Assignment Index (DAI)"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DAINdex on page 824	DCI Format 6-1A "User x" TDD mode and "UL/DL Configuration = 1 to 6"
"Antenna Ports and Scrambling Identity"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:APSI on page 826	DCI Format 6-1A "User x" with "Tx Mode = TM9" and "Search Space = UE-specific"
"CSI Request"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CSIRequest on page 824	DCI Format 6-1A
"SRS Request"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SRSRequest on page 825	DCI Format 6-1A
"TPMI Information for Precoding"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPMPrec on page 826	DCI Format 6-1A "User x" with "Tx Mode = TM6" and "Search Space = UE-specific"

Control Information Field	SCPI command	Dependencies
"PMI Confirmation for Precoding"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PMIConfirm on page 826	DCI Format 6-1A "User x" with "Tx Mode = TM6" and "Search Space = UE-specific"
"HARQ-ACK Ressource Offset"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HRESoffset on page 826	"User x"
"DCI Subframe Repetition Number"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SFRNumber on page 825	For "MPDCCH > Max. Repetitions for MPDCCH Rmax ≥ 2"

Table 5-42: Control information fields in Mode = PRACH

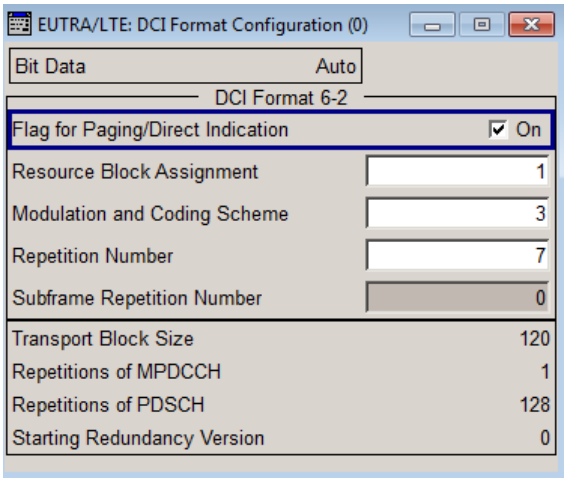
Control Information Field	SCPI command	Dependencies
"Mode"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEMode on page 825	
"Resource Block Assignment"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA on page 821	DCI Format 6-1A See Table 5-43.
"Preamble Index"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAPreamble on page 827	
"PRACH Mask Index"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAMask on page 827	
"Starting CE Level"	[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAStart on page 827	

Table 5-43: Control information field Resource Block Assignment value range

Channel Bandwidth	DCI Format 6-1A PDSCH and PRACH modes	DCI Format 6-1B
1.4 MHz	0 to 31	0 to 1
3 MHz	0 to 63	0 to 3
5 MHz	0 to 127	0 to 7
10 MHz	0 to 255	0 to 15
15/20 MHz	0 to 511	0 to 31

DCI Format 6-2 ← DCI Content Configuration

The DCI format 6-2 is used for paging and direct indication. It is available for "User = P-RNTI".



DCI format 6-2 transmits the following information.

Control Information Field	SCPI command	Dependencies
"Flag for Paging/ Direct Indication"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PAGNg` on page 828	
"Direct Indication Information"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DIINfo` on page 828	
"Modulation and Coding Scheme"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MCS` on page 822	
"Resource Block Assignment"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA` on page 821	Value range depends on the "Channel Bandwidth": • 1.4 MHz: 0 • 3 MHz: 0 to 1 • 5 MHz: 0 to 3 • 10 MHz: 0 to 7 • 15 MHz: 0 to 12 • 20 MHz: 0 to 15
"Repetition Number"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NREP` on page 822	See "Repetition of PDSCH not carrying SIB1-BR" on page 311.
"DCI Subframe Repetition Number"	`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SFRNumber` on page 825	For "MPDCCH > Max. Repetitions for MPDCCH Rmax ≥ 2"

Transport Block Size ← DCI Content Configuration
Indicates the TBS, calculated for the selected "Modulation and Coding Scheme" and "Resource Assignment Field".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TBS?` on page 819

Repetitions of MPDCCH ← DCI Content Configuration
Displays the resulting number of MPDCCH repetitions, calculated for the selected "DCI Subframe Repetition Number".

See "MPDCCH repetition number" on page 316.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPMpdcch?`
on page 820

Repetitions of PDSCH ← DCI Content Configuration
Displays the resulting number of PDSCH repetitions, calculated from the selected "Repetition Number".

See "Repetition of PDSCH not carrying SIB1-BR" on page 311.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPPdsch?`
on page 820

PDSCH Hopping ← DCI Content Configuration
Indicates if PDSCH hopping is enabled or not, as set with the DCI form 6-1A/B field "PDSCH Frequency Hopping".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDSHopping?`
on page 820

Starting Redundancy Version ← DCI Content Configuration
Indicates the starting RV, calculated from the value of the "Redundancy Version" field.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STRV?` on page 821

Start Sufbrame
Sets the next valid starting subframe for the particular MPDCCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STSFrame` on page 818

MPDCCH Format
Selects one of the five MPDCCH formats, where the available values depend on the "Search Space":

- "Search Space = UE-spec": MPDCCH formats 0 to 5
- "Search Space = Type 0 common": MPDCCH formats 2, 3 and 5
- "Search Space = Type 1 common": MPDCCH format 5
- "Search Space = Type 2 common": MPDCCH formats 2, 3 and 5

MPDCCH format defines the "Number ECCEs", see Table 5-6.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDCCh` on page 818

Number ECCEs
MPDCCH is transmitted on an aggregation of one or two consecutive control channel elements (ECCE).

The value is selected automatically, depending on the selected MPDCCH format, see Table 5-6.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CCES? on page 818

ECCE Index
For UE-specific search space, sets the ECCE start index.

The available ECCEs depend on the selected MPDCCH Format.

ECCE index	Occupied subcarriers per subframe
0	0 to 5
1	6 to 11

See also Figure 5-9.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:IDCCe on page 818

No. Dummy ECCEs
Indicates the number of dummy ECCEs that are appended to the corresponding MPDCCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDCCes? on page 819

Conflict
Indicates a conflict between two DCI formats, for example if they have the same ECCE index and start subframe.

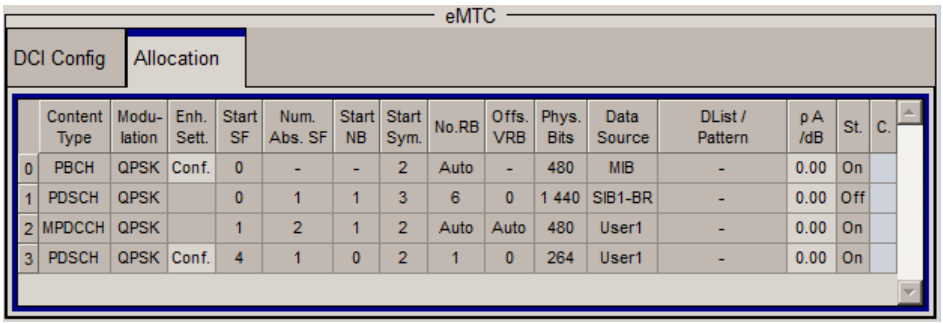
Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CONFlict?
on page 819

5.3.7.4 eMTC Allocations (PBCH, MPDCCH, PDSCH)

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > Configure NB-IoT and eMTC > eMTC > Allocation".

3. Select "ρ A" to boost the power of a particular allocation.



	Content Type	Modu-lation	Enh. Sett.	Start SF	Num. Abs. SF	Start NB	Start Sym.	No.RB	Offs. VRB	Phys. Bits	Data Source	DList / Pattern	ρ A /dB	St.	C.
0	PBCH	QPSK	Conf.	0	-	-	2	Auto	-	480	MIB	-	0.00	On	
1	PDSCH	QPSK		0	1	1	3	6	0	1 440	SIB1-BR	-	0.00	Off	
2	MPDCCH	QPSK		1	2	1	2	Auto	Auto	480	User1	-	0.00	On	
3	PDSCH	QPSK	Conf.	4	1	0	2	1	0	264	User1	-	0.00	On	

The PBCH allocation and the SIB1-BR transmissions are configured automatically, but the PBCH allocation can be changed.
The PDSCH and MPDCCH allocations are configured according to the current DCI configuration, see Chapter 5.3.7.3, "eMTC DCI Configuration", on page 399.
Merely some of the PDSCH precoding settings can be adjusted and scrambling and channel coding disabled.

Settings:

Allocation number....411
Content Type....411
Modulation....412
Enchanced Settings > Config....412
Start SF....412
Num. Abs. SF....413
Start NB....413
Start Symbol....413
No. RB....413
Offset VRB....413
Phys. Bits....413
Data Source....413
ρ A....414
State....414
Conflict....414

Allocation number
Consecutive number of the allocation.

Content Type
Indicates the channel type.

Allocation number	Channel	Description
0	PBCH	Broadcast channel
1	• PDSCH SIB1-BR • MPDCCH	• If PBCH is scheduled and Scheduling Info SIB1-RB ≥ 1, one PDSCH that carries the SIB1-BR message is automatically configured Otherwise, MPDCCH is configured
> 1	• MPDCCH • MPDCCH and PDSCH	Allocated automatically, depending on the current DCI configuration, Chapter 5.3.7.3, "eMTC DCI Configuration", on page 399: • One MPDCCH per P-RNTI, RA-RNTI and DCI of an active eMTC user, see "Configure User" > 3GPP Release • One pair per: – DCI format 6-1A/B used for PDSCH scheduling of an active eMTC user or RA-RNTI – DCI format 6-2 with "Flag for Paging/Direct Indication = On".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONType?` on page 829

Modulation
Indicates the modulation per channel.

eMTC allocations are QPSK modulated, but the PDSCH allocations not carrying SIB1-BR can also use 16QAM. The modulation scheme in the latter case is defined by the DCI filed "Modulation and Coding Scheme".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:MODulation?` on page 829

Enchanced Settings > Config
Accesses the precoding, scrambling and channel coding settings of the selected channel, see Chapter 5.3.7.6, "PDSCH Channel Coding and Scrambling", on page 418.

To configure the MPDCCH settings, select "Frame Configuration > General > General > Configure User > User x > 3GPP Release = CE Mode A/B > EPDCCH/MPDCCH > Config".

Start SF
Indicates the first subframe where the channel can be allocated.

PBCH and PDSCH carrying SIB1-BR always start in the first subframe.

The start subframe of a PDSCH allocation associated with an MPDCCH transmission is calculated as follows:

$\text{Start SF}_{\text{PDSCH}} = \text{Start SF}_{\text{MPDCCH}} + N_{\text{abs}}^{\text{MPDCCH}} + 2$

Where $N_{\text{abs}}^{\text{MPDCCH}}$ depends on the $N_{\text{rep}}^{\text{MPDCCH}}$ and the valid eMTC DL subframes, see:
- "Repetitions of MPDCCH" on page 409
- "SF State" on page 396

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSFrame?` on page 829

Num. Abs. SF
Indicates the number of absolute subframes, i.e. number of subframes the allocation spans.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:ABSFrames?` on page 830

Start NB
Indicates the first narrowband where the channel can be allocated.

- For MPDCCH, the value resembles the one set with the parameter "General > Configure User > MPDCCH Config" > Starting NB
- For PDSCH not carrying SIB1-BR, the value is determined by the DCI field "3GPP Release = CE Mode A".
- The scheduling and hopping pattern of the PDSCH carrying SIB1-BR incl. all related parameter is performed automatically, as defined in TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STNB?` on page 830

Start Symbol
Indicates the first symbol where the channel can be allocated.

The PDSCH carrying SIB1-BR starts always at symbol#3. The start symbol for all other allocations resembles the value set with "General Settings > eMTC > Bitmap" > Starting Symbol.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSYmbol?` on page 830

No. RB
Indicates used number of resource blocks and thus the allocation's bandwidth.

For PDSCH not carrying SIB1-BR, the value is determined by the DCI field "3GPP Release = CE Mode A".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:NORB?` on page 831

Offset VRB
Values different than 0 indicate resource block shift within the narrowbands.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:OVRB?` on page 831

Phys. Bits
Displays the allocation size in bits. The value is calculated similar to the physical bits value in NB-IoT, see "Phys. Bits" on page 367.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PHYSbits?` on page 831

Data Source
Indicates the data source depending on the "Content Type".

The data source is configurable for:

- PBCH with "PBCH > Config > Channel Coding > MIB (including SFN) = Off"
- PDSCH SIB1-BR allocation
- PDSCH allocations that are configured for "eMTC > DCI Config > User = P-RNTI or RA-RNTI"

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DATA` on page 832
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DSELect` on page 832
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PATTern` on page 832

ρ A
Sets the power P_{MPDCCH} or P_{PDSCH} (ρ A) of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:POWer` on page 833

State
Indicates that the allocation is active.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STATe?` on page 833

Conflict
Indicates a conflict between allocations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONFlict?` on page 833

5.3.7.5 PBCH Channel Coding and SIB-BR Configuration

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > eMTC > Allocation".
3. Select "PBCH > Enchanced Settings > Config".

PBCH can be generated in one of the following modes:

- Without channel coding, if "Channel Coding > State > Off"
  Dummy data or user-defined data lists are used.
- Channel coding with arbitrary transport block content
  If channel coding is activated ("Channel Coding > State > On") and parameter "MIB (including SFN) > Off"
- Channel coding with real data (MIB) including SFN
  If channel coding and "MIB (including SFN)" are activated
  This mode is required for the generation of SIB1-BR message.

Settings:

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└ Precoding Scheme....416
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Scrambling....416
└ Scrambling State....416
└ UE ID/n_RNTI....416
Channel Coding....416
└ Channel Coding State....416
└ Type Channel Coding....416
└ Number of Physical Bits....417
└ MIB (including SFN)....417
└ SFN Offset....417
└ SFN Restart Period....417
└ Scheduling Info SIB1-RB....417
└ PDSCH Repetitions SIB1-RB....417
└ MIB Spare Bits....418
└ Transport Block Size/Payload (DL)....418

Precoding
Comprises the precoding settings.

Most of the parameters are set automatically, depending on the selected:

- [Tx Mode] of the corresponding UE ("Frame Configuration > UEx > Tx Mode")
- Number of Tx antennas ("General DL Settings > Antenna Ports > Global MIMO Configuration"

See also Table 5-11.

Precoding Scheme ← Precoding
Selects the precoding scheme.

"None" Disables precoding.

"Tx Diversity"
If "Global MIMO Configuration ≥ 2 Tx Antennas", select precoding for transmit diversity.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCHeme`
on page 834

Number of Layers ← Precoding
Displays the number of layers for the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:NOLayers?`
on page 835

Scrambling
Comprises the scrambling settings.

Scrambling State ← Scrambling
Enables scrambling.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:STATe`
on page 838

UE ID/n_RNTI ← Scrambling
Indicates the user equipment identifier (n_RNTI) or UE ID of the user to which the PDSCH transmission is intended. The displayed "UE ID/n_RNTI" value is used to calculate the scrambling sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:UEID?`
on page 839

Channel Coding
Comprises the channel coding settings. Channel coding state is configurable. All other settings are configured automatically.

Channel Coding State ← Channel Coding
Enables channel coding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:STATe`
on page 839

Type Channel Coding ← Channel Coding
Displays the used channel coding scheme and channel coding rate.

PBCH uses always tail biting convolution coding with code rate 1/3; PDSCH uses always turbo code with code rate 1/3.

Remote command:
n.a.

Number of Physical Bits ← Channel Coding
Indicates the calculated number of physical bits; resembles the information displayed with parameter Phys. Bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PHYSbits?` on page 831

MIB (including SFN) ← Channel Coding
Enables transmission of real MIB (master information block) data. The SFN (system frame number) is included as well.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MIB` on page 840

SFN Offset ← Channel Coding
By default, the counting of the SFN (system frame number) starts with 0. This parameter sets a different start SFN value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SOFFset`
on page 841

SFN Restart Period ← Channel Coding
Determines the time span after which the SFN (system frame number) restarts.

"Sequence Length"
The SFN restart period is equal to the ARB sequence length.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SRPeriod`
on page 841

Scheduling Info SIB1-RB ← Channel Coding
Sets the parameter `schedulingInfoSIB1-RB` that defines the PDSCH number of repetitions N_{Rep}^{PDSCH}. the resulting value is indicated with PDSCH Repetitions SIB1-RB.

The parameter works like the setting "General DL > eMTC > Bitmap" > Scheduling Info SIB1-BR.

For "Scheduling Info SIB1-RB = 0" there is no PDSCH carrying SIB1-BR scheduled and hence no such allocation in the eMTC allocation table.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SIB` on page 840

PDSCH Repetitions SIB1-RB ← Channel Coding
Indicates the number of PDSCH repetitions N_{Rep}^{PDSCH}, as defined with the parameter Scheduling Info SIB1-RB.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:RSIB?`
on page 841

MIB Spare Bits ← Channel Coding
Sets the 5 spare bits in the PBCH transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MSPare`
on page 841

Transport Block Size/Payload (DL) ← Channel Coding
Displays the size of the transport block/payload in bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSize?`
on page 839

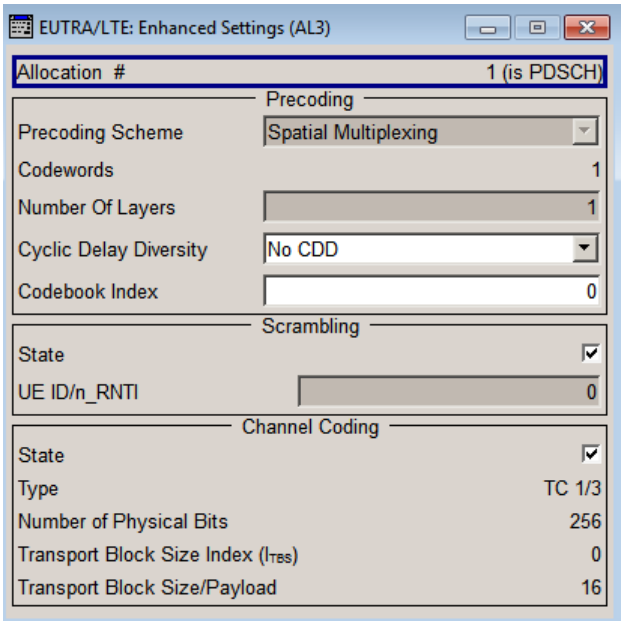
5.3.7.6 PDSCH Channel Coding and Scrambling

Access:

1. Select "General > Link Direction > Downlink".
2. Select "Frame Configuration > Configure NB-IoT and eMTC > eMTC > Allocation".
3. Select "PDSCH > Enchanced Settings > Config".

   The displayed settings depends on the:
   - Number of Tx antennas ("General DL Settings > Antenna Ports > Global MIMO Configuration")
   - "Tx Mode" of the corresponding UE.

   See also Table 5-11.



Settings:

Precoding....419
- Precoding Scheme....420
- Transmission Scheme....420
- Number of Layers....420
- Codeword....420
- Cyclic Delay Diversity....420
- Codebook Index....420
- Antenna Ports....421
- Scrambling Identity n_SCID....421
- Antenna Port Mapping....421
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Scrambling....421
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- UE ID/n_RNTI....422

Channel Coding....422
- Channel Coding State....422
- Type Channel Coding....422
- Number of Physical Bits....422
- Transport Block Size I_{TBS}....422
- Transport Block Size/Payload (DL)....422

Precoding
Comprises the precoding settings.

Most of the parameters are set automatically, depending on the selected:
- "Tx Mode" of the corresponding UE ("Frame Configuration > UEx > Tx Mode")
- Number of Tx antennas ("General DL Settings > Antenna Ports > Global MIMO Configuration"

See also Table 5-11.

Precoding Scheme ← Precoding
Indicates the precoding scheme.

"None" Precoding is disabled.

"Spatial Multiplexing/Tx Diversity/Beamforming (UE-spec.RS)"
For "General DL Settings > Antenna Ports > Global MIMO Configuration ≥ 2 Tx Antennas", indicates that precoding for spatial multiplexing, beamforming or transmit diversity is performed according to TS 36.211.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCHeme`
on page 834

Transmission Scheme ← Precoding
For "Precoding Scheme = Beamforming (UE-spec.RS)", indicates the used transmission scheme.

See Table 5-11.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme?`
on page 835

Number of Layers ← Precoding
Displays the number of layers for the selected allocation.

See also Table 5-11.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:NOLayers?`
on page 835

Codeword ← Precoding
Displays the number of the codeword and the total number of codewords used for the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CODWords?` on page 834

Cyclic Delay Diversity ← Precoding
If "Precoding Scheme = Spatial Multiplexing", sets the CDD for the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CCD`
on page 835

Codebook Index ← Precoding
If "Precoding Scheme = Spatial Multiplexing/Beamforming (UE-spec.RS)", sets the codebook index for the selected allocation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CBINdex
on page 835

Antenna Ports ← Precoding
For "Precoding Scheme = Beamforming (UE-spec.RS)", indicates the antenna ports for the current "Transmission Scheme".

The value is selected from the Tx Mode of the corresponding UE and the number of Tx antennas ("General DL Settings > Antenna Ports > Global MIMO Configuration").

See Table 5-11.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP?
on page 836

Scrambling Identity n_SCID ← Precoding
For "Precoding Scheme = Beamforming (UE-spec.RS)", indicates the scrambling identity (as of TS 36.211).

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCID?
on page 837

Antenna Port Mapping ← Precoding
For "Precoding Scheme = Beamforming (UE-spec.RS)", indicates the way that the logical antenna ports are mapped to the physical TX antennas.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:APM?
on page 837

Mapping Coordinates ← Precoding
For "Precoding Scheme = Beamforming (UE-spec.RS)", switches between the "Cartesian" and "Cylindrical" coordinates representation.

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:DAFormat
on page 837

Mapping Table ← Precoding
Defines the mapping of the antenna ports (AP) to the physical antennas

Remote command:
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:REAL? on page 837
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:IMAGinary? on page 838

Scrambling
Comprises the scrambling settings.

Scrambling State ← Scrambling
Enables scrambling.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:STATe`
on page 838

UE ID/n_RNTI ← Scrambling
Indicates the user equipment identifier (n_RNTI) or UE ID of the user to which the PDSCH transmission is intended. The displayed "UE ID/n_RNTI" value is used to calculate the scrambling sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:UEID?`
on page 839

Channel Coding
Comprises the channel coding settings. Channel coding state is configurable. All other settings are configured automatically.

Channel Coding State ← Channel Coding
Enables channel coding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:STATe`
on page 839

Type Channel Coding ← Channel Coding
Displays the used channel coding scheme and channel coding rate.

PBCH uses always tail biting convolution coding with code rate 1/3; PDSCH uses always turbo code with code rate 1/3.

Remote command:
n.a.

Number of Physical Bits ← Channel Coding
Indicates the calculated number of physical bits; resembles the information displayed with parameter Phys. Bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PHYSbits?` on page 831

Transport Block Size I_{TBS} ← Channel Coding
Displays the resulting transport block size index.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSI` on page 840

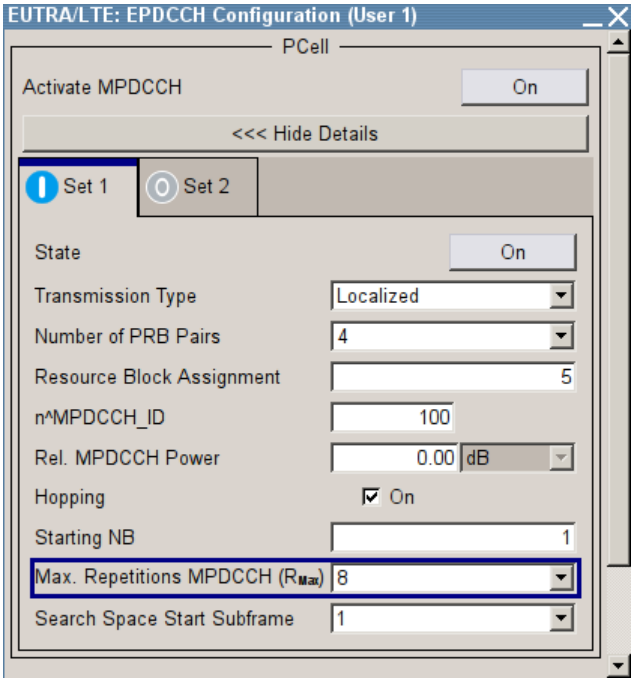
Transport Block Size/Payload (DL) ← Channel Coding
Displays the size of the transport block/payload in bits, calculated from the selected "Resource Assignment Field" and "Modulation and Coding Scheme".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSize?`
on page 839

5.3.7.7 MPDCCH Configuration

Access:

1. Select "Frame Configuration > General > User Configuration".
2. Select "User > 3GPP Release = CE Mode A/B > EPDCCH/MPDCCH > Config".



3. To activate the secon state, select "Set 2 > State > On".
4. Select "Frame Configuration > eMTC > Allocation" to observe the MPDCCH allocation.

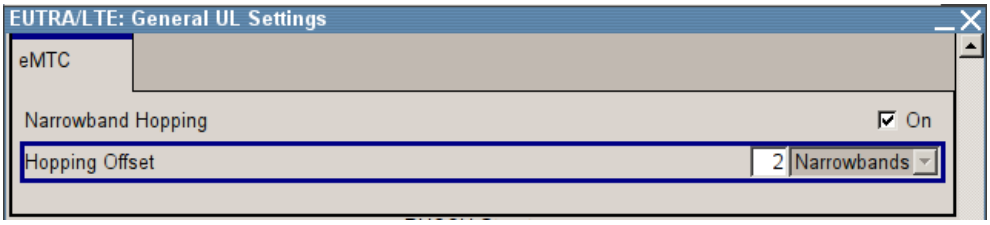
Settings:

See Chapter 4.3.4, "EPDCCH Configuration Settings", on page 132.

5.3.8 eMTC PUSCH Settings

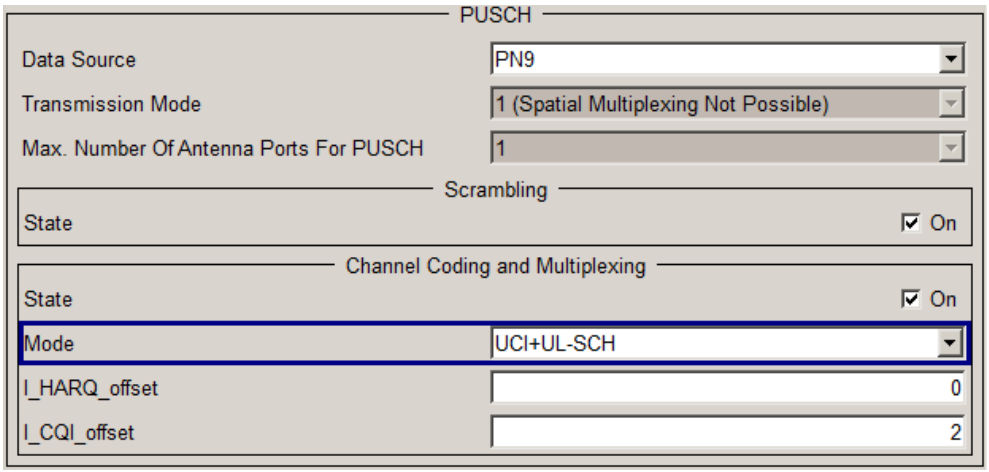
Access:

1. Select "General > General UL Settings > PUSCH > eMTC Parameters".



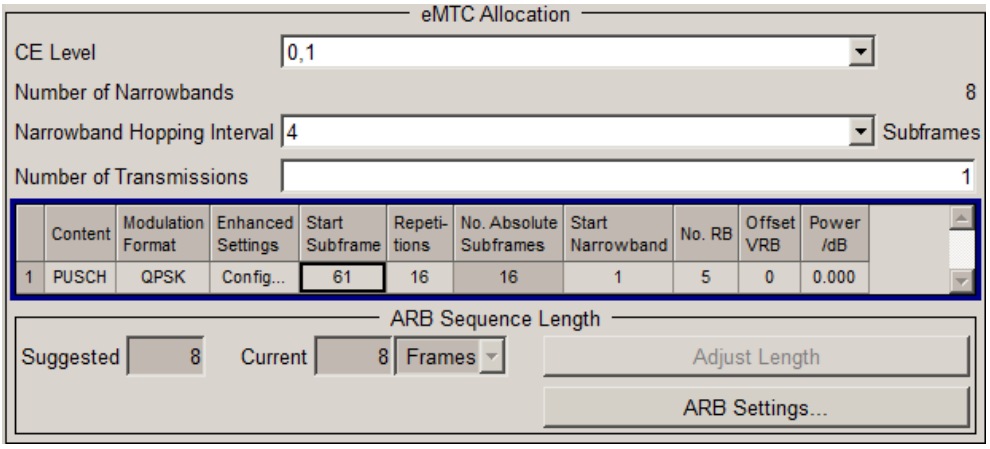
The dialog displays general PUSCH configuration parameters.
To access the UE-specific PUSCH settings, follow the following instructions.

2. Select "Frame Configuration > UE x > 3GPP Release" = **"eMTC"**.
3. To access the settings of the individual UE, click the "UE x" block.
4. Select "UE x > PUSCH".



You can enable PUSCH scrambling and channel coding and multiplexing.
The provided settings are the same as for LTE, expect that eMTC UEs do not support MIMO and the rank indication (RI) concept.
The "Transmission Mode = TM 1" and "Max. Number of AP for PUSCH = 1" are fixed.

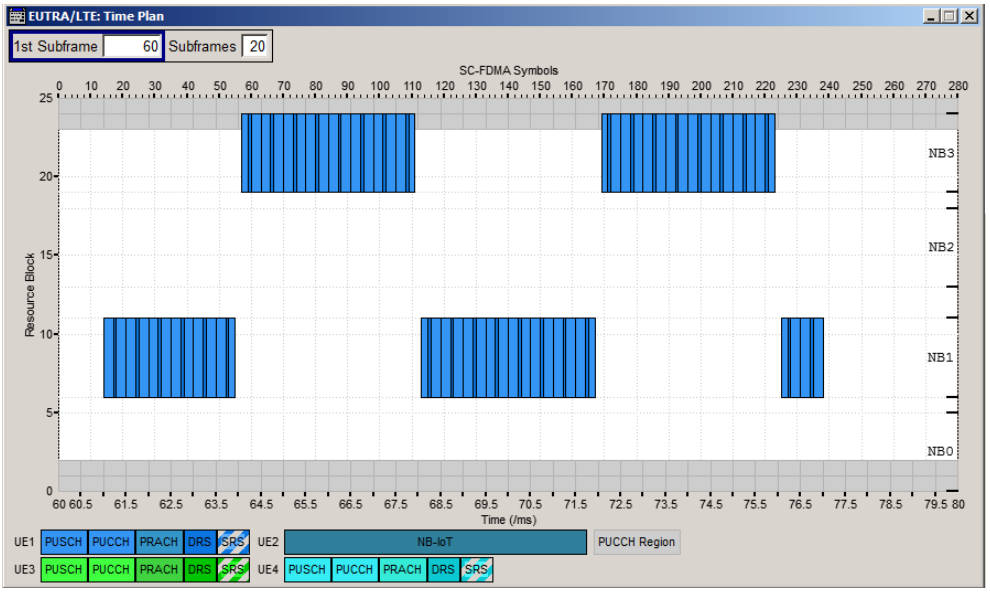
5. To configure the **PUSCH transmission per UE**, select "Frame Configuration > UE x > eMTC Allocation".



The eMTC allocation is individual per UE, in terms of used CE level, frequency hopping and number of transmissions.
There can be up to 20 PUSCH or PUCCH transmissions per UE, each of them using different format and occupying different resources in the time and in the frequency domain.

6. In the "eMTC Allocation" table, select "Transmission # > Content = PUSCH > Enhanced Settings > Config" to configure the channel coding and multiplexing of an eMTC allocation.
See Chapter 5.3.8.3, "eMTC PUSCH Channel Coding and Multiplexing Settings", on page 431.

7. To observe the PUSCH allocations, select "EUTRA/LTE > Frame Configuration > Time Plan".



5.3.8.1 Cell-Specific eMTC PUSCH Settings

Access: see Chapter 5.3.8, "eMTC PUSCH Settings", on page 423.

Narrowband Hopping 426
Hopping Offset 426

Narrowband Hopping
Enables narrowband hopping so that PUSCH allocations can change the used narrowband.

PUSCH hopping pattern is individual per UE. The number of subframes the PUSCH allocation remains in the same NB is defined with the UE-specific parameter Narrowband Hopping Interval.

If hopping is disabled, the PUSCH repetitions are located in the same resource block at the same narrowband.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOPping` on page 845

Hopping Offset
If "Narrowband Hopping > On", sets the value of the cell-specific higher-level parameter f_{hop}^{NB} required to calculate the PUSCH frequency hopping pattern. The hopping offset is difference in narrowbands between the narrowband number of the current and the subsequent narrowband.

The max possible hopping offset depends on the number of available narrowbands (see Number of eMTC Narrowbands).

Use the "Time Plan" to visualize the PUSCH allocation.

For example, see Example "PUSCH hopping" on page 320.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOFfset` on page 845

5.3.8.2 UE-Specific eMTC PUSCH Transmissions Settings

Access: see Chapter 5.3.8, "eMTC PUSCH Settings", on page 423.

The eMTC allocation configuration is individual per UE and is defined **per coverage extension level CE**. eMTC allocation is composed of up to 20 PUCCH or PUSCH transmissions, each one described in a row in the eMTC allocation table.

Settings:

CE Level 427
Number of eMTC Narrowbands 427
Narrowband Hopping Interval 427
Number of Transmissions 428
Content 428
Modulation/Format 428
Enhanced Setting > Config 428
Start Subframe 428

Repetitions....429
No. Absolute Subframes....429
Start Narrowband....429
No. RB....429
Offset VRB....430
Power, dB....430
ARB Sequence Length....430
└ Suggested....430
└ Current....431
└ Adjust Length....431
└ ARB Settings....431

CE Level
Sets the coverage extension level (CE).

3GPP defines two CE modes for eMTC, CEModeA and CEModeB:
- "CE Level = 0, 1" corresponds to CEModeA
  This mode uses small number of PUSCH or PUCCH repetitions.
- "CE Level = 2, 3" corresponds to CEModeB
  This mode enables large number of PUSCH or PUCCH repetitions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:CELevel` on page 868

Number of eMTC Narrowbands
Option: R&S SMBV-K115

This parameter is **dedicated to eMTC** and available if "Mode > eMTC/NB-IoT or LTE/eMTC/NB-IoT" is selected.

It indicates the number of eMTC narrowbands N_{NB} available within the selected channel bandwidth.

The value is calculated as follows:

"Number of Narrorbands" = "Number of Resource Blocks" / 6

For more information, see "Narrowbands" on page 310.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:EMTC:NNBands?` on page 844

Narrowband Hopping Interval
Sets the higher-level parameter N_{ch}^{NB}.

It defines the number of consecutive subframes the hopping pattern remains in the same narrowband.

Table 5-44: Hopping intervals N_{ch}^{NB} per CE level and duplexing mode

"CE Level"	"Duplexing > FDD"	"Duplexing > TDD"
0, 1	1, 2, 4, 8	1, 5, 10, 20
2, 3	2, 4, 8, 16	5, 10, 20, 40

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:HOPP` on page 868

Number of Transmissions
Enables up to 20 individual PUSCH and PUCCH transmissions, where each transmission is configured in a separate row in the eMTC allocation table.

Use the "Time Plan" to visualize the eMTC allocation.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:NTRansmiss` on page 868

Content
Selects the channel type and defines whether PUSCH or PUCCH is transmitted.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CONTent`
on page 869

Modulation/Format
For PUSCH transmission, this parameter sets the used modulation scheme (QPSK, 16QAM or 64QAM).

For PUCCH transmission, this parameter sets the PUCCH format.

Table 5-45: PUCCH formats depending on the CE mode and duplexing mode

"CE Level"	"Duplexing > FDD"	"Duplexing > TDD"
0, 1	1, 1a, 2, 2a, 2b	1, 1a, 1b, 2, 2a, 2b
2, 3	1, 1a	1, 1a

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:MODulation`
on page 869
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:FORMat` on page 869

Enhanced Setting > Config
Access dialogs with further channel coding and multiplexing settings.

The displayed settings depend on the transmission content, see:
- Chapter 5.3.8.3, "eMTC PUSCH Channel Coding and Multiplexing Settings", on page 431
- Chapter 5.3.9.3, "eMTC PUCCH Channel Coding and Multiplexing Settings", on page 439

Start Subframe
Sets the subframe number in that the PUSCH/PUCCH allocation is scheduled for the first time.

The following applies for each subsequent allocation:

$Start_SF_{PUSCH,i+1} = Start_SF_{PUSCH,i} + n_{Rep}^{PUSCH} + n_{invalid_SF} + 1$

Where:
- $n_{invalidSF}$ is the number of SF that is set as not valid for eMTC in the "General UL Settings" dialog (see "Valid Subframes" on page 219).
- n_{Rep}^{PUSCH} is set with the parameter Repetitions.

Example:

- Allocation#1
  PSUCH with Start_SF = 0, n_{Rep}^{PUSCH} = 8 and $n_{invalid_SF}$ = 2
- The first possible "Start Subframe" for allocation#2
  Start_SF = 0 + 8 + 2 + 1 = 11

Note: If more than one UE are configured, the UEs have to use different "Start Subframe".
Otherwise, a conflict is indicated in the "UL Frame Configuration > Subframe > Allocation Table" dialog.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:STSFrame`
on page 869

Repetitions
Sets how many times a transmission is repeated.

Table 5-46: Possible number of repetitions (n_{Rep}^{PUSCH} and n_{Rep}^{PUCCH}) depending on the CE mode and the channel type

"CE Level"	PUSCH	PUCCH
0, 1	1, 2, 4, 8, 16, 32	1, 2, 4, 8
2, 3	1, 4, 8, 16, 32, 64, 128, 192, 256, 384, 512, 768, 1024, 1536, 2048	4, 8, 16, 32

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:REPetitions`
on page 870

No. Absolute Subframes
Number of absolute subframes (n_{abs_SF}) is calculated as follows:

$n_{abs_SF} = n_{Rep}^{PUSCH} + n_{invalid_SF}$

Where:

- $n_{invalidSF}$ is the number of SF that is set as not valid for eMTC in the "General UL Settings" dialog (see "Valid Subframes" on page 219).
- n_{Rep}^{PUSCH} is set with the parameter Repetitions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:ASFRrame?`
on page 870

Start Narrowband
Sets the first NB used for the PSUCH/PUCCH transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:STNBand`
on page 870

No. RB
Sets the number of used resource blocks (RB) within one narrowband.

According to TS 36.211, a UE can allocate between one RB and the whole narrowband, where:

- For CEModeA UE, the used number of RBs is configurable value between 1 and 6 RBs
- For CEModeB UE, the allocations are predefined, see Table 5-47.

Table 5-47: Resource blocks allocation for UE configured in CEModeB [TS 36.213]

Value of resource allocation field	Allocated resource blocks
000	0
001	1
010	2
110	3
100	4
101	5
110	0 and 1
111	2 and 3

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NRBLocks`
on page 870

Offset VRB
For allocations that span less than 6 RB, this parameter shifts the selected No. RB within the NB.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:RBOFfset`
on page 871

Power, dB
Sets the power of the eMTC PUSCH and PUCCH transmission (P_{PUSCH} or P_{PUCCH}).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:POWer` on page 871

ARB Sequence Length
Comprises setting for automatic adjustment of the ARB sequence length.

Suggested ← ARB Sequence Length

- NB-IoT allocations:
  Indicates the ARB sequence length that is required for the selected NPUSCH transmissions.
- eMTC allocations:
  Number of frames required for the one complete transmission.
  The value is calculated as the sum of the Start_SF and n_{abs_SF}.

Use the "Adjust Length" function to apply the suggested value.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:ARB:SUGGested? on page 857
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:ARB:SUGGested? on page 871

Current ← ARB Sequence Length
Indicates the current ARB sequence length.

Adjust Length ← ARB Sequence Length
Sets the ARB sequence length to the suggested value.

ARB Settings ← ARB Sequence Length
Opens the ARB dialog.

5.3.8.3 eMTC PUSCH Channel Coding and Multiplexing Settings

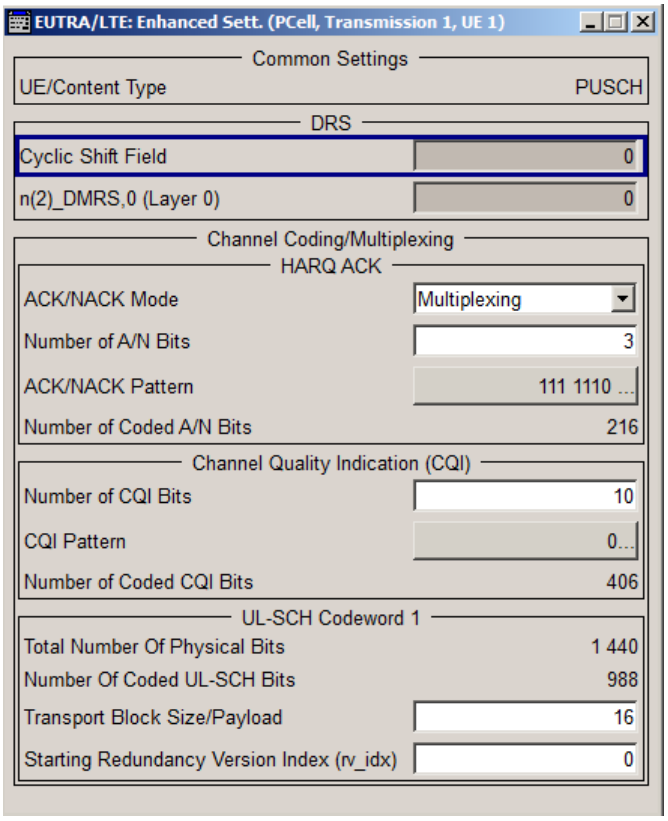
Access: see Chapter 5.3.8, "eMTC PUSCH Settings", on page 423.

In this dialog you can:

- Set the cyclic shift used by the demodulation reference signal (DRS)
- Adjust the parameters for channel coding of the control information (HARQ and CQI)
- Configure the multiplexing of the control information with the data transmission over the uplink shared channel (UL-SCH)

The eMTC PUSCH configuration reuses the LTE concept, expect:

- In eMTC, PUSCH frequency hopping is configured in a different way.
- eMTC does not support rank indication (RI)
- eMTC uses different parameter "Starting Redundancy Version Index (rv_idx)".



Settings:

Common....432
DRS....433
└ Cyclic Shift Filed....433
└ n(2)_DMRS,0 (Layer 0)....433
HARQ ACK....433
└ ACK/NACK Mode....433
└ Number of A/N Bits....434
└ ACK/NACK Pattern....434
└ Number of Coded A/N Bits....434
Channel Quality Indication CQI....434
└ Number of CQI Bits....434
└ CQI Pattern....434
└ Number of Coded CQI Bits....434
Enhanced Setting > UL-SCH....434
└ Total Number of Physical Bits....435
└ Number of Coded UL-SCH Bits....435
└ Transport Block Size/Payload....435
└ Starting Redundancy Version Index (rv_idx)....435

Common

The "Common" dialog indicates the type of the selected channel.

DRS
The provided settings are identical to the LTE demodulation reference signal (DRS) settings.

Cyclic Shift Filed ← DRS
Sets the cyclic shift field in the uplink-related DCI formats.

Cyclic shifts are used to separate the DRS signals of different users in the time domain.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:DRS:CYCShift?`
on page 871

n(2)_DMRS,0 (Layer 0) ← DRS
Displays the part of the demodulation reference signal (DRS) index $n^{(2)}_{DMRS,\,0}$ for layer 0.

"Cyclic Shift Field"	n(2)_DMRS, 0
000	0
001	6
010	3
011	4
100	2
101	8
110	10
111	9

The DMRS index is part of the uplink scheduling assignment and valid for one UE in the subframe. This index applies when multiple shifts within a cell are used and is used by the calculation of the DRS sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NDMRs?` on page 872

HARQ ACK
Access: "UEx > PUSCH > Channel Coding and Multiplexing > State > On" and "Mode = UCI only/UCI + UL-SCH".

The provided settings are identical to the LTE HARQ ACK settings.

ACK/NACK Mode ← HARQ ACK
Sets the ACK/NACK mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:MODE`
on page 873

Number of A/N Bits ← HARQ ACK
Sets the number of ACK/NACK bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:BITS`
on page 874

ACK/NACK Pattern ← HARQ ACK
Sets the ACK/NACK bit pattern.

A "1" indicates an ACK, a "0" - a NACK.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:PATTern`
on page 875

Number of Coded A/N Bits ← HARQ ACK
Displays the number of coded ACK/NACK bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:CBITs?`
on page 875

Channel Quality Indication CQI
Access:
- "UEx > PUSCH > Channel Coding and Multiplexing > State > On"
- "Mode = UCI only/UCI + UL-SCH".

The provided settings are identical to the LTE CQI settings.

Number of CQI Bits ← Channel Quality Indication CQI
Sets the number of CQI bits before channel coding.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:BITS`
on page 872

CQI Pattern ← Channel Quality Indication CQI
Sets the CQI pattern for the PUSCH.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:PATTern`
on page 872

Number of Coded CQI Bits ← Channel Quality Indication CQI
Displays the number of coded CQI bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:CBITs?`
on page 873

Enhanced Setting > UL-SCH
Access:
- "UEx > PUSCH > Channel Coding and Multiplexing > State > On"
- "Mode = UL-SCH only/UCI + UL-SCH".

The eMTC PUSCH configuration reuses the LTE concept.

The same settings and interdependency apply expect the used "Starting Redundancy Version Index (rv_idx)".

Total Number of Physical Bits ← Enhanced Setting > UL-SCH
Displays the size of the eMTC allocation in bits.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PHYSbits?`
on page 875

Number of Coded UL-SCH Bits ← Enhanced Setting > UL-SCH
Displays the number of physical bits used for UL-SCH transmission.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:ULSCh:BITS?`
on page 873

Transport Block Size/Payload ← Enhanced Setting > UL-SCH
Sets the size of the transport block.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CCODing:TBSize`
on page 874

Starting Redundancy Version Index (rv_idx) ← Enhanced Setting > UL-SCH
Sets the redundancy version index.

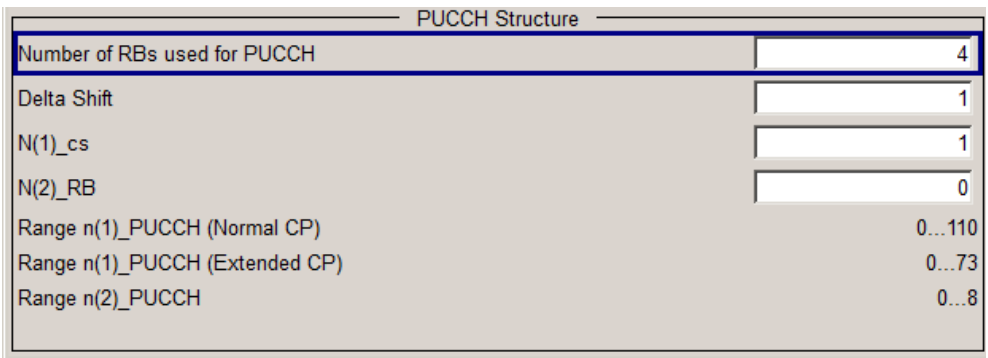
Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CCODing:RVINdex`
on page 876

5.3.9 eMTC PUCCH Settings

Access:

1. Select "General > General UL Settings > PUCCH" to access the **cell-specific PUCCH** settings.

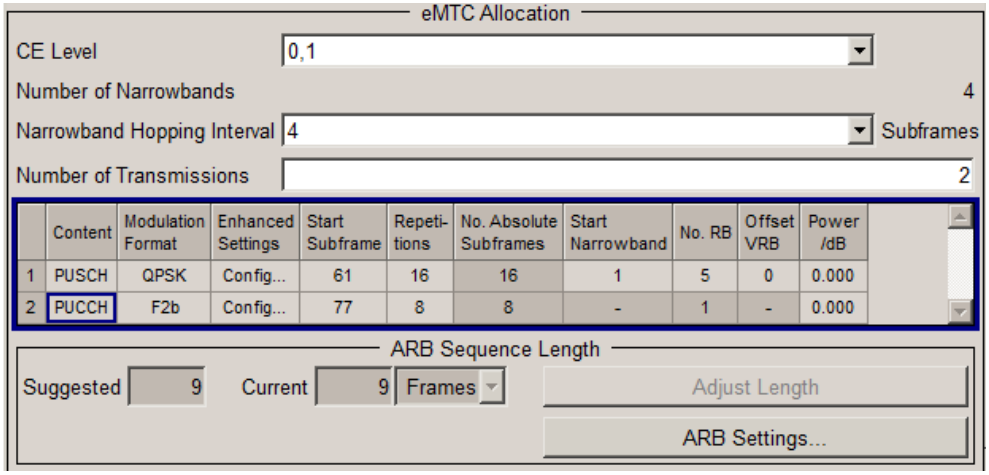
   eMTC reuses the LTE PUCCH configuration.



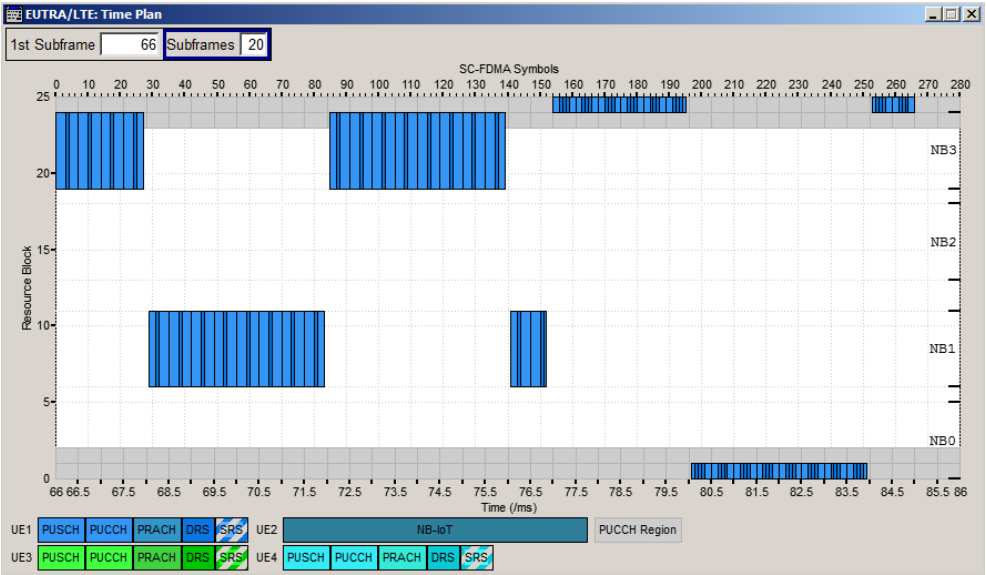
To access the **UE-specific PUCCH settings**, follow the following instructions.

2. Select "Frame Configuration > UE " > **"3GPP Release = eMTC"**.
3. Select "UE x > PUCCH".

   eMTC reuses the UE-specific PUCCH configuration, except that eMTC UEs do not support MIMO and PUCCH format 3.
   Hence "Number of AP for PUCCH Formats = 1".
4. To configure the **PUCCH transmission per UE**, select "Frame Configuration > UE x" > **"eMTC Allocation"**.



   The eMTC allocation is individual per UE, in terms of used CE level, frequency hopping and number of transmissions. There can be up to 10 PUSCH or PUCCH transmissions per UE, each of them using different format and occupying different resources in the time and in the frequency domain.
   For settings description, see Chapter 5.3.8.2, "UE-Specific eMTC PUSCH Transmissions Settings", on page 426.
5. In the "eMTC Allocation" table, select "Transmission # > Content = PUCCH > Enhanced Settings > Config" to configure the **channel coding and multiplexing of an eMTC allocation**.
   See Chapter 5.3.9.3, "eMTC PUCCH Channel Coding and Multiplexing Settings", on page 439.
6. To observe the PUCCH allocations, select "EUTRA/LTE > Frame Configuration > Time Plan".



5.3.9.1 Cell-Specific eMTC PUCCH Settings

Access: see Chapter 5.3.9, "eMTC PUCCH Settings", on page 435.

Settings:

Number of RBs used for PUCCH 437
Delta Shift 438
N(1)_cs 438
N(2)_RB 438
Range n(1)_PUCCH (Normal/Extended CP) 439
Range n(2)_PUCCH 439

Number of RBs used for PUCCH
Sets the PUCCH region in terms of reserved resource blocks, at the edges of the channel bandwidth (see Figure 3-18).

The PUCCH region is displayed on the time plan.

Example:

- "Physical > Channel Bandwidth = 3 MHz"
- "General UL Settings > PUCCH > Number of RBs used for PUCCH = 3"
- "UL Frame Configuration > PUCCH > Format = 2a" and "PUCCH State > On"

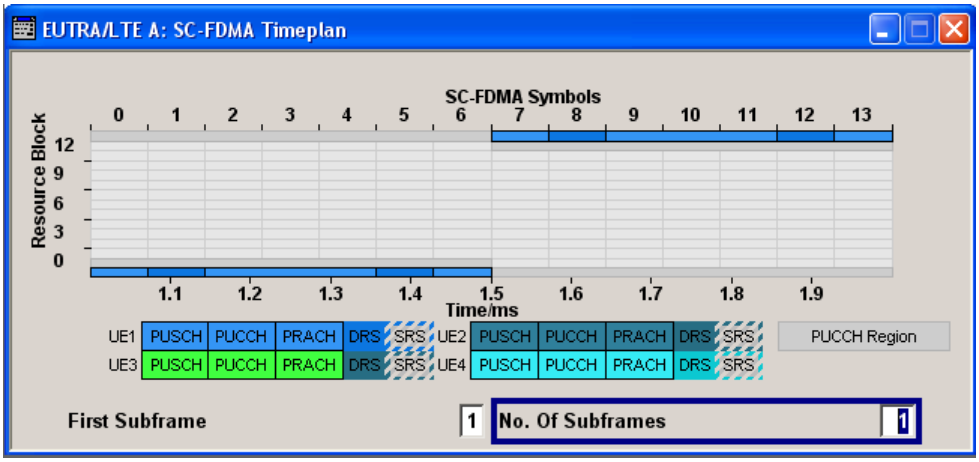


Figure 5-11: Example: Representation of subframe with PUCCH region with three reserved resource blocks on the time plan

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB` on page 560

Delta Shift
Sets the delta shift parameter, i.e. the cyclic shift difference between two adjacent PUCCH resource indices with the same orthogonal cover sequence (OC).

The delta shift determinates the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b (see also Table 3-5).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift` on page 560

N(1)_cs
Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Only one resource block per slot can support a combination of the PUCCH formats 1/1a/1b and 2/2a/2b.

The number of cyclic shifts available for PUCCH format 2/2a/2b N(2)_cs in a block with combination of PUCCH formats is calculated as follows:

N(2)_cs = 12 - N(1)_cs -2

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS` on page 560

N(2)_RB
Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

There can be only one resource block per slot that supports a combination of the PUCCH formats 1/1a/1b and 2/2a/2b. Hence, the number of RBs per slot available for PUCCH format 1/1a/1b is determinate by "N(2)_RB".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB` on page 561

Range n(1)_PUCCH (Normal/Extended CP)
Displays the range of the possible PUCCH format 1/1a/1b transmissions from different UEs in one subframe and per cyclic prefix.

Insufficient ranges are displayed as '-'.

The parameter "Range n(1)_PUCCH (Normal CP)" determines the value range of the index "n_PUCCH" for PUCCH format 1/1a/1b.

See n_PUCCH

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax?` on page 561
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax?` on page 561

Range n(2)_PUCCH
Displays the range of possible number of PUCCH format 2/2a/2b transmissions from different UEs in one subframe.

Insufficient ranges are displayed as '-'.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max?` on page 562

5.3.9.2 UE-Specific eMTC PUCCH Settings

Access: see Chapter 5.3.9, "eMTC PUCCH Settings", on page 435.

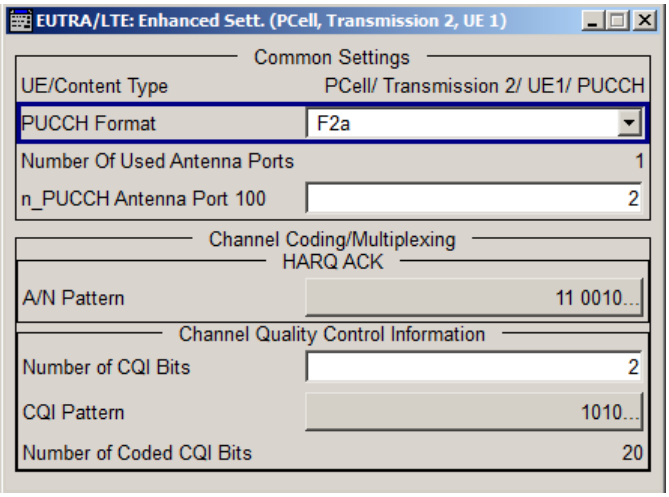
Number of Antenna Ports for PUCCH per PUCCH Format
For 3GPP Release = "LTE-Advanced" UEs, sets the number of antenna ports used for every PUCCH format transmission.

eMTC UEs ("3GPP Release = eMTC") support transmission with one antenna port.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F1Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F2Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F3Naport` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F4Naport?` on page 720
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F5Naport?` on page 720

5.3.9.3 eMTC PUCCH Channel Coding and Multiplexing Settings

Access: see Chapter 5.3.9, "eMTC PUCCH Settings", on page 435.



The eMTC PUCCH configuration reuses the LTE concept.

Settings:

Common....440
└ Format....440
└ Number of Used Antenna Port....440
└ n_PUCCH Antenna Port 100....441
Channel Coding and Multiplexing....441
└ A/N Pattern....441
└ Number of CQI Bits....441
└ CQI Pattern....441
└ Number of Coded CQI Bits....441

Common
The "Common" settings dialog indicates the type and format of the selected channel.

The "UE/Content" indication resembles related information from the "eMTC Allocation" table.

Format ← Common
For PUCCH transmission, this parameter sets the PUCCH format.

Table 5-48: PUCCH formats depending on the CE mode and duplexing mode

"CE Level"	"Duplexing > FDD"	"Duplexing > TDD"
0, 1	1, 1a, 2, 2a, 2b	1, 1a, 1b, 2, 2a, 2b
2, 3	1, 1a	1, 1a

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:FORMat` on page 869

Number of Used Antenna Port ← Common
Indicates that one antenna port is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NAPused?
on page 874

n_PUCCH Antenna Port 100 ← Common
Sets the PUCCH resource index.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NPUCch on page 874

Channel Coding and Multiplexing
Access: "UEx > eMTC Allocation > PUCCH > Format = F2b".

The provided settings are identical to the LTE settings.

A/N Pattern ← Channel Coding and Multiplexing
Sets the PUCCH ACK/NACK pattern.

A "1" indicates an ACK, a "0" - a NACK.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:HARQ:PATTern on page 876

Number of CQI Bits ← Channel Coding and Multiplexing
Sets the number of CQI bits before channel coding.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:BITS
on page 876

CQI Pattern ← Channel Coding and Multiplexing
Sets the CQI pattern for the PUCCH.

Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:PATTern on page 876

Number of Coded CQI Bits ← Channel Coding and Multiplexing
Displays the number of coded CQI bits.

The number of coded CQI bits for PUCCH is always 20.

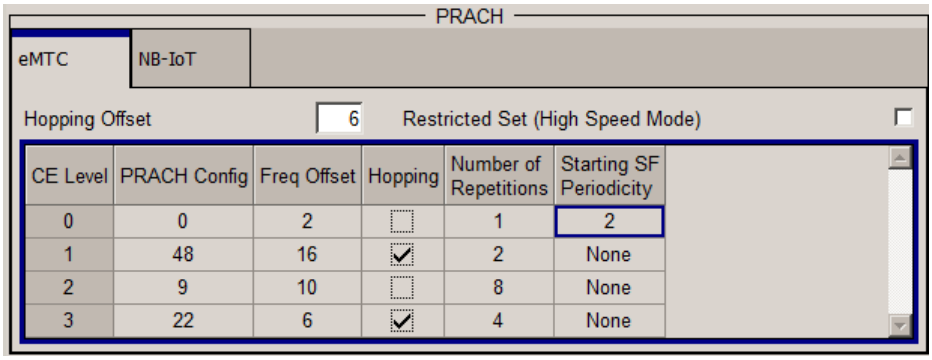
Remote command:
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:CBITs?
on page 877

5.3.10 eMTC PRACH Settings

Access:

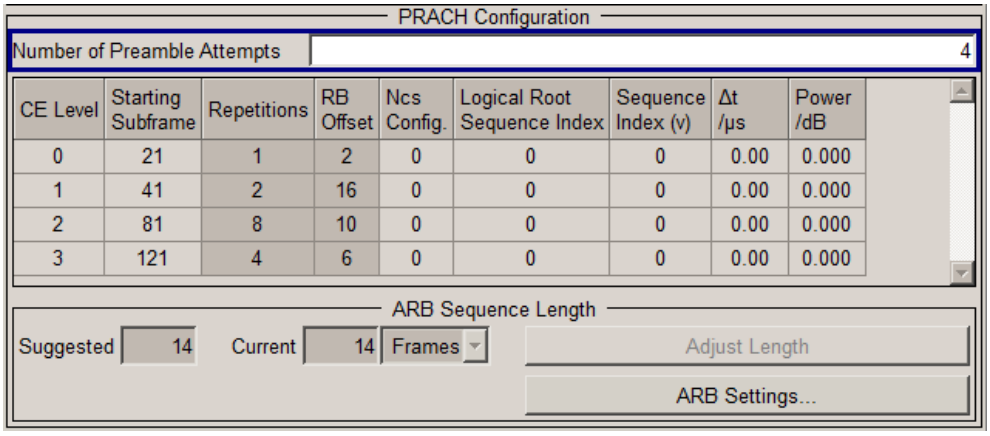
1. Select "General > General UL Settings > PRACH".
2. Select the "eMTC" side tab.

The dialog comprises the parameters to define the PRACH per coverage extension level (CE level).



The group of LTE parameters has no effect on the eMTC PRACH configuration.

3. To allocate the NPRACH for a specific UE, use the following parameters:
   a) Select "UL Frame Configuration > UE1 > 3GPP Release = eMTC".
   b) Select "UE1 > Settings > Common > Mode = PRACH".
   c) Select "PRACH".



You can change the number of preamble attempts, select one of the PRACH configurations per attempt and PRACH allocation.
For description of the related settings, see "eMTC PRACH allocation per UE" on page 445.

4. If necessary, use the "Adjust Length" function to enable larger number of frames automatically so that the PRACH frequency hopping pattern is completed.

5. Open the "Time Plan" to visualize the PRACH allocation:
   a) Select "UL Frame Configuration > Time Plan".

b) Configure the subframes to be displayed.

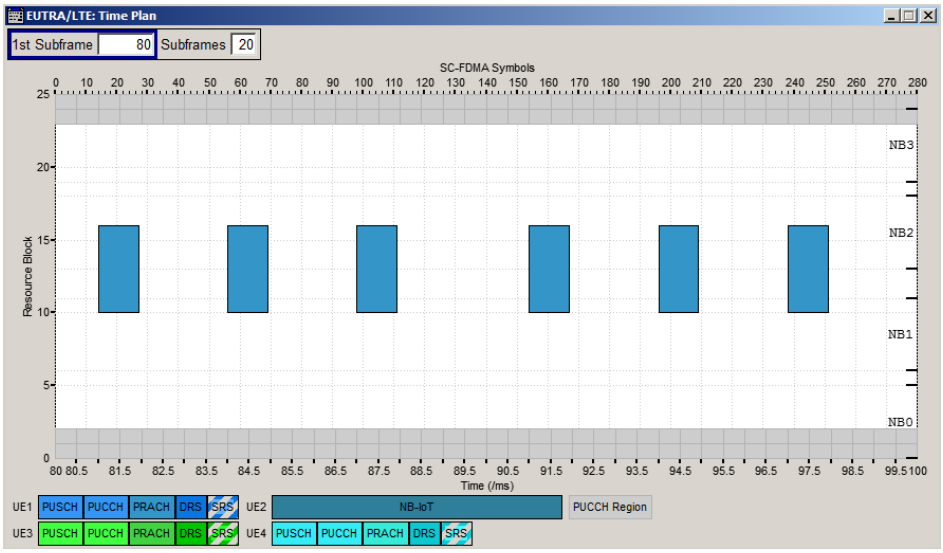


Figure 5-12: PRACH configuration visualization in the "Time Plan" ("PRACH Configuration = 9", "Repetitions = 8"; PRACH bandwidth = 6 RB)

PRACH settings:

eMTC PRACH configurations 443
- Hopping Offset 444
- Restricted Set 444
- CE Level 444
- PRACH Configuration 444
- Freq. Offsets 444
- Hopping 444
- Number of Repetitions 444
- Starting SF Periodicity 444

eMTC PRACH allocation per UE 445
- Number of Preamble Attempts 445
- CE Level 445
- Starting Subframe 445
- Repetitions 445
- Frequency Resource Index 445
- RB Offset 445
- Ncs Configuration 446
- Logical Root Sequence Index 446
- Sequence Index (v) 446
- Delta t /us 446
- Power, dB 446

ARB Sequece Length > Sugested 447

eMTC PRACH configurations

Use the provided settings to configure three PRACH configurations for the different coverage levels (CE).

Hopping Offset ← eMTC PRACH configurations
Sets a PRACH hopping offset as number of resource blocks (RB).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:HOFF` on page 849

Restricted Set ← eMTC PRACH configurations
Set the higher-layer parameter `High-speed-flag` and defines whether unrestricted set or one of the restricted sets ("Type A" or "Type B") is used.

The value influences the PRACH generation out of the Zadoff-Chu sequence.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:RSET` on page 848

CE Level ← eMTC PRACH configurations
Indicates the CE level.

PRACH Configuration ← eMTC PRACH configurations
Selects one of the predefined 64 PRACH configurations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:CONFig` on page 849

Freq. Offsets ← eMTC PRACH configurations
Shifts the PRACH allocation in the frequency domain in terms of resource blocks (RB).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:FOFFset` on page 850

Hopping ← eMTC PRACH configurations
Enables frequency hopping per CE level and PRACH configuration.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:HOPPing` on page 849

Number of Repetitions ← eMTC PRACH configurations
Defines how many times a PRACH is repeated.

According to TS 36.211, PRACH can be repeated N_{rep}^{PRACH} = 1, 2, 4, 8, 16, 32, 64 or 128 times.

If "Hopping > On", the repetitions use different frequency allocations.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:REPetit` on page 850

Starting SF Periodicity ← eMTC PRACH configurations
Sets the higher-layer parameter N_{start}^{PRACH}:

"2, 4, 8, 16, 32, 64, 128 or 256"
Indicates the periodicity of the starting subframes in terms of subframes that are allowed for PRACH transmission.
The following applies:
"Starting SF Periodicity" ≥ Number of Repetitions.

"None" The periodicity of the allowed starting subframes is N_{rep}^{PRACH}, as set with the parameter Number of Repetitions.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:SSFPeriod`
on page 850

eMTC PRACH allocation per UE
Comprises the UE-specific PRACH configuration.

Use this setting to can change the PRACH allocation per UE, for example:
- The number of preamble attempts
- To select starting subframe and configure PRACH allocations.

Number of Preamble Attempts ← eMTC PRACH allocation per UE
Each preamble attempt is defined in a row in the PRACH table.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:EMTC:PRATtempts` on page 877

CE Level ← eMTC PRACH allocation per UE
Selects the CE level. Several PRACH settings are set as configured in the common PRACH setting for the particular CE level, see "eMTC PRACH configurations" on page 443.

Each subsequent preamble attempt (i.e. subsequent row in the PRACH table) has to use a higher CE level.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:CELV`
on page 877

Starting Subframe ← eMTC PRACH allocation per UE
The value is calculated automatically, based on the CE level and the CE level and the CE level used by the previous preamble attempt.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:SFSTart`
on page 878

Repetitions ← eMTC PRACH allocation per UE
Displays the values set in the general PRACH settings dialog for the selected CE level, see Number of Repetitions.

Frequency Resource Index ← eMTC PRACH allocation per UE
For "Duplexing > TDD", sets the frequency resource index f_{RA} for the selected subframe.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:FRINdex`
on page 878

RB Offset ← eMTC PRACH allocation per UE
Indicates the starting RB. The value is calculated form the parameter Freq. Offsets.

Ncs Configuration ← eMTC PRACH allocation per UE
Sets the Ncs configuration and determines the Ncs value for the preamble attempt according to TS 36.211.

Table 5-49: Value range Ncs configuration

Parameter	Ncs configuration
"PRACH > Restricted Set = Off"	0 to 15
"PRACH > Restricted Set = Type A"	0 to 14
"PRACH > Restricted Set = Type B"	0 to 12
"Duplexing > TDD" and "PRACH Configuration" > 47	0 to 6

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:NCSConf`
on page 878

Logical Root Sequence Index ← eMTC PRACH allocation per UE
Sets the logical root sequence index.

Parameter	Root sequence (u)
"Duplexing > TDD" and "PRACH OCnfiguration" > 47	0 to 137
Otherwise	0 to 838

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:RSEQuence`
on page 878

Sequence Index (v) ← eMTC PRACH allocation per UE
Sets the sequence index **v**.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:SINDex`
on page 879

Delta t /us ← eMTC PRACH allocation per UE
Sets the parameter Delta_t in us.

Any Δt value different than 0 shifts the preamble in the time domain.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:DT`
on page 879

Power, dB ← eMTC PRACH allocation per UE
Sets the preamble attempt power relative to the UE power.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:POWer`
on page 879

ARB Sequece Length > Sugested
Indicates the ARB sequence length that is required for the current PRACH configuration.

Use the "Adjust Length" function to apply the suggested value.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:EMTC:ARB:SUGGested?`
on page 880

6 Observing Current Allocations on the Time Plan

You can observe the current allocations on the time plan. There are dedicated uplink and downlink time plans and, if TDD duplexing mode is used, the time plan also visualizes the special subframes.

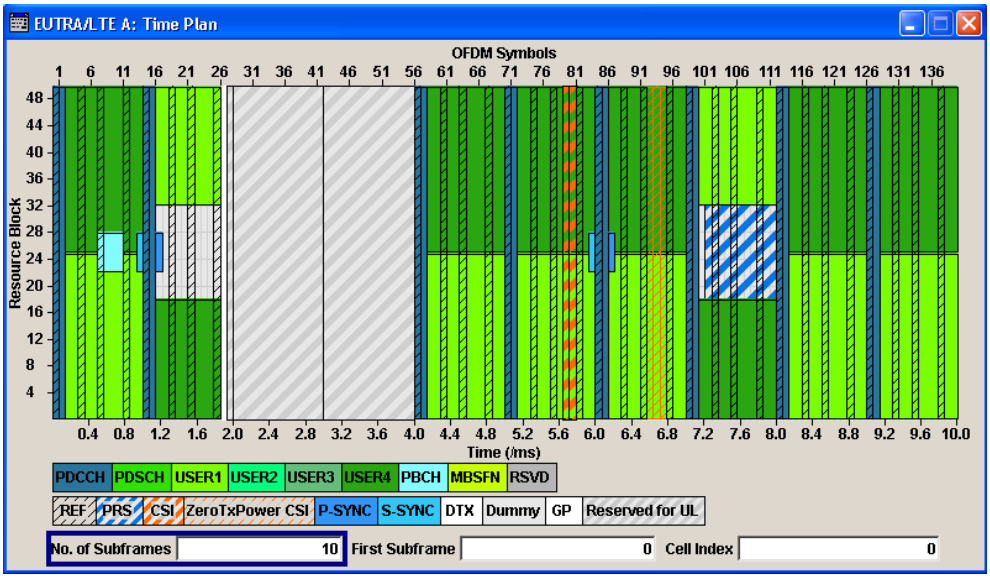
The time plan shows active channels and signals, the allocations of the active UEs and indicates the cell it applies for if a carrier aggregation is used. Per default, the time plan shows the allocation per used channel bandwidth and one subframe but you can extend the displayed time region to up to 40 subframes. You can also scroll over all available subframes and open the time plan in a separate window.

- OFDMA Time Plan 448
- SC-FDMA Time Plan 449
- TDD Time Plan 451
- eMTC/NB-IoT Indication in the DL Time Plan 453
- eMTC/NB-IoT Indication in the UL Time Plan 454

6.1 OFDMA Time Plan

Access:

1. Select "General > Link Direction > Downlink (OFDMA)".
2. Select "Frame Configuration > Time Plan".



The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation to a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

P-SYNC/S-SYNC is automatically calculated according to the settings in General DL Settings dialog.

Cell
With enabled "General DL Settings > CA > Activate Carrier Aggregation > On" state, indicates to which cell (i.e. component carrier) the settings apply.

Remote command:
n.a

First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframes
Selects the number of subframes to be displayed.

Remote command:
n.a.

View Mode
Determines how the allocations are displayed.

If at least one NB-IoT UE is enabled, you use this parameter to zoom in and out in the frequency domain.

"PRB/VRB" The "Time Plan" displays the entire channel bandwidth. It shows the allocated virtual resource blocks (VRBs) or the physical resource blocks (PRBs).
In this granularity, an in-band or guard band NB-IoT allocation is indicated as one resource block; NRS are not visible. This mode is not available in standalone NB-IoT operation.

"Single RB" The "Time Plan" displays the allocation of the anchor carrier (one single RB) as selected in the RB index field.
The NRS, NPSS/NSSS and the downlink channels are shown in greater detail.
Note that the y-axis indicates the frequency allocation in terms of number of subcarriers.

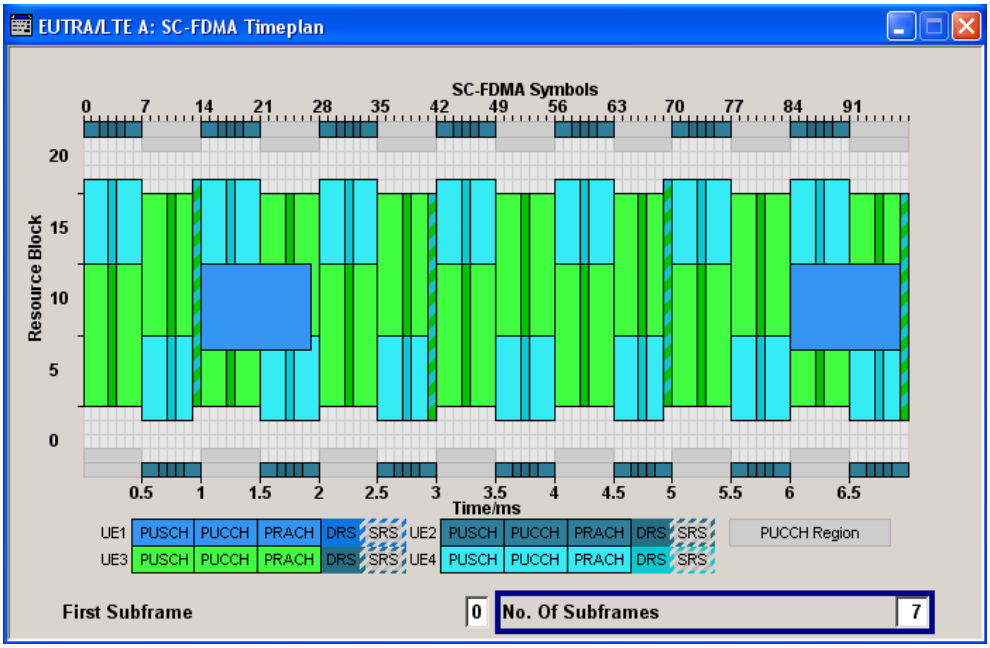
Remote command:
n.a.

6.2 SC-FDMA Time Plan

Access:

1. Select "General > Link Direction > Uplink (SC-FDMA)".

2. Select "Frame Configuration > Time Plan".



This dialog shows the uplink time plan.

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation of a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

Sounding Reference Signals (SRS) are automatically calculated according to the settings for signal structure in "User Equipment" dialog.

An enabled SFN offset is also displayed, see "SFN Offset" on page 219.

Cell
In enabled "General UL Settings > CA > Activate Carrier Aggregation > On" state, determines the settings of which cell (Primary Cell or SCell) are displayed.

First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframes
Selects the number of subframes to be displayed.

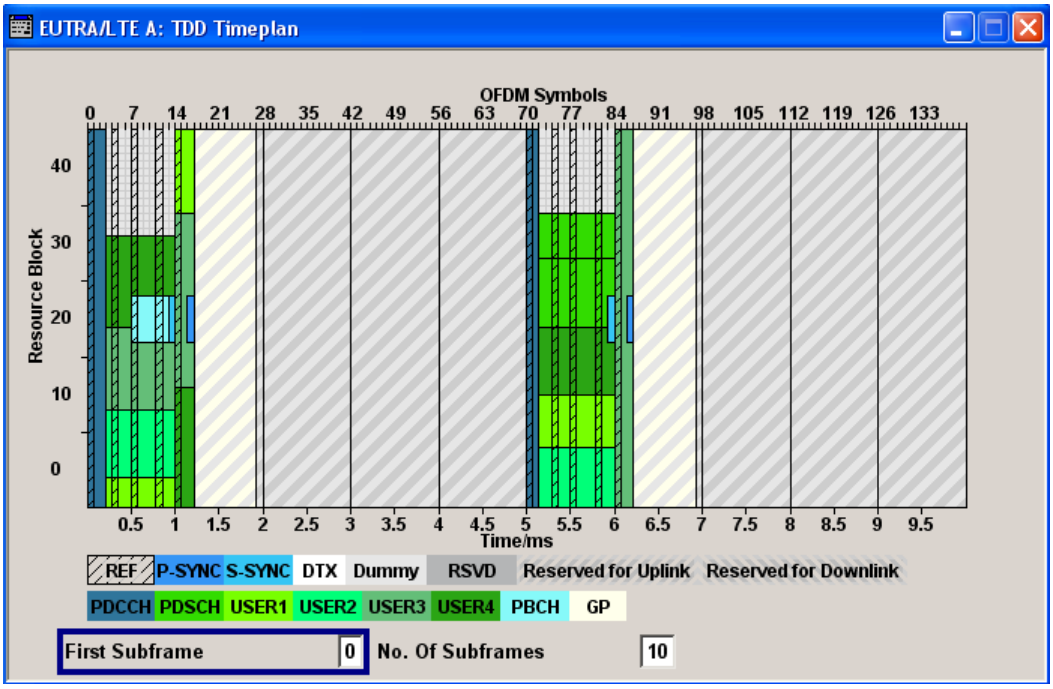
Remote command:
n.a.

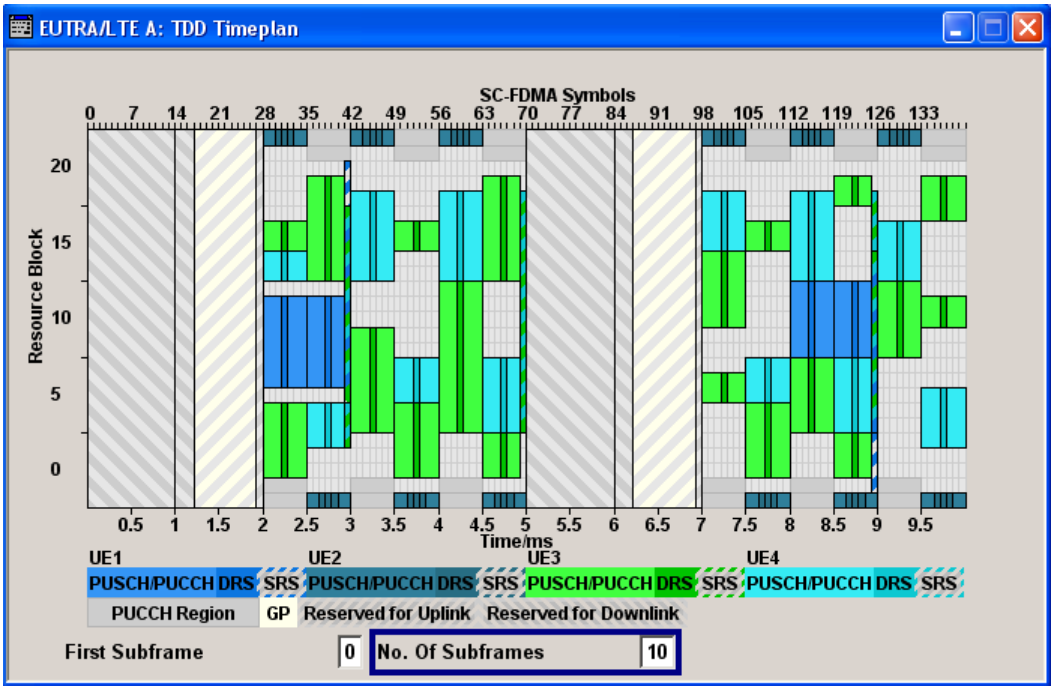
6.3 TDD Time Plan

The "TDD Timeplan" menu is called in the "DL" or "UL Frame Configuration" menu with the button "Show Time Plan" whenever TDD is selected as "Duplexing" mode.

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain.

The frame structure depends on the selected "DL/UL Configuration" and the "Configuration of Special Subframe".





First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframes
Selects the number of subframes to be displayed.

Remote command:
n.a.

View Mode
Determines how the allocations are displayed.

If at least one NB-IoT UE is enabled, you use this parameter to zoom in and out in the frequency domain.

"PRB/VRB" The "Time Plan" displays the entire channel bandwidth. It shows the allocated virtual resource blocks (VRBs) or the physical resource blocks (PRBs).
In this granularity, an in-band or guard band NB-IoT allocation is indicated as one resource block; NRS are not visible. This mode is not available in standalone NB-IoT operation.

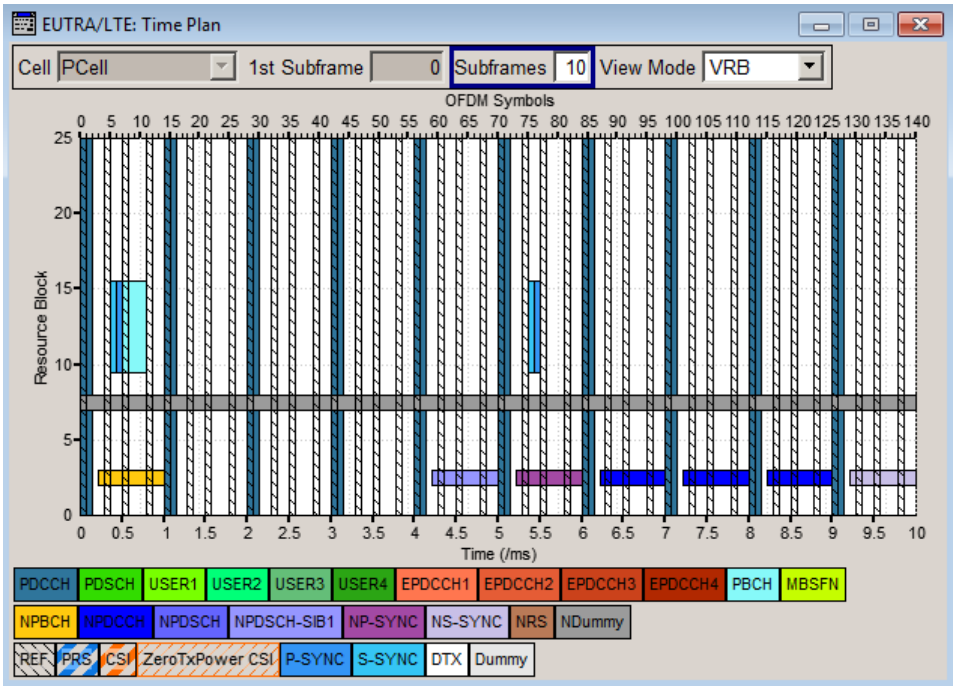
"Single RB" The "Time Plan" displays the allocation of the anchor carrier (one single RB) as selected in the RB index field.
The NRS, NPSS/NSSS and the downlink channels are shown in greater detail.
Note that the y-axis indicates the frequency allocation in terms of number of subcarriers.

Remote command:
n.a.

6.4 eMTC/NB-IoT Indication in the DL Time Plan

Access:

1. In the "General" dialog, select "Mode > LTE/eMTC/NB-IoT".
2. Select **"Link Direction > Downlink"**.
3. In the "General DL Settings > NB-IoT Carriers" dialog, for the anchor carrier set "Mode = In-Band"
4. Select "Frame Configuration > Time Plan".



5. To display the NB-IoT allocations in greater detail:
   a) Select "View Mode > Single RB".
   b) Select the RB number in that the anchor carrier is allocated, for example "RB = 2".

   This dialog shows the downlink time plan.
   Note that the y-axis indicates the frequency allocation in terms of **number of sub-carriers**.

   Allocations are calculated as configured in the "DL Frame Configuration > NB-IoT Allocations" dialog.
   With the default settings as in this example, displayed are only the NPBCH and the NPSS/NSSS; other downlink channels are not configured.

Settings:

First Subframe....454
Subframes....454
View Mode....454

First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframes
Selects the number of subframes to be displayed.

Remote command:
n.a.

View Mode
Determines how the allocations are displayed.

If at least one NB-IoT UE is enabled, you use this parameter to zoom in and out in the frequency domain.

"PRB/VRB" The "Time Plan" displays the entire channel bandwidth. It shows the allocated virtual resource blocks (VRBs) or the physical resource blocks (PRBs).
In this granularity, an in-band or guard band NB-IoT allocation is indicated as one resource block; NRS are not visible. This mode is not available in standalone NB-IoT operation.

"Single RB" The "Time Plan" displays the allocation of the anchor carrier (one single RB) as selected in the RB index field.
The NRS, NPSS/NSSS and the downlink channels are shown in greater detail.
Note that the y-axis indicates the frequency allocation in terms of number of subcarriers.

Remote command:
n.a.

6.5 eMTC/NB-IoT Indication in the UL Time Plan

Access:

1. In the "General" dialog, select "Mode > LTE/eMTC/NB-IoT".
2. Select **"Link Direction > Uplink (SC-FDMA)"**.
3. Select "Frame Configuration > Time Plan".
4. Select "View Mode > Channel BW".

   This dialog shows the uplink time plan.

Allocations are calculated as configured in the "User Equipment" dialog.

5. To display the NB-IoT allocations in greater detail:
   a) Select "View Mode > Single RB".
   b) Select the number of RB, for example "RB = 1" or "RB = 24".

   Note that the y-axis indicates the frequency allocation in terms of number of subcarriers. The left and the right y-axis shows the subcarrier numbering depending on the subcarrier spacing ("@15kHz" and "@3.75kHz").

Settings:

First Subframe.....455
Subframes.....455
View Mode.....455

First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframes
Selects the number of subframes to be displayed.

Remote command:
n.a.

View Mode
If at least one NB-IoT UE is enabled, you use this parameter to zoom in and out in the frequency domain.

"Channel BW" The "Time Plan" displays the entire channel bandwidth.
In this granularity, an NB-IoT allocation is indicated as one resource block. NPUSCH or NPRACH hops are not visible.

"Single RB" The "Time Plan" displays one single RB as selected in the RB index field.
The NPRACH and NPUSCH incl. the NDRS signals are shown in greater detail. Frequency hops are visible.
Note that the y-axis indicates the frequency allocation in terms of number of subcarriers.

The left and the right y-axis shows the subcarrier numbering depending on the subcarrier spacing:
- "@15kHz", one RB consists of 12 subcarrieres.
- "@3.75kHz", there are 48 subcarriers.

7 Performing BS Tests According to TS 36.141

The "Test Case Wizard" supports tests on base stations in conformance with the 3GPP specification for Base Station conformance testing. It offers a selection of predefined settings according to Test Cases in TS 36.141. For an overview of the test cases covered by the test case wizard, refer to Chapter 7.3, "Supported Test Cases", on page 458.

With the "Test Case Wizard", it is possible to create highly complex test scenarios with just a few keystrokes.

The "Test Case Wizard" has effect on frequency and level settings, link direction, filter, trigger, baseband clock source, marker settings and base station or user equipment configuration.

The "Test Case Wizard" also effects:

- AWGN
- Co-located modulation signals
- Fading profiles
- CW interferers.

The "Test Case Wizard" presets the instrument for tests according to the test specification. If it is required, you can change the predefined settings by varying the corresponding parameter in the EUTRA/LTE dialogs.

7.1 Introduction to Conformance Testing

The main purpose of the conformance testing is to ensure that the base station (BS) and the user equipment (UE) are fulfilling a defined level of minimum performance.

The 3GPP organization defines three groups of conformance testing for the UE: Radio Frequency (RF), Radio Resource Management (RRM) and Signaling. There is only one group conformance testing for the BS, the RF conformance tests.

This chapter is intended to give an overview of the 3GPP test specifications dealing with the conformance tests. Only a brief description is provided.

7.1.1 UE Conformance Testing

The UE conformance tests are not in the scope of this description.

UE RF FDD/TDD Conformance Test Specifications

The UE RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.521. The following list gives an overview of the related specifications:

- TS 36.124 "ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"
- TS 36.521-1 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing"

  Overview of the test cases:

  – Subclause 6: UE RF transmitter test cases
  Transmit power, Output power dynamics, Transmit signal quality, Output RF spectrum emissions and Transmit intermodulation

  – Subclause 7: UE RF receiver test cases
  Diversity characteristics, Reference sensitivity power level, Maximum input level, Adjacent Channel Selectivity (ACS), In-band blocking, Out-of-band blocking, Narrow band blocking, Spurious response, Intermodulation characteristics, Spurious emissions

  – Subclause 8: UE RF FDD/TDD performance test cases
  Demodulation of PDSCH (Cell-Specific Reference Symbols), Demodulation of PDSCH (User-Specific Reference Symbols), Demodulation of PDCCH/ PCFICH, Demodulation of PHICH, Demodulation of PBCH
- TS 36.521-2 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)"
- TS 36.521-3 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management (RRM) conformance testing"

UE RRM Conformance Test Specifications

The following specifications deal with UE RRM conformance testing:

- TS 36.133 "Requirements for support of radio resource management"
- TS 36.521-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

UE Signaling Conformance Test Specifications

The UE signaling conformance tests are defined in the TS 36.523.

- TS 36.523-1 "User Equipment (UE) conformance specification; Part 1: Protocol conformance specification"
- TS 36.523-2 "User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) pro-forma specification"
- TS 36.523-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

7.1.2 BS Conformance Testing

BS RF FDD/TDD Conformance Test Specifications

The BS RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.141

- TS 36.113 "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"
- TS 36.141 "Base Station (BS) conformance testing"
  The BS RF Conformance Tests are described in Chapter 7.3, "Supported Test Cases", on page 458.

7.1.3 Repeater Conformance Testing

The repeater conformance tests are based on the core specification TS 36.106 and defined in the TS 36.143 "FDD repeater conformance testing".

7.2 Basic Configuration

The basic equipment layout for preforming test with the "Test Case Wizard" is the same as for the EUTRA/LTE signal generation. It includes the options:

- Baseband Main Module (R&S SMU/SMJ/SMATE-B13)
- Baseband Generator (R&S SMBV-B10)
- Digital Standard EUTRA/LTE (R&S SMBV-K55)
- Frequency option (R&S SMx-B10x: RF 100kHz - x GHz)

However, some of the tests require further options. The additionally required hardware and/or software options are listed as a prerequisite in the description of the corresponding test case.

Test cases where the signal generator hardware and/or software equipment is not sufficient are shown in grey color but are not selectable.

RF power and frequency limitations of the hardware equipment restrict the setting ranges.

7.3 Supported Test Cases

The BS RF conformance tests defined in the TS 36.141 are divided into three main parts, the RF transmitter characteristics, the RF receiver characteristics and the RF performance requirements.

The "Test Case Wizard" supports the test cases listed in the tables below.

Only the test cases that require a signal generator are implemented in the "Test Case Wizard".

Table 7-1: Transmitter Tests

Chapter in TS 36.141	**Test Case**	**Section in this document with further information**
	Output power dynamics	this test case does not require a signal generator
6.3.1	RE Power control dynamic range	
6.3.2	Total power dynamic range	
6.4	Transmit ON/OFF power	
	Transmitted signal quality	
6.5.1	Frequency error	
6.5.2	Error Vector Magnitude	
6.5.3	Time alignment between transmitter branches	
6.5.4	DL RS power	
	Unwanted emissions	
6.6.1	Occupied bandwidth	
6.6.2	Adjacent Channel Leakage power Ratio (ACLR)	
6.6.3	Operating band unwanted emissions	
6.6.4	Transmitter spurious emissions	
6.7	Transmitter intermodulation	chap. 7.7.5, on page 478

Table 7-2: Receiver Characteristics

Chapter in TS 36.141	**Test Case**	**Section in this document with further information**
7.2	Reference sensitivity level	chap. 7.8.4, on page 485
7.3	Dynamic range	chap. 7.8.5, on page 487
7.4	In-channel selectivity	chap. 7.8.6, on page 489

7.3.1 Generic Structure of the Description of the Implemented Test Cases

The description of the test cases in this document follows a common structure.

- Test Case Number and Test Case Name
- Short Description and Test Purpose
  Some of the definitions are directly taken form the 3GPP test specification.

- Prerequisites, required hardware and software options
- Test setup
- Description of test case specific parameters

7.4 Standard Test Setups

The tests can be performed using the standard test setup according to TS 36.141. Test setups beside the three standard test setups described below are specified at the individual description of the corresponding test case.

7.4.1 Standard Test Setup - One Path

The RF port outputs the wanted signal (with or without interference) and is connected to the Rx port of the base station. The signal generator will start signal generation at the first received eNB frame trigger.

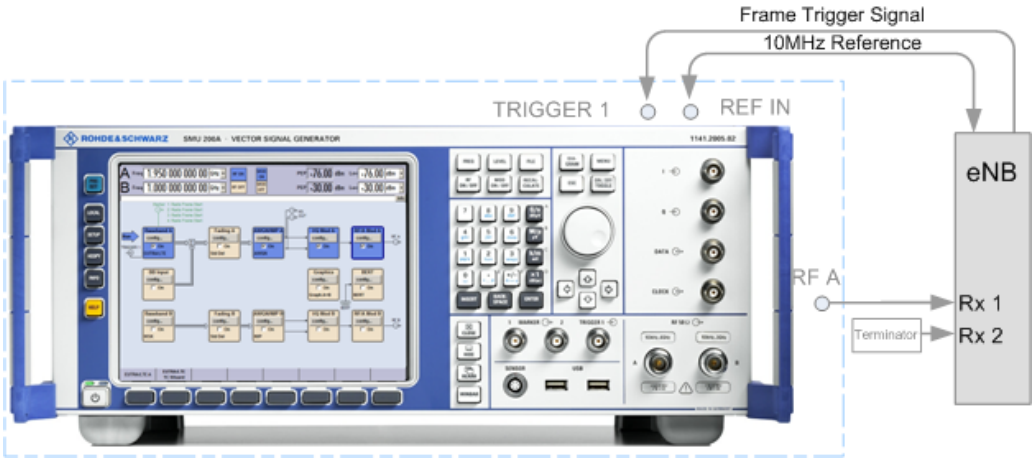


Figure 7-1: One Path Standard Test Setup (Example of R&S SMU simulating the test case 7.3 "Dynamic Range")

7.4.2 Standard Test Setup - Two Paths

For two-paths measurements, the test cases always require option Second RF path (R&S SMx-B20x), a second option Baseband Main Module (R&S SMx-B13) and at least one option to generate the interfering signal in addition to the basic configuration. The signal routing is fixed.

The signal generator outputs the reference measurement channel signal, i.e. the wanted signal at output RF A and the interfering signal(s) at output RF B. After combining the two (three) signals the sum signal is fed into the base station Rx port. The signal generator will start signal generation at the first received eNB frame trigger.

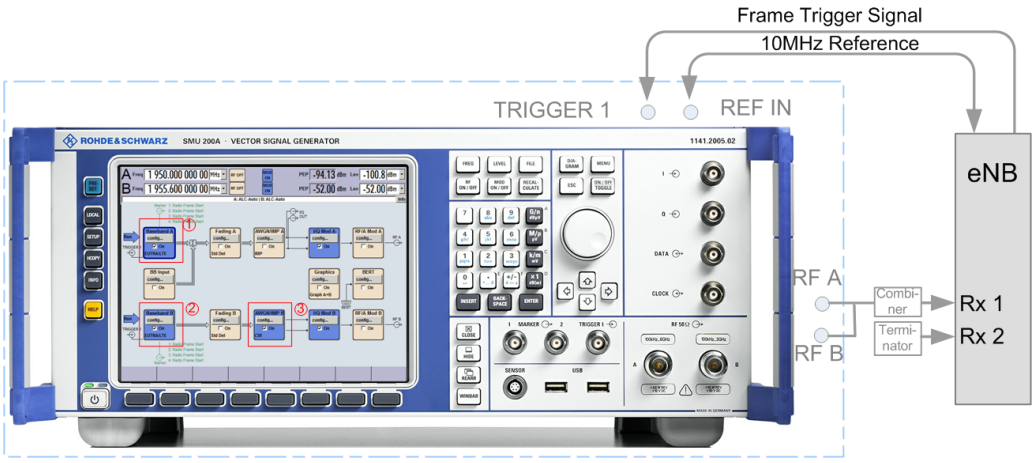


Figure 7-2: Two Paths Standard Test Setup (Example of R&S SMU simulating test case 7.8 "Receiver Intermodulation")

1 = Baseband A generates the wanted signal
2 = Baseband B generates the EUTRA/LTE interfering signal
3 = AWGN B generates the CW interfering signal

7.4.3 Test Setup - Diversity Measurements

For diversity measurements, the test cases always require at least option Second RF path (R&S SMx-B20x) and a second option Baseband Main Module (R&S SMx-B13) in addition to the basic configuration. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first received eNB frame trigger.

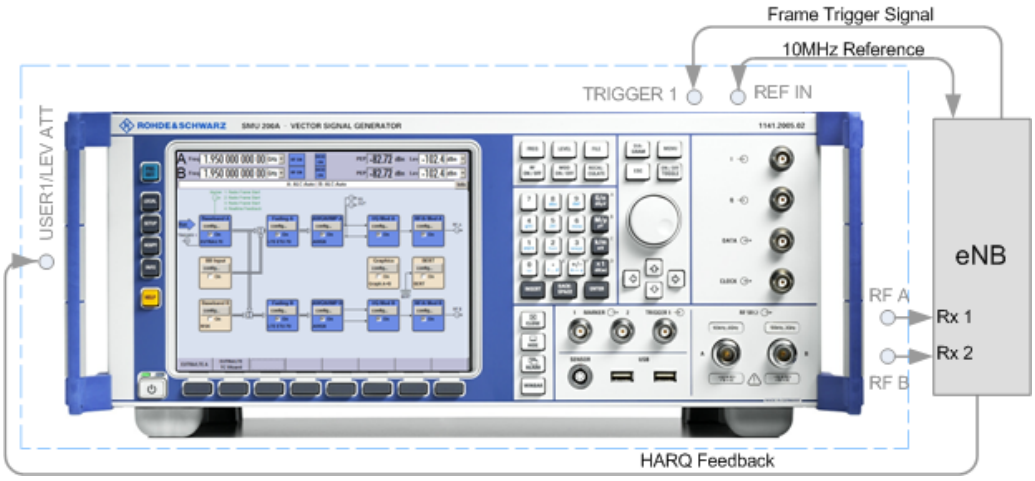


Figure 7-3: Test Setup for Diversity Measurements (Example of R&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")

As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

7.4.4 Test Setup - Four Rx Antennas

Test setup with four Rx antennas require a second signal generator, equipped with two paths (e.g. two R&S SMU). The required options of both signal generators are identical. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first received eNB frame trigger.

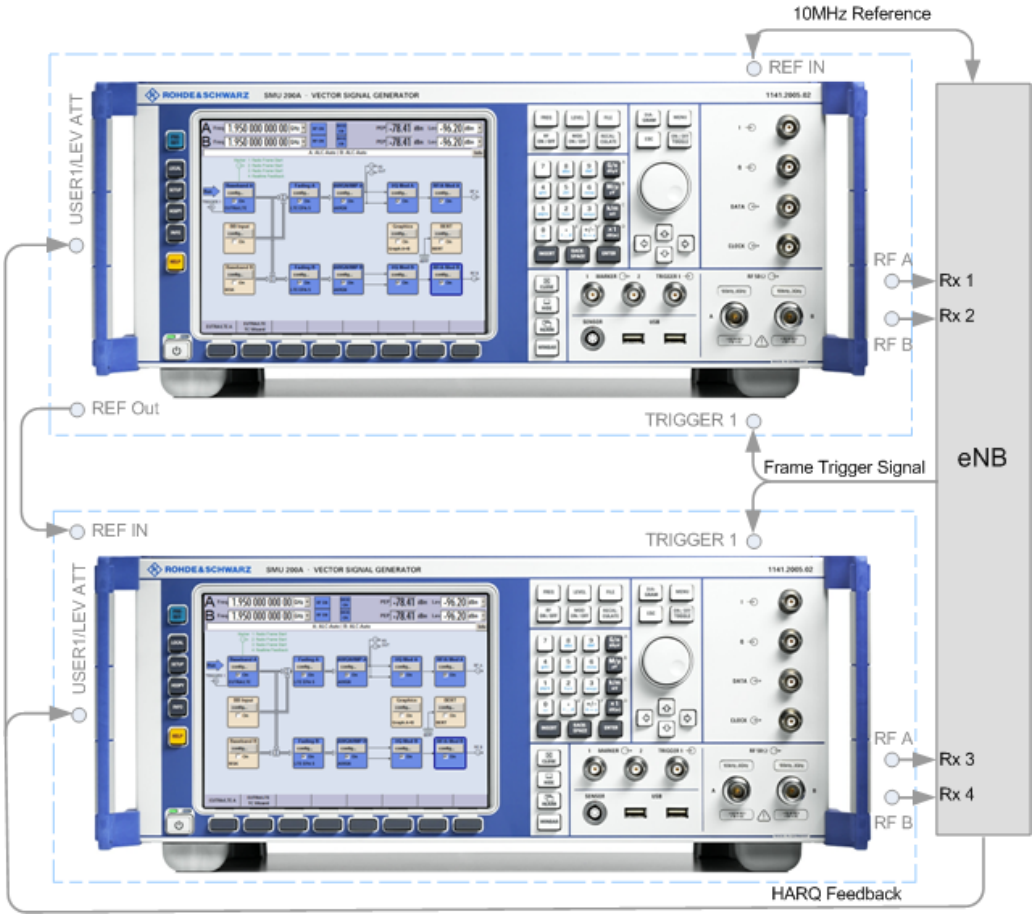


Figure 7-4: Test Setup for tests with four Rx antennas (Example of 2xR&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")

As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

7.5 General Considerations

This section lists some common topics for all BS RF conformance tests. Considerations specific to one conformance test part, are described at the corresponding section.

Test Frequencies

EUTRA/LTE is designed to operate in the operating bands defined in Table 7-3. The table shows the start and the stop frequencies of both uplink and downlink frequency bands according to TS 36.141.

Table 7-3: EUTRA/LTE operating bands

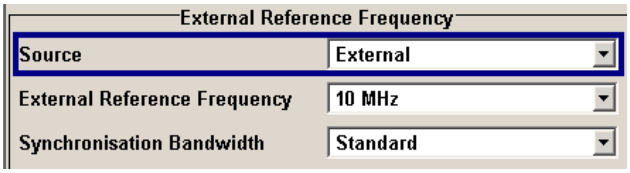
EUTRA Operating Band	Uplink (UL) band BS receive UE transmit F_{UL_low} to F_{UL_high}	Downlink (DL) operating band BS transmit UE receive F_{DL_low} to F_{DL_high}	Duplex Mode
1	1920 MHz to 1980 MHz	2110 MHz to 2170 MHz	FDD
2	1850 MHz to 1910 MHz	1930 MHz to 1990 MHz	FDD
3	1710 MHz to 1785 MHz	1805 MHz to 1880 MHz	FDD
4	1710 MHz to 1755 MHz	2110 MHz to 2155 MHz	FDD
5	824 MHz to 849 MHz	869 MHz to 894MHz	FDD
6	830 MHz to 840 MHz	875 MHz to 885 MHz	FDD
7	2500 MHz to 2570 MHz	2620 MHz to 2690 MHz	FDD
8	880 MHz to 915 MHz	925 MHz to 960 MHz	FDD
9	1749.9 MHz to 1784.9 MHz	1844.9 MHz to 1879.9 MHz	FDD
10	1710 MHz to 1770 MHz	2110 MHz to 2170 MHz	FDD
11	1427.9 MHz to 1447.9 MHz	1475.9 MHz to 1495.9 MHz	FDD
12	699 MHz to 716 MHz	729 MHz to 746 MHz	FDD
13	777 MHz to 787 MHz	746 MHz to 756 MHz	FDD
14	788 MHz to 798 MHz	758 MHz to 768 MHz	FDD
...			
17	704 MHz to 716 MHz	734 MHz to 746 MHz	FDD
...			
33	1900 MHz to 1920 MHz	1900 MHz to 1920 MHz	TDD
34	2010 MHz to 2025 MHz	2010 MHz to 2025 MHz	TDD
35	1850 MHz to 1910 MHz	1850 MHz to 1910 MHz	TDD
36	1930 MHz to 1990 MHz	1930 MHz to 1990 MHz	TDD
37	1910 MHz to 1930 MHz	1910 MHz to 1930 MHz	TDD
38	2570 MHz to 2620 MHz	2570 MHz to 2620 MHz	TDD

EUTRA Operating Band	Uplink (UL) band BS receive UE transmit F_{UL_low} to F_{UL_high}	Downlink (DL) operating band BS transmit UE receive F_{DL_low} to F_{DL_high}	Duplex Mode
39	1880 MHz to 1920 MHz	1880 MHz to 1920 MHz	TDD
40	2300 MHz to 2400 MHz	2300 MHz to 2400 MHz	TDD

The measurements that have to be performed according to TS 36.141 for verifying a proper operation of systems apply to appropriate frequencies in the bottom, middle and top of the operating frequency band of the base station (BS). These frequencies are denoted as RF channels B (bottom), M (middle) and T (top).

Reference Frequency

When building up the measurement setups according to TS 36.141 it might be useful that all the instruments share a common reference clock. When you feed an external clock, the RF module configuration should be switched to external reference frequency.



In the external reference mode an external signal with selectable frequency and defined level must be input at the REF IN connector. This signal is output at the REF OUT connector. The reference frequency setting is effective for both paths. For achieving very good reference sources of high spectral purity a wideband setting is provided.

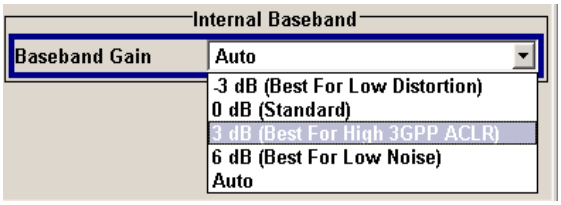
Baseband Clock

The clock source is automatically switched to internal when the test case settings are activated.

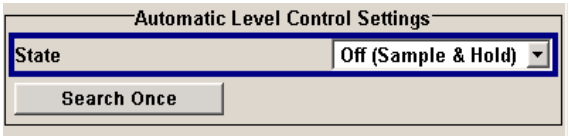
Improvement of signal quality

Improvement of signal quality is possible via several settings:

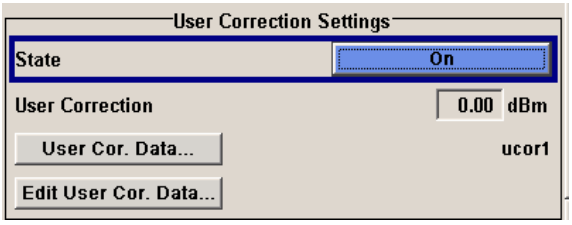
- In the "I/Q Settings" menu the internal baseband gain can be set to improved ACLR performance (3 dB or 6 dB)



- In the "Automatic Level Control Settings" menu the RF output level can be recalibrated with "Search Once" in "Sample&Hold" mode. This is recommended if in CW mode the signal/intermodulation ratio is to be improved for multi-transmitter measurements. With setting "Auto", the level control is automatically adapted to the operating conditions, it may cause increased intermodulation, however.



- To consider the frequency response of the test setup, select "RF > User Correction" and crate a list of correction values.



- To compensate cable loss and additionally inserted attenuator, adjust the RF level ("Status Bar > Level").

- Additional settings in the impairments section of the AWGN block

Virtual Resource Block (VRB) Offset

In this implementation, the RBs are allocated by default at the left edge of the spectrum. However, some test cases do not require allocation of the entire bandwidth or RB allocation at a specific part of the bandwidth. Adjust the additional parameter "Offset VRB" to define the position of the RBs.

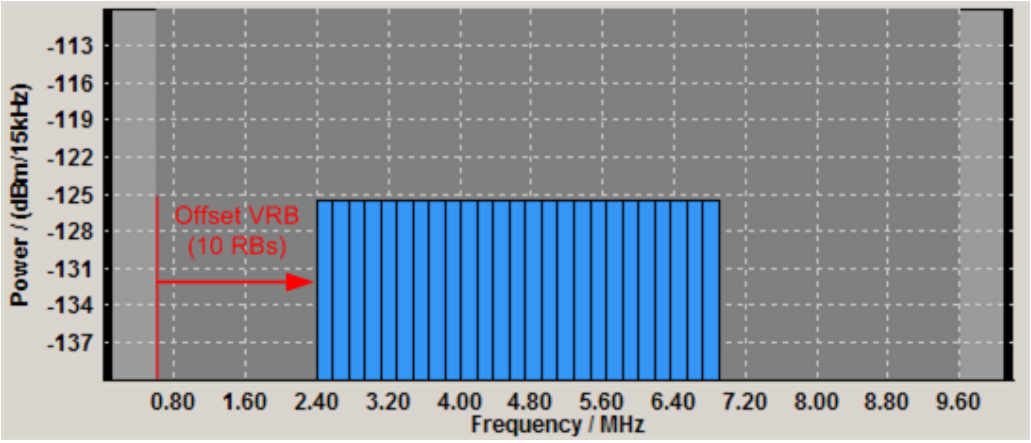
Example: Offset VRB

"Channel Bandwidth" = 10 MHz, i.e. 50 RBs

"Allocated Resource Blocks" = 25

"Offset VRB" = 10

The RBs are offset by 10 RBs and allocated RBs start at position 11.



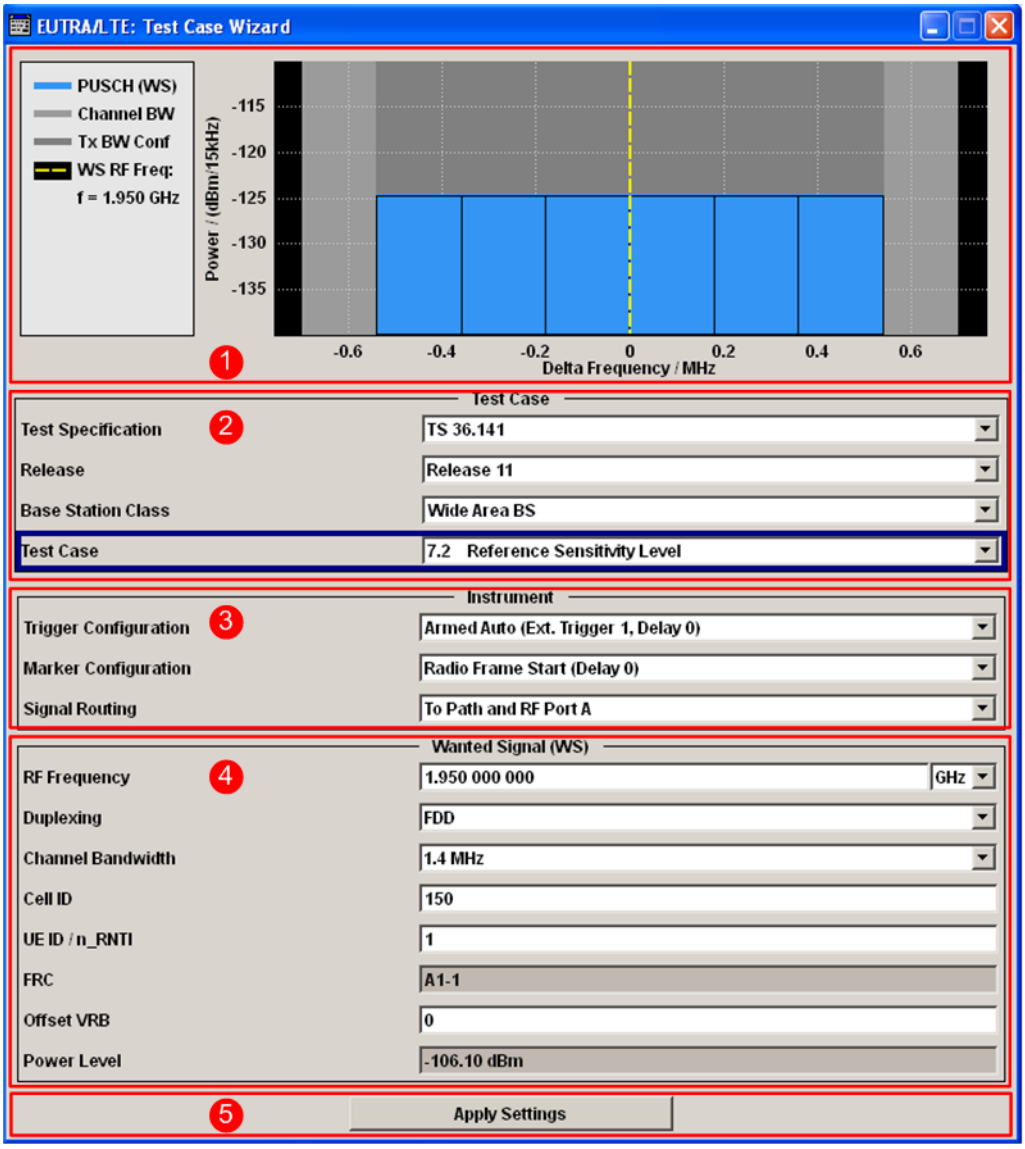
Use also the SC-FDMA Time Plan to visualize the RB allocation for the wanted signal (path A) and the interfering signal (path B).

7.6 User Interface

► To access the "Test Case Wizard" dialog, select "Baseband Block > EUTRA/LTE > Test Case Wizard".

The "Test Case Wizard" dialog comprises three main parts, the "General Settings" area for selecting the test case and the settings regarding routing, trigger and marker configuration, an area with additional parameters like the configuration of the wanted and interfering signals, AWGN and fading settings and the "Apply Settings" button.

The graph symbolizes the interference scenario defined by power level and frequency offset.



1 = Graph
2 = Test Case settings
3 = Insrument settings
4 = Additional parameters
4 = Apply settings

7.6.1 Test Case Settings

The upper part of the dialog comprises the settings for selecting the test case.

Test Specification
Selects the 3GPP test specification used as a guide line for the test cases.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:SPEC` on page 882

Release
Displays the 3GPP test specification release version used as a guide line for the test cases.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease` on page 882

Base Station Class
Determines whether the test is to be performed for a local area, home area, medium range or a wide area base station. The different base station classes are specified for different output power ("Power Level" on page 471).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass` on page 882

Test Case
Selects the test case.

Note: Not all test case are available for all instruments. The enabled test cases depend on the instrument's hardware (e.g. instrument equipped with one or two paths, etc) and/or the installed SW options (e.g. Fading Simulator, etc.).

See Chapter 7.3, "Supported Test Cases", on page 458 for an overview of the available test cases.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:TC` on page 886

7.6.2 Instrument Settings

This section comprises the settings for configuring the general signal generators parameters.

Trigger Configuration
Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

"Armed Auto (Ext. Trigger 1, Delay 0)"	The trigger settings are customized for the selected test case. The trigger setting "Armed Auto" with external trigger source "External Trigger 1" is used; the trigger delay is set equal to zero. Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.
"Unchanged"	The current trigger settings of the signal generator are retained unchanged.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig` on page 883

Marker Configuration
Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

"Radio Frame Start (Delay 0)" The marker settings are customized for the selected test case. "Radio Frame Start" markers are output; the marker delays are set equal to zero.

"Unchanged" The current marker settings of the signal generator are retained unchanged.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig` on page 882

Signal Routing
Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.

"To RF A"
The baseband signal is routed to RF output A.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout` on page 883

Frequency Allocation of the Interfering signal
Determines the frequency position of the wanted and the interfering signal.

Example: Wanted and interfering signal within the same channel

"Test Case" = 7.4 "In Channel Selectivity"

"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the allocated RBs within the channel. Allocation in the lower or higher frequencies is possible.

Example: Interfering signal in the adjacent channel

"Test Case" = 7.5A "Adjacent Channel Selectivity"

"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the wanted signal compared to the interfering signal. Allocation in the lower or higher frequencies is possible, i.e. the position of the allocated bandwidth of the wanted and the interfering signal can be mirrored.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation` on page 881
`[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation` on page 881

7.6.3 Wanted Signal and Cell-Specific Settings

The following settings are available for almost all transmitter and receiver characteristics and performance requirements tests. Specific parameters are listed together with the description of the corresponding test case.

For the in-channel test cases 7.4, 8.2.2 and 8.3.3, the cell-specific settings apply also for the interfering signal, respectively for the signal of the stationary UE.

RF Frequency 470
Duplexing 470
TDD UL/DL Configuration 470
Signal Advance N_TA_offset 470
Channel Bandwidth 470
Cell ID 470
Cyclic Prefix 470
UE ID/n_RNTI 471
FRC 471
Offset VRB 471
Power Level 471

RF Frequency
Sets the RF frequency of the wanted signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency` on page 889

Duplexing
Selects whether TDD or FDD duplexing mode is used (see also "Duplexing" on page 64).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex` on page 887

TDD UL/DL Configuration
For TDD mode, selects the UL/DL Configuration number (see also "TDD UL/DL Configuration" on page 94).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig` on page 889

Signal Advance N_TA_offset
Sets the parameter $N_{TAoffset}$.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset` on page 888

Channel Bandwidth
Selects the channel bandwidth (see also Chapter 4.10.2, "Physical Settings", on page 214).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW` on page 887

Cell ID
Sets the Cell ID (see alsoChapter 4.10.4, "Cell-Specific Settings", on page 217).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID` on page 887

Cyclic Prefix
Selects normal or extended cyclic prefix.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix on page 887

UE ID/n_RNTI
Sets the UE ID/n_RNTI.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID on page 889

FRC
Displays the fixed reference channel used. An overview of the FRCs and the cross-reference between the selected Channel Bandwidth and the FRC is given in the individual description of the test cases.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC on page 888

Offset VRB
Sets the number of RB the allocated RB(s) are shifted with (see also Example "Offset VRB" on page 465).

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB on page 888

Power Level
Displays the power level, depending on the selected test case.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLEVel? on page 889

7.6.4 Apply

Button "Apply Settings" triggers a selective preset of the signal generator prior to presetting the setting according to the selected test case. Further modification of the generator settings is still possible. Signal generation starts with the first trigger event.

Apply Settings
Activates the current settings of the test case wizard.

Note: The settings of the selected test case becomes active only after selecting "Apply Settings".

Initialization of the signal generator with the test case settings is performed by a partial selective reset that includes only the baseband, fading and AWGN module and the RF frequency and RF level settings. Other settings of the signal generator are not altered.

Before triggering the signal generator the user still can change these other settings. This is particularly useful when compensating for cable loss and additionally inserted attenuators by adjusting the RF power level offset is required.

Signal generation is started at the first trigger received by the generator. The RF output is not activated /deactivated by the test case wizard. Activate the "RF > State > On" at the beginning of the measurement.

Note: For safety reasons the RF is not active unless the button "RF ON" has been selected.

Note: The settings in the dialogs "EUTRA/LTE > Trigger/Marker/Clock", in the "Global Trigger/Clock Settings" and in the "User Marker / AUX I/O Settings" are not affected by the selective preset, if the parameter "Trigger/Marker Configuration" is set to "Unchanged".

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings` on page 881

7.7 Transmitter Characteristics (TS 36.141, Chapter 6)

The transmitter characteristics comprise the maximum output power, output power dynamics, transmitted signal quality, unwanted emissions and transmitter intermodulations. The "Test Case Wizard" supports the generation of signals in accordance with the transmitter intermodulations test case. A brief description about the unwanted emission tests is also provided (see Chapter 7.7.2, "Introduction to the Unwanted Emissions Tests", on page 472).

7.7.1 Prior Considerations

Test Models

3GPP specifies EUTRA test models (E-TM) for testing the transmitter characteristic. For an overview, see "Test Models" on page 64.

Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See Table 7-3 for an overview of the supported frequency operating bands.

Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best ACP Optimization" is automatically selected.

Test Setup

Transmitter tests require a separate measuring equipment, e.g. the Vector Signal Analyzer R&S FSV.

7.7.2 Introduction to the Unwanted Emissions Tests

The unwanted emissions from the transmitter are divided into two main groups, the out-of-band (OOB) emissions and the spurious emissions. The out-of-band emissions

are emissions on frequencies close to the frequency of the wanted signal. Spurious emissions are emissions caused by unwanted transmitter effects, like harmonics, parasitic emissions, intermodulation products and frequency conversion products.

- ACLR
  The Adjacent Channel Leakage power Ratio (ACLR) is defined as the ratio between the power transmitted in the channel bandwidth of the wanted signal to the power of the unwanted emissions transmitted on the adjacent channel.
  The test specification defines ACLR requirements for LTE and UTRA receivers. Different setting applies for paired and unpaired spectrum (see Table 7-4 and Table 7-5).

Table 7-4: Base Station ACLR in paired spectrum

EUTRA transmitted signal channel bandwidth $BW_{Channel}$, MHz	**BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted**	**Assumed adjacent channel carrier (informative)**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit**
1.4 / 3 / 5 / 10 / 15 / 20	$BW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	44.2 dB
	$2xBW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	
	$BW_{Channel}$/2+ 2.5 MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{Channel}$/2+ 7.5 MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	

Table 7-5: Base Station ACLR in unpaired spectrum with synchronized operation

EUTRA transmitted signal channel bandwidth $BW_{Channel}$, MHz	**BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted**	**Assumed adjacent channel carrier (informative)**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit**
1.4 / 3	$BW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	44.2 dB
	$2xBW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	
	$BW_{Channel}$/2+ 0.8 MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}$/2+ 2.4 MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
5 / 10 / 15 / 20	$BW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	
	$2xBW_{Channel}$	EUTRA of same BW	Square (BW_{Config})	
	$BW_{Channel}$/2+ 0.8 MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}$/2+ 2.4 MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}$/2+ 2.5 MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{Channel}$/2+ 7.5 MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{Channel}$/2+ 5 MHz	7.68 Mcps UTRA	RRC (7.68 Mcps)	
	$BW_{Channel}$/2+ 15 MHz	7.68 Mcps UTRA	RRC (7.68 Mcps)	

- Operating Band Unwanted Emissions
  The 3GPP specification introduces the term operating band unwanted emissions instead of the spectrum mask. The operating band unwanted emissions requirements are defined from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the operating band.

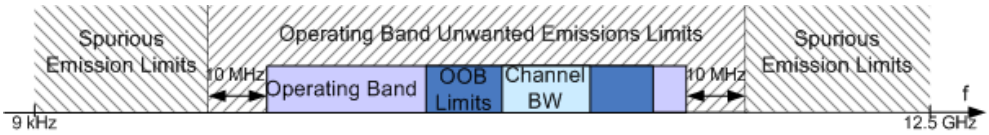


Figure 7-5: Transmitter tests frequency limits

  The operating band unwanted emissions require a 100 kHz measurement bandwidth.

- Spurious Emissions
  The transmitter spurious emissions limits apply from 9 kHz to 12.5 GHz, excluding the frequency range defined for the operating band unwanted emissions (see Figure 7-5).
  Refer to Table 7-6 for an overview of the general settings for the measurements. Additional requirements may apply for co-existence with other systems and/or co-location with other base stations. For detailed requirements, refer to the TS 36.141.

Table 7-6: Spurious emissions

Frequency range	Maximum level Category A	Maximum level Category B	Measurement Bandwidth
9kHz - 150kHz	-13 dBm	-36 dBm	1 kHz
150kHz - 30MHz			10 kHz
30MHz - 1GHz			100 kHz
1GHz - 12.75 GHz		-30 dBm	1 MHz

7.7.3 General Workflow for Carrying Out a Transmitter Test

The following describes the general workflow, only the basic steps are listed.
For detailed description about working with the analyzer and the base station, refer to the corresponding description.

The basic test setup is illustrated on Figure 7-6.

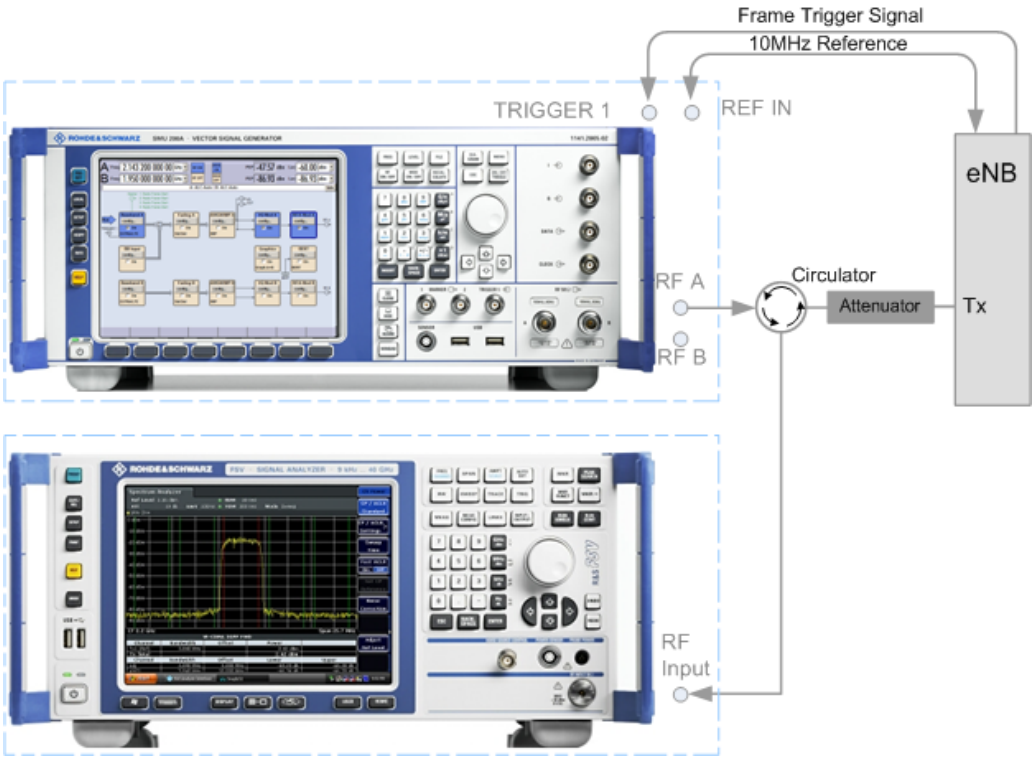


Figure 7-6: Test setup for Test case 6.7: Transmitter Intermodulation

1. Set the base station to the basic state and configure it for the selected test case.
   a) Initialize the base station,
   b) Set the base station to test model E-TM1.1,
   c) Set maximum transmit power,
   d) Set the frequency.
2. Set the signal generator to the basic state
   a) Preset the signal generator unless some settings (e.g. in terms of I/Q and RF blocks) have to be kept.
3. Set the analyzer to the basic state
4. Set the test case wizard
   a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard"
   b) Select "Test Case 6.7: Transmitter Intermodulation".
      The parameters are preset according to TS 36.141
   c) Adjust the settings of the wanted signal (RF level and Channel Bandwidth).
   d) Enter the test frequency (e.g. M). It must be the same as the base station has been set to.
   e) Enter the Interfering Signal parameters.
   f) Activate the settings with the "Apply Settings" button.
      The signal generator is now ready to start signal generation

5. Set the analyzer to the measurement frequency and perform further necessary settings.
   Refer to the description of the analyzer for further information.
6. In the signal generator, switch on the RF output.
7. Start the measurement
   a) Send a start trigger impulse from the base station to the signal generator and to the analyzer.

   The signal generator outputs the test model interfering signal; Measurement procedures are started.
8. Calculate the result
   The analyzer calculates the out-of-band emission and the spurious emission.

7.7.4 Interfering Signal Settings

The following settings are common for the transmitter tests that require interfering signal (IS). Specific parameters are listed together with the description of the corresponding test case.

The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth and center frequency relative to the carrier frequency of the wanted signal.

Offset to Channel Edge
Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth. This parameter determines the carrier frequency of the interfering signal (see RF Frequency).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEDge` on page 885

RF Frequency
Displays the RF Frequency of the interfering signal, determined by the RF Frequency of the wanted signal and the selected Offset to Channel Edge.

The $RF\ Frequency_{interfering\ signal}$ is calculated as follows:

- For "Frequency Allocation > Interfering Signal > At Higher Frequencies"
  "$RF\ Frequency_{interfering\ signal}$" = "$RF\ Frequency_{wanted\ signal}$" + Delta
- For "Frequency Allocation > Interfering Signal > At Lower Frequencies"
  "$RF\ Frequency_{interfering\ signal}$" = "$RF\ Frequency_{wanted\ signal}$" - Delta

Where for both cases **Delta** is calculated as follows:

Delta = "$BW_{wanted\ signal}$"/2 + $Offset_{interfering\ signal}$

In "Test Case > 6.2.6", the $Offset_{interfering\ signal}$ = 2.5 MHz; in "Test Case > 6.2.7", Delta = "$BW_{wanted\ signal}$".

Example: Calculation of RF Frequency in Test Case 6.7

"$BW_{wanted\ signal}$" = 1.4 MHz

"RF $Frequency_{wanted\ signal}$" = 1 950 MHz

$Offset_{interfering\ signal}$ = 7.5 MHz

Delta = 1.4/2 + 7.5 = 8.2 MHz

For "Frequency Allocation > Interfering Signal > At Higher Frequencies": "RF $Frequency_{interfering\ signal}$" = 1 950 + 8.2 = 1 958.2 GHz

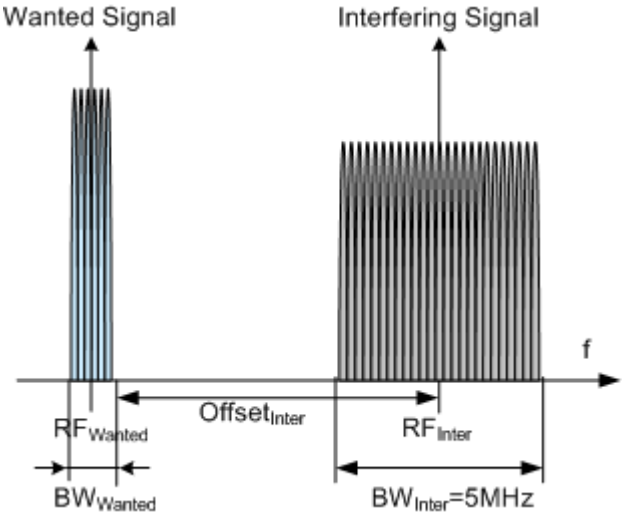


Figure 7-7: Example: Offset to Channel Edge (Channel Bandwidth = 1.4 MHz)

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency` on page 885

Channel Bandwidth
Displays the channel bandwidth of the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?` on page 883

Duplexing
Selects whether TDD or FDD duplexing mode is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex` on page 884

Test Model
Displays the test model. The interfering signal is generated according to E-TM1.1 test model.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel?` on page 886

Power Level/Power Level P-CPICH
Displays the power level of the interfering signal.

Test Case	Power level
6.7	The power level is always 30 dB below the Output Power Level of the wanted signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLEVel?` on page 885

7.7.5 Test Case 6.7: Transmitter Intermodulation

Test Purpose

The test purpose is to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its nonlinear elements caused by presence of the own wanted signal and an interfering signal reaching the transmitter via the antenna (TS 36.141).

Required Options

See Chapter 7.2, "Basic Configuration", on page 458.

Test Setup

See Figure 7-6.

The [RF] output of the signal generator is connected to the analyzer via a circulator and external attenuator. The Tx signal of the base station is connected to the RF input of the analyzer via a circulator.

Short Description

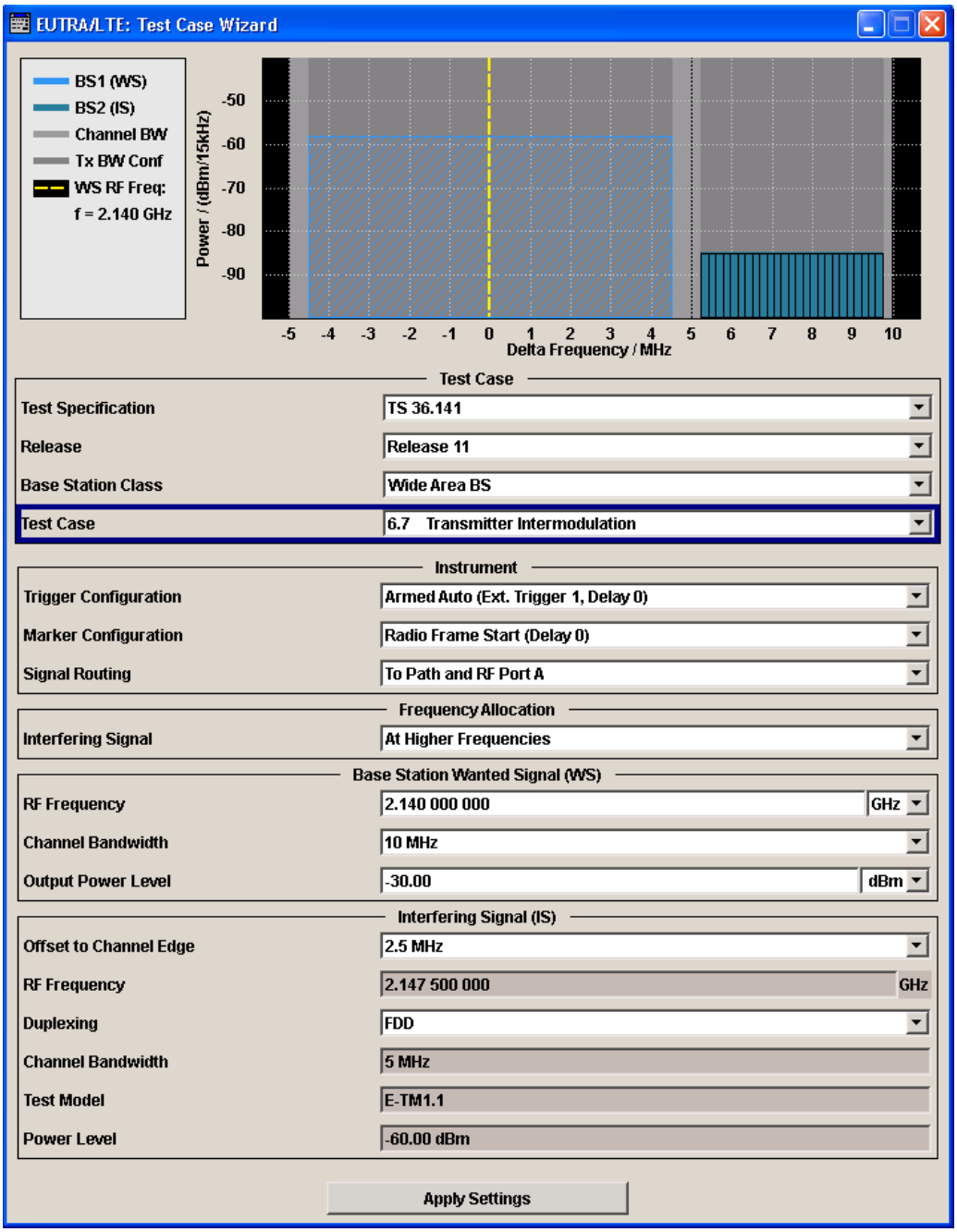
The transmitter intermodulation test is intended to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its nonlinear elements caused by presence of wanted signal and an interfering signal reaching the transmitter via the antenna.

The BS transmits signals in accordance with E-TM1.1 at maximum power and with channel bandwidth $BW_{Channel}$ corresponding to the maximum bandwidth supported by the base station. The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth. The interfering signal power shall be 30 dB lower than the power of the wanted signal at the frequency offsets of ±2.5 MHz, ±7.5 MHz and ±12.5 MHz.

The transmit intermodulation level shall not exceed the out-of-band emission requirements and transmitter spurious emissions requirements for all third and fifth order intermodulation products which appear in the frequency ranges defined in Table 7-4, Table 7-5 and Table 7-6. For detailed information about the operating band unwanted emissions, refer to section 6.6.3.5 in TS 36.141.

The test shall be done on three channels (B, M and T).

User Interface



The settings of the interfering signal are described in Chapter 7.7.4, "Interfering Signal Settings", on page 476.

Base Station Wanted Signal

The common settings of the wanted signal are described in Chapter 7.6.3, "Wanted Signal and Cell-Specific Settings", on page 469.

Output Power Level ← Base Station Wanted Signal
Sets the output power level of the wanted signal. The power level of the interfering signal is always 30 dB lower than this level.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel` on page 888

7.8 Receiver Characteristics (TS 36.141, Chapter 7)

Most of the receiver tests can be performed with the signal generator only, i.e. without additional measurement equipment.

The receiver requirements are divided into the following main categories, intended to

- Prove the receiver's ability to receive the wanted signal:
  - Chapter 7.8.4, "Test Case 7.2: Reference Sensitivity Level", on page 485
  - Chapter 7.8.5, "Test Case 7.3: Dynamic range", on page 487
- Prove how susceptible the receiver is to different types of interfering signals:
  - Chapter 7.8.6, "Test Case 7.4: In-channel selectivity (ICS)", on page 489

  The several test cases shell cover a wide range of scenarios with different types of impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

7.8.1 Prior Considerations

Fixed Reference Channels (FRC)

The receiver tests use fixed reference channels (FRC) as defined in TS 36.141, Annex A "Reference Measurement channels".

The following FRCs are defined for the receiver tests:

- FRC A1: A1-1 to A1-5 (QPSK)
- FRC A2: A2-1 to A2-3 (16QAM)

Refer to Table 4-12 for an overview of all supported FRC.

Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See Table 7-3 for an overview of the supported frequency operating bands.

Channel Bandwidth of the LTE Interfering Signal

For all test cases using an interfering LTE signal, the bandwidth of the interfering signal shall be the same as the wanted signal, but at the most 5 MHz.

Reference Sensitivity Power Level $P_{REFSENS}$

$P_{REFSENS}$ depends on the channel bandwidth and the base station class as specified in TS 36.104, subclause 7.2.1. The Table 7-7 gives an overview of the resulting power levels for the wanted signal per test case.

Table 7-7: BS reference sensitivity levels

Channel Bandwidth, MHz	Base Station Class	Reference sensitivity power level, $P_{REFSENS}$, dBm	ACS Test Case Wanted signal mean power, dBm	Narrow-band Blocking/ Blocking/Receiver Intermodulation Test Case Wanted signal mean power, dBm
1.4	Wide Area BS	-106.8	-95.8	-100.8
	Local Area BS / Home Area BS	-98.8	-87.8	-92.8
	Medium Range BS	-101.8	-90.8	-95.8
3	Wide Area BS	-103.0	-95.0	-97.0
	Local Area BS / Home Area BS	-95.0	-87.0	-89.0
	Medium Range BS	-98.0	-90.0	-92.0
5 /10 /15 /20	Wide Area BS	-101.5	-95.5	-95.5
	Local Area BS / Home Area BS	-93.5	-87.5	-87.5
	Medium Range BS	-96.5	-90.5	-90.5

Power Settings

The "Level Reference" parameter in the "Filter/Clipping/Power Settings" dialog is automatically set to "Frame RMS Power" for FDD Duplexing Mode and to "UL Part of Frame RMS Power" for TDD Duplexing Mode.

Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best EVM Optimization" is automatically selected.

7.8.2 General Workflow for Carrying Out a Receiver Test

The following instruction lists the general steps for performing a BS conformance test with the help of "Test Case Wizard". Specific requirements are described together with the individual test case.

For detailed description about the configuration of the base station, refer to the corresponding description.

1. Connect the instrument and the DUT according to the corresponding test case setup.
   See also Chapter 7.4, "Standard Test Setups", on page 460.
2. Set the base station to the basic state
   a) Initialize the base station
   b) Set the frequency
   c) Set the base station to receive the Fixed Reference Channel (for most receiver test cases)
3. Preset the signal generator to ensure a defined instrument state.
4. Configure the test case wizard
   a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard".
   b) Select a test case, e.g. "TS 36.141: 7.3 Dynamic Range".
   c) Enter additional required parameters, e.g. power class of base station.
   d) Enter the test frequency, e.g. M.
      It must be the same as the base station has been set to.
   e) Select "Apply Settings" to activate the settings.

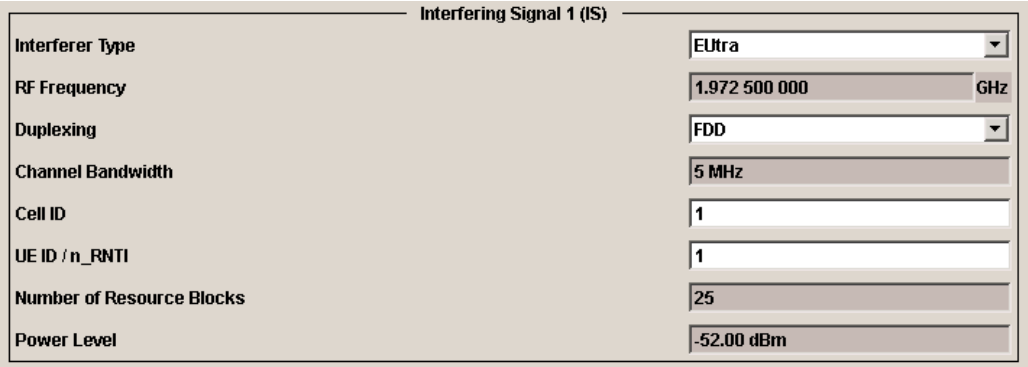
   The signal generator is now ready to start signal generation
5. Switch on RF output
6. If required, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
7. Start the measurement
   a) Send a start trigger impulse from the base station to the signal generator.

   The signal generator will start signal generation.
8. Calculate the result

   The base station internally calculates the BER, BLER or Pd depending on the test case. This value is compared to the required value.

7.8.3 Interfering Signal Settings

The following settings are available for almost all receiver tests, requiring an interfering signal (IS). Specific parameters are listed together with the description of the corresponding test case.



Interferer Type
(enabled for Blocking and Receiver Intermodulation tests)

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal or out-of-band CW signal.
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal or narrow-band EUTRA signal.
  The second interfering signal is always a CW signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe` on page 884

RF Frequency
Display the center frequency of the interfering signal.

The center frequency is calculated as follows:

- For "Frequency Allocation > Interfering Signal > At Higher Frequencies"
  "RF Frequency$_{\text{interfering signal}}$" = "RF Frequency$_{\text{wanted signal}}$" + Delta
- For "Frequency Allocation > Interfering Signal > At Lower Frequencies"
  "RF Frequency$_{\text{interfering signal}}$" = "RF Frequency$_{\text{wanted signal}}$" - Delta

Where for both cases Delta is calculated as follows:

Delta = "Channel Bandwidth$_{\text{wanted signal}}$"/2 + Offset$_{\text{interfering signal}}$

See also "RF Frequency" on page 476.

Example:

"Channel Bandwidth$_{\text{wanted signal}}$" = 5 MHz

"RF Frequency$_{\text{wanted signal}}$" = 1 950 MHz

Offset$_{\text{interfering signal}}$ = 2.5025 MHz

Delta = 5/2 + 2.5025 = 5.0025 MHz

For "Frequency Allocation > Interfering Signal > At Higher Frequencies": "RF Frequency$_{\text{interfering signal}}$" = 1 950 + 5.0025 = 1 955.0025 MHz

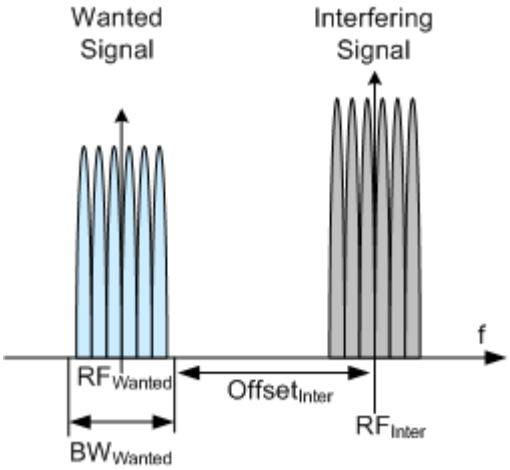


Figure 7-8: Example: Adjacent Channel Selectivity (ACS), Channel BW = 1.4 MHz

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency` on page 885

Duplexing
Selects whether TDD or FDD duplexing mode is used.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex` on page 884

TDD UL/DL Configuration
For TDD mode, selects the UL/DL Configuration number.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig` on page 886

Signal Advance N_TA_offset
Sets the parameter $N_{TAoffset}$.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset` on page 885

Channel Bandwidth
Displays the channel bandwidth of the interfering signal. The interfering signal has the same bandwidth as the wanted signal, but at the most 5 MHz.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW? on page 883

Cell ID
Sets the Cell ID for the interfering signal.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID on page 884

UE ID/n_RNTI
Sets the UE ID/n_RNTI for the interfering signal.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID on page 886

Number of Resource Blocks
The number of RBs used by the LTE interfering signal is set automatically:

- For **ACS and In-channel Selectivity measurements**, the number of RBs depends on the selected channel bandwidth for the wanted signal. The bandwidth of the interfering signal is equal to the bandwidth allocated for the wanted signal, but at the most 5 MHz.
- For **Narrow-band Blocking** tests, the interfering signal is a single resource block LTE signal.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBLock? on page 884

Power Level
The power level of the interfering LTE signal is set automatically depending on the selected channel bandwidth.

Remote command:
[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLEVel? on page 885

7.8.4 Test Case 7.2: Reference Sensitivity Level

Test Purpose

To verify that at the BS Reference sensitivity level the throughput requirement shall be met for a specified reference measurement channel (TS 36.141).

Required Options

See Chapter 7.2, "Basic Configuration", on page 458.

Test Setup

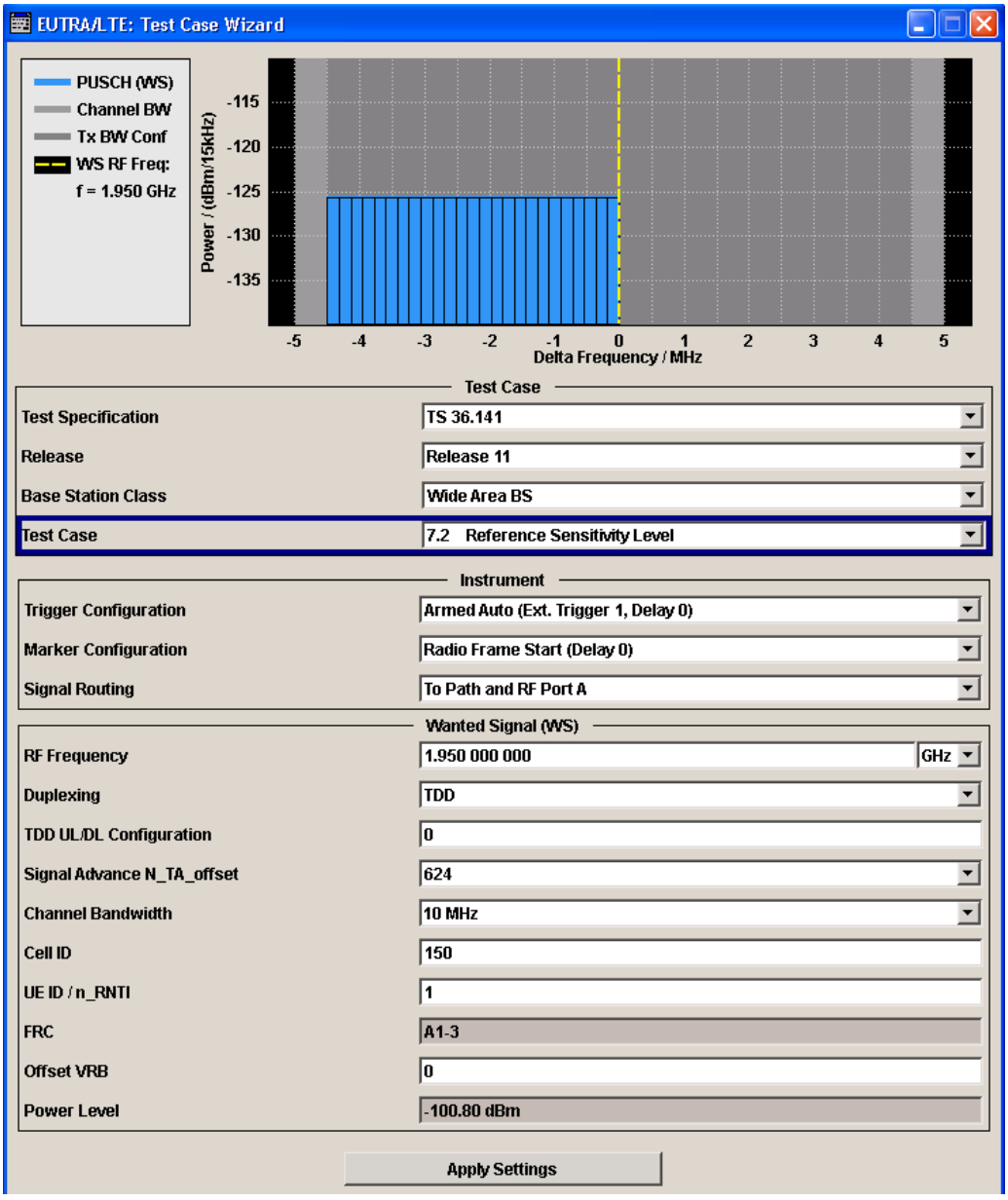
See Chapter 7.4.1, "Standard Test Setup - One Path", on page 460

Short Description

The reference sensitivity level measurement is a test case that aims to verify the Noise Figure of the receivers. The test case uses FRCs with QPSK modulation.

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; to adjust the position of the allocated RBs within the selected channel bandwidth, use the parameter "Offset VRB".

For the parameter in the Table 7-7 the throughput measured shall be equal or greater than 95%.



The settings of the wanted signal are described in Chapter 7.6.3, "Wanted Signal and Cell-Specific Settings", on page 469.

7.8.5 Test Case 7.3: Dynamic range

Test Purpose

To verify that at the BS receiver dynamic range, the relative throughput shall fulfil the specified limit (TS 36.141).

Required Options

- See Chapter 7.2, "Basic Configuration", on page 458.
- Option Additive White Gaussian Noise AWGN (R&S SMBV-K62)

Test Setup

See Chapter 7.4.1, "Standard Test Setup - One Path", on page 460

Short Description

The dynamic range test case aims to stress the receiver and measure its capability to demodulate the useful signal even in the presence of a heavy interfering signal inside the received channel bandwidth. The test case uses FRCs with 16QAM modulation. The throughput measurements are performed for different level of the wanted and the interfering AWGN signals.

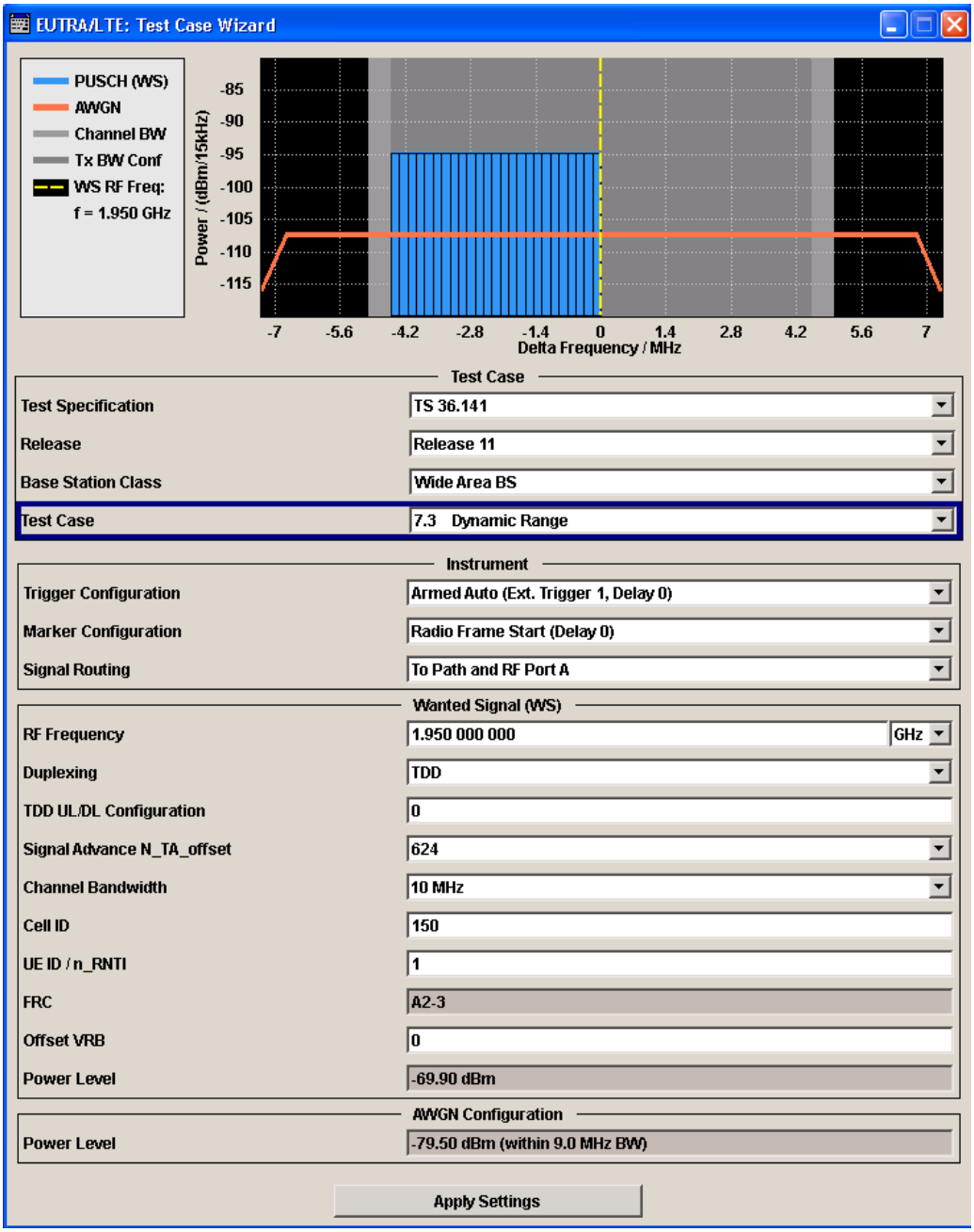
The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; to adjust the position of the allocated RBs within the selected channel bandwidth, use the parameter "Offset VRB".

For the parameter in the Table 7-8 the throughput shall be equal or greater than 95%.

Table 7-8: Dynamic range (Wide Area BS)

Channel Bandwidth, MHz	Reference Measurements Channel	Wanted signal mean power, dBm	Interfering signal mean power, dBm / BW_{Config}	Type of interfering signal
1.4	FRC A2-1	-76.0	-88.7	AWGN
3	FRC A2-2	-72.1	-84.7	AWGN
5	FRC A2-3	-69.9	-82.5	AWGN
10	FRC A2-3	-69.9	-79.5	AWGN
15	FRC A2-3	-69.9	-77.7	AWGN
20	FRC A2-3	-69.9	-76.4	AWGN

For the parameters of the other base station classes (Local Area BS, Home BS and Medium Range BS), refer to TS 36.141.



The settings of the wanted signal are described in Chapter 7.6.3, "Wanted Signal and Cell-Specific Settings", on page 469.

AWGN Configuration
Comprises the settings of the interfering signal.

Power Level ← AWGN Configuration
Displays the power level of the AWGN signal. The value is set automatically according to Table 7-8 and depending on the selected Channel Bandwidth.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLEVel?` on page 881

7.8.6 Test Case 7.4: In-channel selectivity (ICS)

Test Purpose

The purpose of this test is to verify the BS receiver ability to suppress the IQ leakage (TS 36.141).

Required Options

The required options depend on whether the test will be performed with an instrument equipped with one or two paths.

- Instrument equipped with one path, e.g. R&S SMBV:
  See Chapter 7.2, "Basic Configuration", on page 458.

Test Setup

See Chapter 7.4.1, "Standard Test Setup - One Path", on page 460.

Short Description

In-channel selectivity (ICS) is a measure of the receiver ability to receive a "weak" wanted signal at its assigned Resource Block locations in the presence of a "strong" interfering signal. The interfering signal shall be an EUTRA/LTE signal with the same bandwidth as the wanted signal, but at the most 5 MHz. The wanted and the interfering signal are allocated around the center frequency (see Figure 7-9); to swap the position of the wanted and interfering signal, use the parameter "Frequency Allocation".

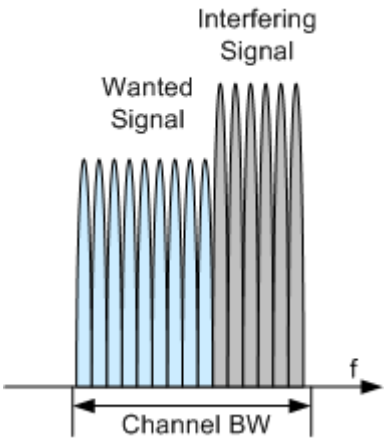


Figure 7-9: Example: In-channel selectivity (ICS), Channel BW = 3 MHz, Frequency Allocation = Lower Frequency

In a one-path instrument, the wanted and the interfering LTE signals are both generated using the same path. The interfering signal is simulated as an additional user equipment (UE). The level difference between the wanted and the interfering signals is

handled in the baseband. As the interferer level is higher, it is used as a reference; the level of the wanted signal is set relatively lower to the interferer.

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; to adjust the position of the allocated RBs within the selected channel bandwidth, use the parameter "Offset VRB".

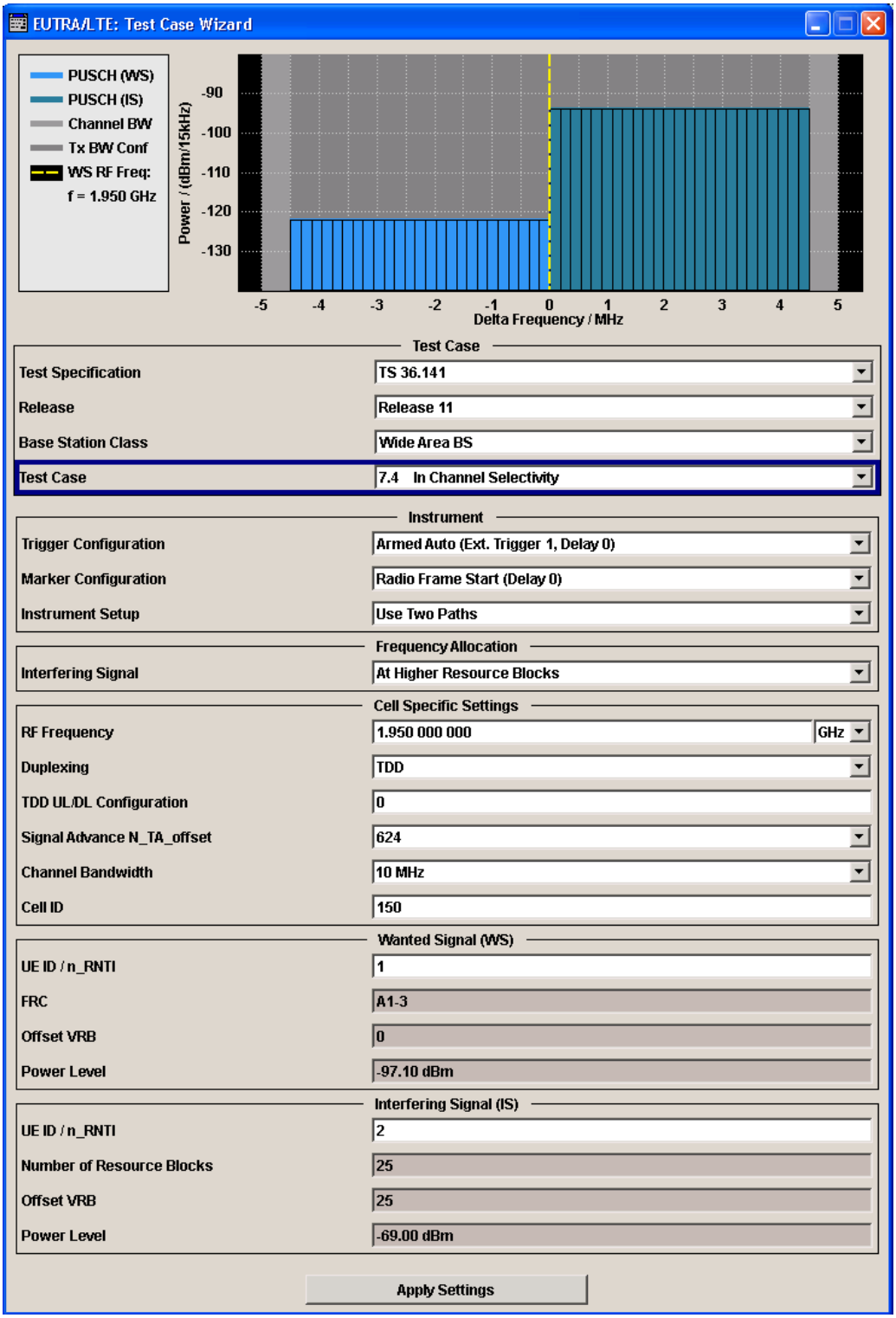
For the parameter in the Table 7-9 the throughput shall be equal or greater than 95%.

Table 7-9: In-channel selectivity (Wide Area BS)

Channel Bandwidth, MHz	Reference Measurements Channel	Wanted signal mean power, dBm	Interfering signal mean power, dBm / BW_{Config}	Type of interfering signal
1.4	FRC A1-4	-105.5	-87	1.4 MHz EUTRA signal, 3 RBs
3	FRC A1-5	-100.7	-84	3 MHz EUTRA signal, 6 RBs
5	FRC A1-2	-98.6	-81	5 MHz EUTRA signal, 10 RBs
10	FRC A1-3	-97.1	-77	10 MHz EUTRA signal, 25 RBs
15	FRC A1-3	-97.1	-77	15 MHz EUTRA signal, 25 RBs*
20	FRC A1-3	-97.1	-77	20 MHz EUTRA signal, 25 RBs*

*) Wanted and interfering signal are placed adjacently around the carrier frequency

For the parameters of the other base station classes (Local Area BS, Home BS and Medium Range BS), refer to TS 36.141.



The cell-specific settings and the settings of the wanted signal are described in Chapter 7.6.3, "Wanted Signal and Cell-Specific Settings", on page 469.

Refer to Chapter 7.8.3, "Interfering Signal Settings", on page 482 for description of the corresponding settings.

8 Signal Control and Signal Characteristics

This section lists settings provided for improving the signal and spectrum characteristics of the generated signal, defining the signal power and the signal generation start.

It covers the following topics:

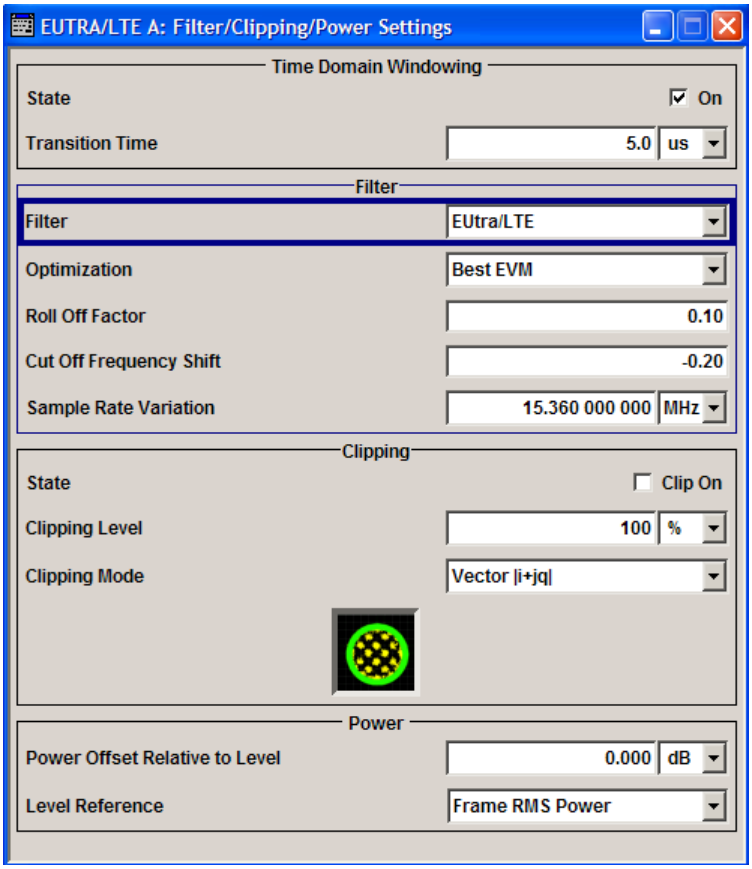
- Filter/Clipping/Power Settings....492
- Adjusting the Signal Power....501
- Trigger/Marker/Clock Settings....504

8.1 Filter/Clipping/Power Settings

Access:

► Select "Main dialog > Filter/Clipping/ARB Settings".

The dialog comprises the settings, for enabling time domain windowing and clipping, and adjusting the filter and power settings.



8.1.1 Time Domain Windowing Settings

Settings:

State....493
Transition Time....493

State
Activates/deactivates the time domain windowing.

Time domain windowing is a method that influences the spectral characteristics of the signal. The method removes the spikes caused by the OFDM; it does not replace oversampling and subsequent signal filtering.

Time domain windowing is not stipulated by the 3GPP standard.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDW:STATe` on page 525

Transition Time
Sets the transition time when time domain windowing is active.

The transition time defines the overlap range of two OFDM symbols. At a setting of 1 us and if sample rate = 15.36 MHz, 15 samples overlap.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TDW:TRTime` on page 525

8.1.2 Filter Settings

Provided are the following settings for configuring the baseband filter:

Filter....493
Optimization....493
Load User Filter....495
Rolloff factor or BxT....496
Cutoff frequency shift....496
Cutoff Frequency Factor....497
Filter Mode....497
Sample Rate Variation....497

Filter
Sets the baseband filter.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE` on page 520

Optimization
Selects one of the provided EUTRA/LTE filters.

Each filter is designed for different application field and optimized for a particular performance. Depending on the filter implementation, these filters require different calculation time. The applied upsampling factor also influences the size of the calculated output waveform file.

Waveforms can be calculated in the following ways:

- With the "Generate Waveform File" function
- With the signal generation software R&S WinIQSIM2

The following table outlines the difference between the provided EUTRA/LTE filters by comparing their major specifications.

Table 8-1: Overview of the EUTRA/LTE filters

Characteristic	"Best EVM"	"Best ACP" "Best ACP (Narrow)"	"Balanced EVM and ACP"	"Best EVM (no upsampling)"
Design goal	An excellent EVM performance while ignoring the effects on ACP	A combination of an excellent ACP performance and a good EVM performance "Best ACP (Narrow)" features also a smoother shape in frequency domain	A trade-off between EVM and ACP performance	A combination of an excellent ACP performance and a good EVM performance Small output waveform file size
Calculation time (in real-time processing)	By real-time processing, short calculation time	Long calculation time: the filtered signal is precalculated because of the filter complexity	By real-time processing, short calculation time	Long calculation time: the filtered signal is precalculated because of the filter complexity
Upsampling	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate The signal processing requires twice as much internal memory. The available memory on the instrument is sufficient for the simulation of half as many frames compared to filter "Best EVM"	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate	Upsampling is not applied The sample rate of the output waveform is not changed
Output waveform file size	Increased file size	Increased file size	Increased file size	File size is maintained The resulting file size is smaller than in the other cases
Recommended application field	Receiver and performance tests with internal real-time generation, where BLER is analyzed	Transmitter and components tests where excellent ACP is required		Receiver and performance tests with pre-generated waveform files, where BLER is analyzed

In specific configurations, an internal ("Auto") filter is applied automatically. This filter is designed for best possible optimization in configurations, like the carrier aggregation with carriers that span different bandwidths.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization` on page 522

`[:SOURce<hw>]:BB:EUTRa:FILTer:AUTO?` on page 522

Load User Filter
If Filter > "User" is selected, it opens the standard dialog "Select List File User Filter" for loading a user-defined filter file.

User filters are used as offline filters. The following types are supported:

- Files with predefined file format and extensions `*.vaf`
  For information, refer to the description "Introduction to "filtwiz" Filter Editor" on the Rohde & Schwarz web page.
- ASCII files with simple format and file extension `*.dat`
  These files describe filters as a sequence of normalized filter coefficients. Each coefficient is defined as a pair of I and Q samples. The I and Q components alternate at each file line. The I and Q values vary between - 1 and + 1.
  A user filter can contain up to 2560 coefficients.
  The user filter must be real-valued. For both I and Q components of the coefficients, only real coefficients different than 0 are allowed.
  You can create user filter files for example with MATLAB, see Example "Script that generates user filter file" on page 495.

Example: Script that generates user filter file

This MATLAB script creates a user filter file that fits the LTE default settings: "Channel Bandwidth = 10 MHz", "Number of Resource Blocks = 50", "FFT Size = 1024".

```
n_fft = 1048; %10MHz
n_scs = 50*12; %50RBs*12 subcarriers per RB

trans_region = 0.02 * n_fft/2; %in %, controls steepness of filter slopes,
relative to nyquist frequency

%cutoff frequencies
f = [n_scs/2 n_scs/2+trans_region];

%ripples in dB
rp = 0.01; %passband
rs = 80; %stopband
dev = [(10^(rp/20)-1)/(10^(rp/20)+1) 10^(-rs/20)];

%estimate filter order
[n,fo,ao,w] = firpmord(f,[1 0],dev,n_fft);

%generate filter coefficients
b = firpm(n,fo,ao,w);

fvtool(b); %displays filter response

%write filter out into .dat filter coefficient file
coeffs_out = zeros(2*length(b),1);
coeffs_out(1:2:end) = real(b);
coeffs_out(2:2:end) = imag(b);
```

```
dlmwrite(['smw_user_filter_' num2str(n) 'coeffs_' num2str(n_scs)
'scs_' num2str(n_fft) 'fft.dat'],coeffs_out);
```

Remote command:
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER on page 523

Rolloff factor or BxT
Sets the filter parameter.

The rolloff factor affects the steepness of the filter slopes. A "Rolloff Factor = 0" results in the steepest slopes; values near to 1 make the slopes more flat.

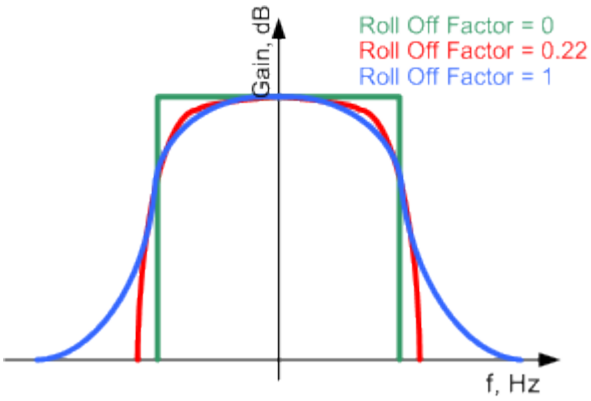


Figure 8-1: Example of the frequency response of a filter with different rolloff factors

For the default cosine filter, a rolloff factor of 0.10 is used.

Remote command:
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25 on page 521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor on page 522

Cutoff frequency shift
(available for filter parameter cosine and EUTRA/LTE with EVM optimization only)

The cutoff frequency is a filter characteristic that defines the frequency at the 3 dB down point. The "Cut Off Frequency Shift" affects this frequency in the way that the filter flanks are "moved" and the transition band increases by "Cut Off Frequency Shift"*"Sample Rate".

- A "Cut Off Frequency Shift" = -1 results in a very narrow-band filter
- Increasing the value up to 1 makes the filter more broad-band
- By "Cut Off Frequency Shift" = 0, the -3 dB point is at the frequency determined by the half of the selected "Sample Rate".

Tip: Use this parameter to adjust the cutoff frequency and reach spectrum mask requirements.

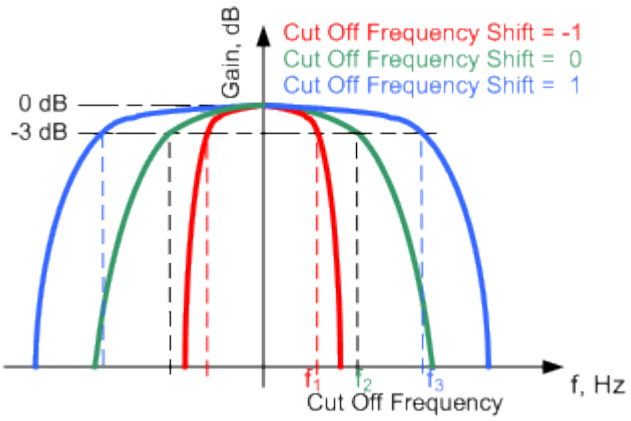


Figure 8-2: Example of the frequency response of a filter with different cutoff frequency shift

Example:

"Channel Bandwidth" = 10 MHz

"Sample Rate" = 15.36 MHz

"Cutoff frequency shift" = 0

Frequency at 3 dB down point = +/- 7.68 MHz

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS` on page 521

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS` on page 521

Cutoff Frequency Factor

(available for filter parameter lowpass and EUTRA/LTE with ACP optimization only)

Sets the value for the cutoff frequency factor.

The cutoff frequency of the filter can be adjusted to reach spectrum mask requirements.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs` on page 521

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor` on page 522

`[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM` on page 521

Filter Mode

Selects an offline or real-time filter mode.

Remote command:

`[:SOURce<hw>]:BB:EUTRa:FILTer:MODE` on page 520

Sample Rate Variation

Sets the sample rate of the signal. A variation of this parameter affects the ARB clock rate; all other signal parameters remain unchanged.

The value of this parameter is set according to the current physical settings, like the channel bandwidth.

If carrier aggregation is activated, the sample rate is set to a fixed value ("Auto") and cannot be changed.

Remote command:
[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation on page 523

8.1.3 Clipping Settings

Settings:

Clipping State....498
Clipping Level....498
Clipping Mode....498

Clipping State
Switches baseband clipping on and off.

Baseband clipping is a simple and effective way of reducing the crest factor of the signal. Since clipping is done before to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe on page 524

Clipping Level
Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel on page 524

Clipping Mode
Selects the clipping method. The dialog displays a graphical illustration on how this two methods work.

- "Vector | i + jq |"
  The limit is related to the amplitude | i + q |. The I and Q components are mapped together, the angle is retained.
- "Scalar | i | , | q |"
  The limit is related to the absolute maximum of all the I and Q values | i | + | q |. The I and Q components are mapped separately, the angle changes.

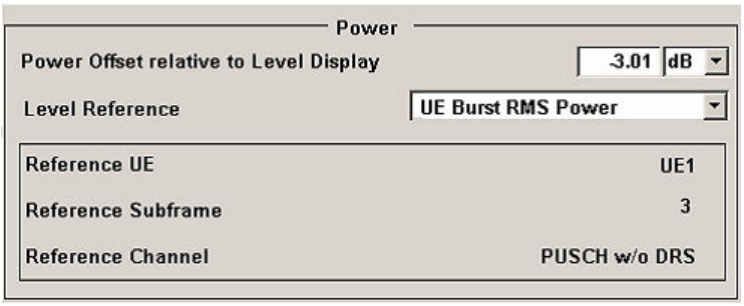
Selects the clipping method. A graphic illustrates how the two methods work.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE on page 524

8.1.4 Power Settings

The "Power" section provides access to the settings necessary to adjust the global power level of the generated LTE signal.

For an overview of the provided power settings and detailed information on how to adjust them, refer to Chapter 8.2, "Adjusting the Signal Power", on page 501.



Settings:

Power Offset Relative to Level Display 499
Power Reference 499
Reference UE 500
Reference Subframe/Slot 501
Reference Channel 501

Power Offset Relative to Level Display
Sets the power offset of the baseband relative to the RMS level ("Level") displayed in the status bar.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:ORTLevel` on page 526

Power Reference
Defines the reference the "Level" display in the status bar is referring to.

"Frame RMS Power"
The displayed RMS and PEP are measured during the whole frame.
All frames are considered, not only the first one.

"DL Part of Frame RMS Power"
The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS).
All frames are considered, not only the first one.

"UL Part of Frame RMS Power"
The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS).
All frames are considered, not only the first one.

"UE Burst RMS Power"

The displayed RMS and PEP are measured during an automatically selected **reference time span**, that is selected according to the following algorithm:

- For the first active UE, find the first active subframe.
  In case of eMTC/NB-IoT, find the first transmission of the first active UE. Omit invalid subframes.
- Find the first PUSCH, PUCCH or both.
  Exclude the DRS.
- In PRACH mode, find the first PRACH preamble.
- If there is no active subframe, use the SRS.

The signal portion (subframe or slot number), the channel and the first active UE used as reference are displayed with the parameters Reference Subframe/Slot, Reference Channel, and Reference UE.
This power mode is required for the AWGN settings calculation (e.g. according to TS 36.141), in case the simulated UE does not use all subframes.
If at least one UL eMTC or NB-IoT UE is active, "UE Burst RMS Power" is the default level reference.

"NPBCH Symbols Power"

Option: R&S SMBV-K115
Enabled in standalone NB-IoT operation (Downlink FDD mode, "Channel Bandwidth = 200 kHz" and "Activate NB-IoT = On")
The displayed RMS and PEP are measured during the NPBCH symbols 3, 9 and 11.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference` on page 526

Reference UE

If Power Reference = "UL Burst RMS Power", indicates the **first active UE** used as reference of the RMS and PEP measurement.

If several UEs are active during the measurement time, the displayed RMS and PEP values apply **to all UEs** that are active during the reference measurement time.

Example:

Standard SISO configuration, standard signal routing, no additional baseband gain:

- Two active UEs with "UE1 > UE Power = 0 dB" and "UE2 > UE Power = 0 dB".
  UE1 and UE2 have active allocations in subframe = 0
- "Power Reference = UL Burst RMS Power"
- Reference time indicated as "Reference UE = UE1" and "Reference Subframe = 0"
- RMS value "Status bar > Level = -30 dBm"

Because during the reference subframe both UEs are active, the power of each UE during this subframe is -33 dBm. The indication "Reference UE = UE1" is merely information on the reference time span.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:RUE?` on page 527

Reference Subframe/Slot
If Power Reference = "UL Burst RMS Power", displays the signal portion (subframe or slot) to that the measured RMS and PEP are referring.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?` on page 527

Reference Channel
If Power Reference = "UL Burst RMS Power", displays the channel type the measured RMS and PEP are referring to.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel` on page 527

8.2 Adjusting the Signal Power

The R&S SMBV equipped with option EUTRA/LTE (R&S SMBV-K55) provides several possibilities to adjust the power level of the generated LTE signal. It also provides settings to adjust the relations between the power levels of the channels and signals in the LTE signal itself.

8.2.1 General Power-Related Settings Overview

The general power settings are as follows:

- Output level (P_{out}) of the instrument
  To adjust the value, select "Status bar > Level".
- Power Offset Relative to Level Display is a parameter related to the level of the signal at the output of the baseband part of the instrument. The parameter sets the relative power offset of the selected baseband path compared to the power level displayed in the header of the instrument. A value of 0 dB refers to the level set in the main "Level" settings; a negative value lowers the level of the selected baseband.

  Use this parameter to adjust the baseband output power compared to the baseband power of the other baseband, if the following applies:

  – The performed test case requires the signals of UEs with different SNR
  – The same AWGN block is used.

  An example of such a test scenario are the multi-user PUCCH tests as defined in TS 36.141.

8.2.2 Downlink Power-Related Settings Overview

In downlink direction, the value displayed in the "Level" display defines the RMS level of the output signal calculated upon several frames.

- FDD duplexing mode
  The displayed RMS and the PEP values are valid for the whole frame.

- TDD duplexing mode
  The calculation is based only on the downlink parts of the frame, i.e. the DL subframes and the DwPTS.
  (See also parameter Power Reference).

Additionally to the general power settings, the following settings are influencing the power of the output signal in downlink direction:

- Downlink Reference Signal Structure
- Synchronization Signal Settings
- PBCH Power and PDSCH Power
- PCFICH Settings, PHICH Settings, (E)PDCCH Settings
- Cell-Specific Settings
- NRS/N-SYNC (NPSS/NSSS)
- NPBCH, NPDCCH and NPDSCH Settings

All DL power configurations are set relative to each other. The absolute power level of one resource element during one subframe depends on the configuration during the remaining subframes.

Example:

If:

- PDCCH power = 2 dB
- For a particular PDSCH, PDSCH power = -3 dB

The power level of the PDCCH subcarriers is with 5 dB higher than the power level of the PDSCH subcarriers.

The basis for the calculation of the absolute power level of the channels and the signals in DL direction is the **power of one reference signal resource element**. The value is displayed with the parameter "General DL Settings " > "Downlink Signals" > Reference Signal Power. Use this parameter to configure specific absolute power of one RS subcarrier, like for example to set a required SNR defined for a 15kHz subband.

Example:

- Select "EUTRA/LTE > Set to Default".
- "Level = - 30 dB"
- "RS Power per RE relative to Level Display = - 27.78 dB"
  "Power Offset relative to Level Display = 0 dB"
- Select "PDSCH power = - 3 dB"

The absolute power level of one single reference signal (RS) subcarrier is -57.78 dBm.

The absolute power level of a PDSCH subcarrier calculated based on the absolute power level of a single RS is -60.78 dBm.

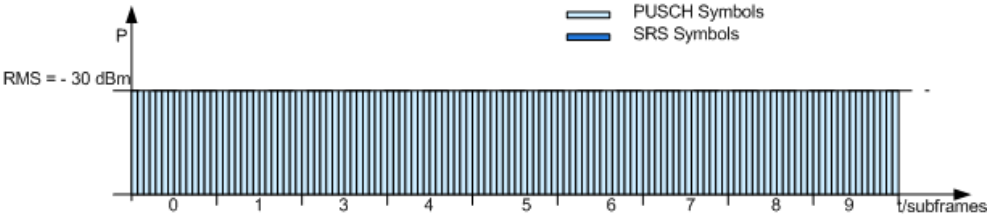
8.2.3 Uplink Power-Related Settings Overview

Additionally to the general power settings listed in General Power-Related Settings Overview, the following settings are influencing the power of the output signal in uplink direction:

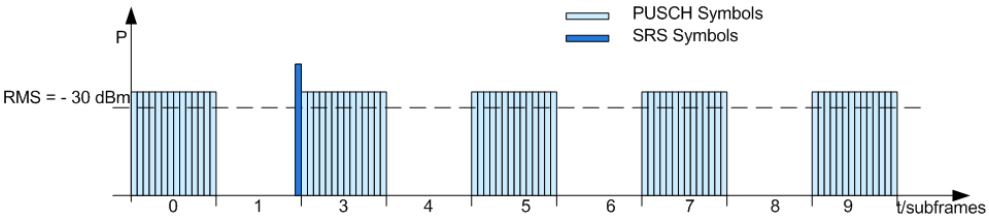
- Power reference
- Power factors for PUSCH/PUCCH/PRACH/SRS
- DRMS Power Offset (available for PUSCH and PUCCH)
- UE Power

While generating an uplink signal, the power displayed in the "Level" display defines the current RMS level at the output. The RMS and PEP values however are calculated based upon different parts of the signal, depending on the value of the parameter Power Reference

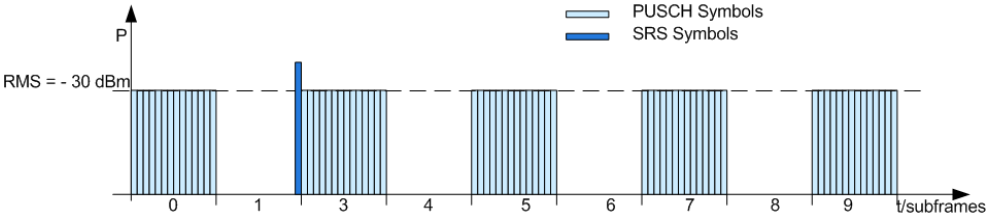
- "Power Reference" = "Frame RMS Power" (UL FDD) or "UL Part of Frame RMS Power" (UL TDD)
  In the FDD duplexing mode, the displayed RMS and the PEP values ("Level" and "PEP") are valid for the whole frame. In TDD duplexing mode, the calculation is based only on the uplink parts of the frame, i.e. the UL subframes and the UpPTS.



  Note: The absolute power of a single subframe depends also on the signal within of the remaining subframes.



- "Power Reference" = "UE Burst RMS Power" (UL FDD and UL TDD)
  The displayed "Level" and "PEP" values are measured only for a certain burst of a single UE. See the description of the parameter Power Reference for description of the decision algorithm and how the reference bursts are selected.

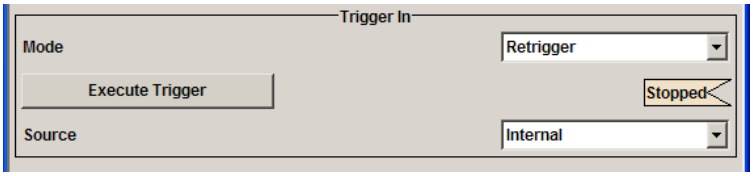


  Use this mode to simplify the configuration of the SNR required for the test cases defined in TS 36.141, in case the PUSCH is not transmitted in every subframe.

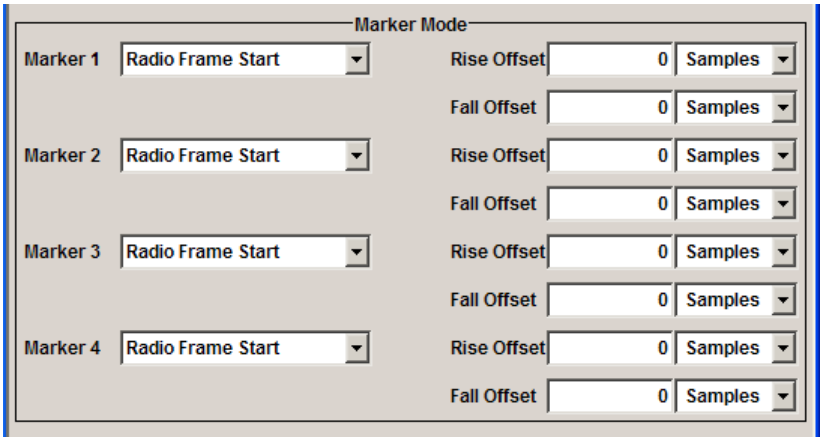
8.3 Trigger/Marker/Clock Settings

To access this dialog, select "Main Menu > Trigger/Marker".

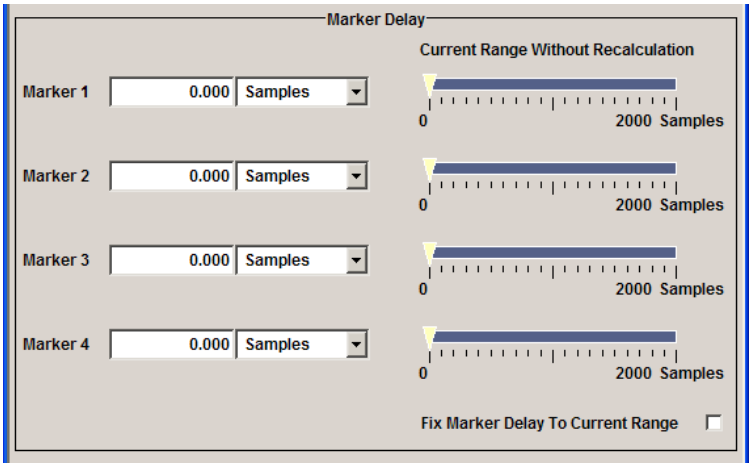
The "Trigger In" section is where the trigger for the signal is set. Various parameters are provided for the settings, depending on which trigger source - internal or external - is selected. The status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



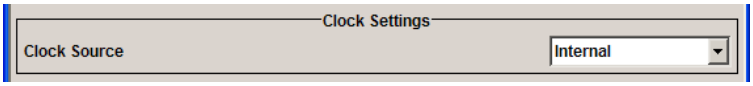
The "Marker Mode" section is where the marker signals at the [MARKER] output connectors are configured.



The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



The "Clock Settings" section is where the clock source is selected and - in the case of an external source - the clock type.



The buttons in the last section lead to submenu for general trigger, clock and mapping settings.

8.3.1 Trigger In

The "Trigger In" section is where the trigger for the signal is set. Various parameters are provided for the settings, depending on which trigger source - internal or external - is selected. The status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

Trigger Mode
Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal or external) causes a restart.
- "Armed Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal or external) causes a restart.
- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Use the "Armed_Auto" mode for Base Station Tests if a frame marker from the device under test starts the signal output. Subsequent frame markers does not cause a restart of the signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence` on page 530

Signal Duration Unit
Defines the unit for describing the length of the signal sequence to be output in the "Single" trigger mode.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit` on page 532

Signal Duration
Enters the length of the signal sequence to be output in the "Single" trigger mode.

Use this parameter to output part of the signal deliberately, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth` on page 532

Running/Stopped
With enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"
  The signal is generated; a trigger was (internally or externally) initiated in triggered mode.
- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe?` on page 531

Arm
Stops signal generation. This button appears only with "Running" signal generation in the "Armed_Auto" and "Armed_Retrigger" trigger modes.

Signal generation can be restarted by a new trigger (internally with "Execute Trigger" or externally).

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute` on page 531

Execute Trigger
Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute` on page 531

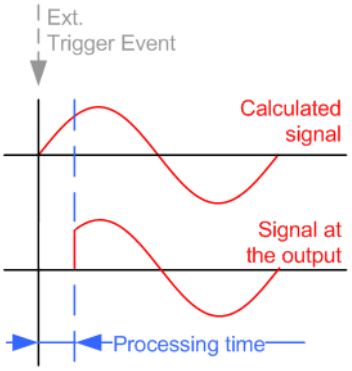
Trigger Source
Selects trigger source. This setting is effective when a trigger mode other than "Auto" has been selected.

- "Internal"
  The trigger event is executed by "Execute Trigger".
- "External"
  The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER connector.
  Use the "Global Trigger/Clock Settings" dialog to define the polarity, the trigger threshold and the input impedance of the trigger signal.

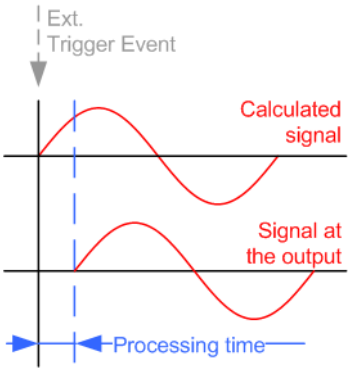
Remote command:
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce on page 530

Sync. Output to External Trigger
Enables signal output synchronous to the trigger event.

- "On"
  Corresponds to the default state of this parameter.
  The signal calculation starts simultaneously with the trigger event. Because of the processing time of the instrument, the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



- "Off"
  The signal output begins after elapsing of the processing time. Signal output starts with sample 0. The complete signal is output.
  This mode is recommended for triggering of short signal sequences. Short sequences are sequences with signal duration comparable with the processing time of the instrument.



For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See Table 8-2 for an overview of the required settings.

Table 8-2: Typical applications

System Trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	On
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	Off
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	Off

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut` on page 531

Trigger Delay Unit
Selects the unit ("Samples" or "Time") of the external and other baseband trigger delay.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT` on page 531

Trigger Delay
Delays the trigger event of the signal from:
- The external trigger source

Use this setting to:
- Synchronize the instrument with the device under test (DUT) or other external devices

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay` on page 532
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay` on page 533

Actual External Delay
Indicates the resulting external trigger delay in "Time" unit.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?` on page 533

Trigger Inhibit
Sets the duration for inhibiting a new trigger event after triggering. The input has to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:INHibit` on page 533

8.3.2 Marker Mode

The marker output signal for synchronizing external instruments is configured in the "Marker settings" section "Marker Mode".

Marker Mode
Selects a marker signal for the associated marker output.

"Restart (ARB)"
A marker signal is generated at the start of each ARB sequence.

"Radio Frame Start"
A marker signal is generated at the start of each radio frame.

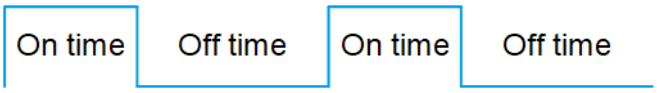
"Frame Active Part"
The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode).
This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

"Subframe" A marker signal is generated at the start of each subframe.

"User Period" A marker signal is generated at the beginning of every user-defined period. The period is defined in "Period."

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod` on page 536

"ON/OFF Period"
A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.



Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime` on page 535
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime` on page 535

"System Frame Number (SFN) Restart"
A marker signal is generated at the start of every SFN period.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE` on page 535

Rise/Fall Offset
(Available for marker mode Subframe, Radio Frame Start, and Restart (ARB) only)

Sets the value for the rise/fall offset. The rising ramp of the marker is shifted by the set value in samples. Positive values shift the rising ramp to later positions; negative values shift it to earlier positions.

The value range is -640000 to 640000.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset` on page 535
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset` on page 535

8.3.3 Marker Delay

The delay of the signals on the [MARKER] outputs is set in the "Marker Delay" section.

R&S SMBV supports two markers.

Marker x Delay
Enters the delay between the marker signal at the marker outputs and the start of the frame or slot.

The input is expressed as a number of symbols/samples. If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range, the delay of the marker signals can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay` on page 536

Current Range without Recalculation
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?`
on page 536
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?`
on page 536

Fix marker delay to current range
Restricts the marker delay setting range to the dynamic range. In this range, the delay can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed` on page 536

8.3.4 Clock Settings

The "Clock Settings" are used to set the clock source and a delay if required.

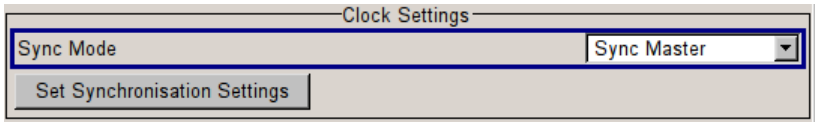
Sync. Mode
Selects the synchronization mode.

This parameter is used to enable generation of precise synchronous signal of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type.
Avoid unnecessary cable length and branching points.

"None" The instrument is working in stand-alone mode.

"Sync. Master" The instrument provides all connected instrument with its synchronization (including the trigger signal) and reference clock signal.



"Sync. Slave" The instrument receives the synchronization and reference clock signal from another instrument working in a master mode.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:MODE on page 529

Set Synchronization Settings
Performs automatically adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Sync. Mode".

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:MODE on page 529

Clock Source
Selects the clock source.

"Internal" The internal clock reference is used to generate the symbol clock.

"External" The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.
The symbol rate must be correctly set to accuracy of +/-2 % (see data sheet).
The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce on page 528

Clock Mode
Enters the type of externally supplied clock.

"Sample" A sample clock is supplied via the [CLOCK] connector.

"Multiple Sample" A multiple of the sample clock is supplied via the [CLOCK] connector; the sample clock is derived internally from this.

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE on page 528

Clock Multiplier
Enters the multiplication factor for clock type "Multiple".

Remote command:
[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier on page 528

Expected Clock Frequency
If an external clock signal is used, this parameter indicates the expected clock frequency value.

The value is calculated as follows:

"Expected Clock Frequency" = * Clock Multiplier

Measured External Clock
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
`CLOCk:INPut:FREQuency?`

8.3.5 Global Settings

This section provides access general trigger, clock and mapping settings.

Global Trigger/Clock Settings
Accesses the "Global Trigger/Clock/Input Settings" dialog.

This dialog is to set the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the operating manual.

9 Remote-Control Commands

The following commands are required to generate signals with the EUTRA/LTE options in a remote environment. We assume that the R&S SMBV has already been set up for remote operation in a network as described in the R&S SMBV documentation. A knowledge about the remote control operation and the SCPI command syntax are assumed.

Conventions used in SCPI command descriptions

For a description of the conventions used in the remote command descriptions, see section "Remote Control Commands" in the R&S SMBV operating manual.

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	1	Available baseband signals
OUTPut<ch>	1 .. 2	Available markers
EXTernal<ch>	1	External trigger connectors
SUBF<st0>	• DL 0 to 39 • UL 0 to 199	Subfame number The maximum value depends on the selected sequence length, see [:SOURce<hw>]:BB:EUTRa:SLENgth.
ALLoc<ch0>	• DL – For subframes with PBCH, i.e. SUBF0, SUBF10, SUBF20 and SUBF30: <ch0> = 0 to 111 – For all other subframes: <ch0> = 0 to 110 • UL 0 to 7 Where 0 refers to UE1 • for NB-IoT 0 to 100	• Allocation number • Allocation number (user equipment number) • NB-IoT DCI allocation
CELL<ch0> CELL<st0> CELL<dir> CELL<ccidx>	0 to 4	Component carrier Option R&S SMBV-K85
CW<user> CW<cw> <cwid>	1 | 2	Codeword
ITEM<ch0>	0 to 19	Number of rows in the DCI table
UE<st>	[1] to 8	User equipment (UL)
USER<ch>	1|2|3|4	DL user

Suffix	Value range	Description
PMCH<ch0>	0 to 15	PM channel number
<srsidx>	1 to 6	SRS set
BURSt<st0>	0 to 39	LAA bursts
CARRier<ch>	0 to 4	NB-IoT DL carrier
CELV<ch0>	0 to 3	CE level
CFG<ch0>	0 to 2	NPRACH configuration
TRANs<ch>	0 to 10	eMTC/NB-IoT allocation
ATT<ch0>	0 to 40 0 to 30	eMTC PRACH preamble attempt NPRACH preamble attempt

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, the tasks include:

- Managing settings and data lists, i.e. storing and loading settings, creating and accessing data lists, accessing files in a particular directory, etc.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMBV operating manual.

Programming examples

This description provides simple programming examples. The purpose of the examples is to present **all** commands for a given task. In real applications, one would rather reduce the examples to an appropriate subset of commands.

The programming examples have been tested with a software tool which provides an environment for the development and execution of remote tests. To keep the example as simple as possible, only the "clean" SCPI syntax elements are reported. Non-executable command lines (e.g. comments) start with two // characters.

At the beginning of the most remote control program, an instrument (p)reset is recommended to set the instrument to a definite state. The commands `*RST` and `SYSTem:PRESet` are equivalent for this purpose. `*CLS` also resets the status registers and clears the output buffer.

The following commands specific to the EUTRA/LTE standard are described here:

- Primary Commands 515
- Filter/Clipping/Power 520
- Clock 528
- Timing Configuration 529
- Trigger 529

- Marker....534
- General TDD Commands....537
- General Downlink Commands....538
- General Uplink Commands....550
- DL Frame Configuration....563
- DL MBFSN....571
- DL Carrier Aggregation....583
- CSI-RS....588
- LAA and DRS....595
- Enhanced PBCH, PDSCH, PMCH....606
- Enhanced PCFICH, PHICH and PDCCH Configuration....614
- Auto Sequence....649
- UL Frame Configuration....661
- UL Carrier Aggregation....666
- UL Enhanced....670
- User Configuration....686
- EPDCCH....697
- Dummy Data Configuration....701
- SPS Configuration....703
- User Equipment....704
- Sidelink Configuration....728
- eMTC/NB-IoT Commands....757
- Test Case Wizard Remote-Control Commands....880

9.1 Primary Commands

[:SOURce<hw>]:BB:EUTRa:STATe....515
[:SOURce<hw>]:BB:EUTRa:DUPLexing....516
[:SOURce<hw>]:BB:EUTRa:LINK....516
[:SOURce<hw>]:BB:EUTRa:STDMode....516
[:SOURce<hw>]:BB:EUTRa:PRESet....517
[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog....517
[:SOURce<hw>]:BB:EUTRa:SETTing:DEL....517
[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD....518
[:SOURce<hw>]:BB:EUTRa:SETTing:STORe....518
[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST....518
[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD....518
[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL....518
[:SOURce<hw>]:BB:EUTRa:SLENgth....519
[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate....519
[:SOURce]:BB:EUTRa:VERSion?....519

[:SOURce<hw>]:BB:EUTRa:STATe <State>

Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: `SOURce1:BB:EUTRa:STATe ON`

Manual operation: See "State" on page 60

[:SOURce<hw>]:BB:EUTRa:DUPLexing <Duplexing>

Sets the duplexing mode.

Parameters:
<Duplexing> TDD | FDD
*RST: FDD

Example: `SOURce1:BB:EUTRa:DUPLexing FDD`

Manual operation: See "Duplexing" on page 64

[:SOURce<hw>]:BB:EUTRa:LINK <Link>

Sets the transmission direction.

Parameters:
<Link> UP | DOWN
*RST: DOWN

Example: `SOURce:BB:EUTRa:LINK DOWN`

Manual operation: See "Link Direction" on page 64

[:SOURce<hw>]:BB:EUTRa:STDMode <StandardMode>

Sets the supported 3GPP standard.

Parameters:
<StandardMode> LTE | IOT | LIOT

LTE
Standalone LTE mode.
IoT-specific commands containing the keywords `EMTC` or `NIOT` are discarded.

IOT
Standalone IoT mode.
The commands related to LTE-specific features like carrier aggregation or MBSFN are discarded.

LIOT
Mixed LTE and IoT configuration, for example for interoperability tests.

*RST: LTE

Example: See Example "NPRACH configuration" on page 770.

Options: LTE requires R&S SMBV-K55
IOT|LIOT require R&S SMBV-K115

Manual operation: See "Mode" on page 63

[:SOURce<hw>]:BB:EUTRa:PRESet

Sets the parameters of the digital standard to their default values (`*RST` values specified for the commands).

Not affected is the state set with the command `SOURce<hw>:BB:EUTRa:STATe`.

Example: `SOURce1:BB:EUTRa:PRESet`

Manual operation: See "Set to Default" on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog <Catalog>

Queries the files with settings in the default directory. Listed are files with the file extension `*.lte`.

Parameters:
<Catalog> <filename1>,<filename2>,...
Returns a string of filenames separated by commas.

Example:
```
MMEM:CDIR /var/user/lte
SOURce1:BB:EUTRa:SETTing:CATalog?
// lte, test
SOURce1:BB:EUTRa:SETTing:DEL "test"
SOURce1:BB:EUTRa:SETTing:LOAD "lte"
// SOURce1:BB:EUTRa:SETTing:STORe "lte_2"
```

Manual operation: See "Save/Recall..." on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:DEL <Filename>

Deletes the selected file from the default or the specified directory. Deleted are files with extension `*.lte`.

Setting parameters:
<Filename> string
Filename or complete file path; file extension can be omitted

Example: See `[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog` on page 517.

Usage: Setting only

Manual operation: See "Save/Recall..." on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD <Filename>

Loads the selected file from the default or the specified directory. Loaded are files with extension `*.lte`.

Parameters:

<Filename> string

Filename or complete file path; file extension can be omitted

Example: See `[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog` on page 517.

Manual operation: See "Save/Recall..." on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:STORe <Filename>

Stores the current settings into the selected file; the file extension (`*.lte`) is assigned automatically.

Parameters:

<Filename> string

Filename or complete file path

Example: See `[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog` on page 517.

Manual operation: See "Save/Recall..." on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST <State>

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

Note: This function is not affected by the "Preset" function.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: ON

Manual operation: See "Save/Recall..." on page 61

[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD <Tdd>
[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL <Filename>

Selects a predefined test model as defined in TS 36.141.

Parameters:

<Filename> <test_model_name>

Example: `SOURce1:BB:EUTRa:SETTing:TMOD:DL 'E-TM1_1__20MHz'`

`SOURce1:BB:EUTRa:SETTing:TMOD:DL 'N-TM_Standalone'`

Options: NB-IoT test models (N-TM) require R&S SMBV-K115

Manual operation: See "Test Models" on page 64

[:SOURce<hw>]:BB:EUTRa:SLENgth <SLength>

Sets the sequence length of the signal in number of frames. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

Max. No. of Frames = Arbitrary waveform memory size/(sampling rate x 10 ms).

Parameters:

<SLength> integer

Range: 1 to dynamic
*RST: 1

Example: `BB:EUTR:SLEN 4`
Selects the generation of 4 frames.

Manual operation: See "Sequence Length" on page 64

[:SOURce<hw>]:BB:EUTRa:WAVeform:CREate <Filename>

Stores the current settings as an ARB signal in a waveform file (`*.wv`).

Setting parameters:

<Filename> string

Filename or complete file path; file extension is assigned automatically

Example:
```
MMEM:CDIR /var/user/lte
SOURce1:BB:EUTRa:STATe 1
SOURce1:BB:EUTRa:WAVeform:CREate "lte_test"
```

Usage: Setting only

Manual operation: See "Generate Waveform File…" on page 63

[:SOURce]:BB:EUTRa:VERSion?

Queries the version of the 3GPP standard underlying the definitions.

Return values:

<Version> string

Example: `BB:EUTR:VERS?`

Usage: Query only

Manual operation: See "3GPP Version" on page 63

9.2 Filter/Clipping/Power

9.2.1 Filter Settings

[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE....520
[:SOURce<hw>]:BB:EUTRa:FILTer:MODE....520
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS....521
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization....522
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor....522
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor....522
[:SOURce<hw>]:BB:EUTRa:FILTer:AUTO?....522
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER....523
[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation....523

[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE <Type>

Selects the baseband filter type.

Parameters:

<Type> RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | RECTangle | PGAuss | LPASs | DIRac | ENPShape | EWPShape | LTEFilter | LPASSEVM | SPHase | APCO25 | USER

*RST: LTEFilter

Example: `SOURce1:BB:EUTRa:FILTer:TYPE COS`
Sets the filter type.

Manual operation: See "Filter" on page 493

[:SOURce<hw>]:BB:EUTRa:FILTer:MODE <OptMode>

Selects an offline or real-time filter mode.

Parameters:

<OptMode> RTime | OFFLine

*RST: RTime

Example: See `[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase` on page 521

Manual operation: See "Filter Mode" on page 497

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:APCO25 <Apco25>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine <Cosine>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:GAUSs <Gauss>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASs <LPass>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LPASSEVM <CutoffFrequency>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:PGAuss <PGauss>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:RCOSine <RCosine>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:SPHase <SPhase>

Sets the filter parameter.

Filter type	Parameter	Parameter name	Min	Max	Incre-ment	Default
APCO25	Rolloff factor	<Apco25>	0.05	0.99	0.01	0.2
COSine	Rolloff factor	<Cosine>	0	1	0.01	0.1
GAUSs	BxT	<Gauss>	0.15	2.5	0.01	0.5
LPASs	Cutoff frequency	<LPass>	0.02	2	0.01	0.34
LPASSEVM	Cutoff frequency	<CutoffFrequency>	0.05	2	0.01	0.29
PGAuss	BxT	<PGauss>	0.15	2.5	0.01	0.5
RCOSine	Rolloff factor	<RCosine>	0	1	0.01	0.22
SPHase	BxT	<SPhase>	0.15	2.5	0.01	2

Example:
```
SOURce:BB:EUTRa:FILTer:TYPE COS
SOURce:BB:EUTRa:FILTer:PARameter:COSine 0.1
SOURce:BB:EUTRa:FILTer:PARameter:COSine:COFS -0.2
SOURce:BB:EUTRa:FILTer:MODE RTime
```

Manual operation: See "Rolloff factor or BxT" on page 496

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:COSine:COFS <Cofs>
[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFS <CutOffFreqShift>

Sets the filter parameter.

Parameters:
<CutOffFreqShift> float

Range: -1 to 1
Increment: 0.01
*RST: -0.2

Example:
```
SOURce:BB:EUTRa:FILTer:TYPE LTEF
SOURce:BB:EUTRa:FILTer:PARameter:LTE:OPTimization ACP
SOURce:BB:EUTRa:FILTer:PARameter:LTE:COFS 0.34
```

Manual operation: See "Cutoff frequency shift" on page 496

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:OPTimization <Optimization>

Defines the applied EUTRA/LTE filter.

Available are `EVM`, `ACP`, `ACPN` (ACP narrow), `STD` (a trade\-off between ACP and EVM) and `BENU` (Best EVM, no upsampling).

Parameters:

<Optimization> STD | EVM | ACP | ACPN | BENU

*RST: EVM

Example: `BB:EUTR:FILT:PAR:LTE:OPT ACPN`
Selects ACP (narrow) optimization.

Manual operation: See "Optimization" on page 493

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor <CutoffFactor>

Sets the cutoff frequency factor for the LTE filter type.

Parameters:

<CutoffFactor> float

Range: 0.02 to 2
Increment: 0.001
*RST: 0.34

Example:
```
SOURce:BB:EUTRa:FILTer:TYPE LTEF
SOURce:BB:EUTRa:FILTer:PARameter:LTE:OPTimization EVM
SOURce:BB:EUTRa:FILTer:PARameter:LTE:COFFactor 0.1
SOURce:BB:EUTRa:FILTer:PARameter:LTE:ROFactor -0.2
```

Manual operation: See "Cutoff Frequency Factor" on page 497

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:ROFactor <RollOffFactor>

Sets the rolloff factor for the LTE filter type.

Parameters:

<RollOffFactor> float

Range: 0 to 1
Increment: 0.01
*RST: 0.1

Example: See `[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:LTE:COFFactor` on page 522

Manual operation: See "Rolloff factor or BxT" on page 496

[:SOURce<hw>]:BB:EUTRa:FILTer:AUTO?

Queries if the internal ("Auto") filter is applied.

This filter is selected automatically, if carrier aggregation with carriers that span different bandwidths is used.

Return values:
<Auto> 0 | 1 | OFF | ON
*RST: 0

Example: `SOURce1:BB:EUTRa:FILTer:AUTO?`

Usage: Query only

Manual operation: See "Optimization" on page 493

[:SOURce<hw>]:BB:EUTRa:FILTer:PARameter:USER <Filename>

Loads the file from the default or the specified directory.

Loaded are files with extension `*.vaf` or `*.dat`.

Parameters:
<Filename> string
Complete file path incl. filename and extension

Example:
```
SOURce:BB:EUTRa:FILTer:TYPE USER
SOURce:BB:EUTRa:FILTer:PARameter:USER "/var/user/my_filter.dat"
```

Manual operation: See "Load User Filter" on page 495

[:SOURce<hw>]:BB:EUTRa:SRATe:VARiation <Variation>

Sets the output sample rate.

A variation of this parameter affects the ARB clock rate; all other signal parameters remain unchanged.

The current value of this parameter depends on the current physical settings, like the channel bandwidth.

Parameters:
<Variation> float
Range: 400 to 4E7
Increment: 0.001
*RST: 15.360000E6
Default unit: Hz

Example:
```
SOURce:BB:EUTRa:LINK DOWN
SOURce:BB:EUTRa:DL:BW BW10_00
SOURce:BB:EUTRa:SRATe:VARiation?
//  15360000
```

Manual operation: See "Sample Rate Variation" on page 497

9.2.2 Clipping Settings

[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel....524
[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE....524
[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe....524

[:SOURce<hw>]:BB:EUTRa:CLIPping:LEVel <Level>

Sets the limit for level clipping.

Parameters:

<Level> integer

Range: 1 to 100
*RST: 100

Example: `BB:EUTR:CLIP:LEV 80PCT`
Sets the limit for level clipping to 80% of the maximum level.
`BB:EUTR:CLIP:STAT ON`
Activates level clipping.

Manual operation: See "Clipping Level" on page 498

[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE <Mode>

Sets the method for level clipping.

Parameters:

<Mode> VECTor | SCALar

VECTor
The reference level is the amplitude | i+jq |.

SCALar
The reference level is the absolute maximum of the I and Q values.

*RST: VECTor

Example: `BB:EUTR:CLIP:MODE SCAL`
Selects the absolute maximum of all the I and Q values as the reference level.
`BB:EUTR:CLIP:LEV 80PCT`
Sets the limit for level clipping to 80% of this maximum level.
`BB:EUTR:CLIP:STAT ON`
Activates level clipping.

Manual operation: See "Clipping Mode" on page 498

[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe <State>

Activates level clipping (Clipping). The value is defined with the command `[SOURce:]BB:EUTRa:CLIPping:LEVel`, the mode of calculation with the command `[SOURce:]BB:EUTRa:CLIPping:MODE`.

Parameters:
<State> ON | OFF
*RST: 0

Example: `BB:EUTR:CLIP:STAT ON`
Activates level clipping.

Manual operation: See "Clipping State" on page 498

9.2.3 Time Domain Windowing Settings

[:SOURce<hw>]:BB:EUTRa:TDW:STATe <State>

Activates/deactivates the time domain windowing.

Parameters:
<State> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:EUTR:TDW:STAT ON`
Activates time domain windowing.

Manual operation: See "State" on page 493

[:SOURce<hw>]:BB:EUTRa:TDW:TRTime <TransitionTime>

Sets the transition time when time domain windowing is active.

Parameters:
<TransitionTime> float
Range: 0 to 1E-5
Increment: 1E-7
*RST: 5E-6
Default unit: s

Example: `SOURce1:BB:EUTRa:TDW:TRTime 0.000002`
Sets the transition time to 2us.

Manual operation: See "Transition Time" on page 493

9.2.4 Power Settings

[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference 526
[:SOURce<hw>]:BB:EUTRa:POWC:ORTLevel 526
[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel 527
[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe? 527
[:SOURce<hw>]:BB:EUTRa:POWC:RUE? 527

[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference <LevelReference>

Defines the reference for the "Level" display in the status bar.

Parameters:

<LevelReference> FRMS | DRMS | UEBurst | URMS | NPBCH

FRMS
The displayed RMS and PEP are measured during the whole frame.
All frames are considered, not only the first one.

DRMS
The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS).
All frames are considered, not only the first one.

URMS
The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS).
All frames are considered, not only the first one.

UEBurst
The displayed RMS and PEP are measured during a single subframe (or slot) of a certain UE.

NPBCH
In NB-IoT standalone operation, the displayed RMS and PEP are measured during the NPBCH symbols 3, 9 and 11.

*RST: FRMS

Example: `SOURce1:BB:EUTRa:POWC:LEVReference UEBurst`
Sets level reference to UE burst RMS power

Options: NPBCH requieres R&S SMBV-K115

Manual operation: See "Power Reference" on page 499

[:SOURce<hw>]:BB:EUTRa:POWC:ORTLevel <OffsRelatLevel>

Sets the power offset of the baseband relative to the RMS level displayed in the instrument's global Level display in the header of the instrument.

Parameters:

<OffsRelatLevel> float

Range: -20 to 0
Increment: 0.001
*RST: 0

Example: `BB:EUTR:POWC:ORTL -1.0 dB`
Sets the power offset of the baseband part

Manual operation: See "Power Offset Relative to Level Display" on page 499

[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel <RefChannel>

If `[:SOURce<hw>]:BB:EUTRa:POWC:LEVReferenceUEBurst`, queries the channel type to that the measured RMS and PEP are referring.

Parameters:

<RefChannel> NF | PUSCH | PUCCH | PRACH | SRS | PUCPUS | SL

*RST: NF

Example:
```
BB:EUTR:POWC:LEVR UEB
BB:EUTR:POWC:RUE?
```

Options: SL requires R&S SMBV-K119

Manual operation: See "Reference Channel" on page 501

[:SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?

If `[:SOURce<hw>]:BB:EUTRa:POWC:LEVReferenceUEBurst`, queries the subframe or slot number used as reference for measuring the RMS and PEP values.

Return values:

<RefSubframe> integer

Range: 0 to 39

*RST: 0

Example:
```
SOURce1:BB:EUTRa:POWC:LEVReference UEB
SOURce1:BB:EUTRa:POWC:REFSubframe?
```

Usage: Query only

Manual operation: See "Reference Subframe/Slot" on page 501

[:SOURce<hw>]:BB:EUTRa:POWC:RUE?

If `[:SOURce<hw>]:BB:EUTRa:POWC:LEVReferenceUEBurst`, queries the UE to that the measured RMS and PEP are referring.

Return values:

<ReferenceUe> UE1 | UE2 | UE3 | UE4

*RST: UE1

Example:
```
BB:EUTR:POWC:LEVR UEB
BB:EUTR:POWC:RUE?
```
Queries the reference UE

Usage: Query only

Manual operation: See "Reference UE" on page 500

9.3 Clock

[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE....528
[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce....528
[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier....528
[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:MODE....529
[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:EXECute....529

[:SOURce<hw>]:BB:EUTRa:CLOCk:MODE <Mode>

Sets the type of externally supplied clock.

Parameters:

<Mode> SAMPle | MSAMp

SAMPle
The sample clock is supplied via the clock connector.

MSAMp
A multiple of the clock is supplied and the clock is derived internally from it.

*RST: SAMPle

Example:
```
SOURce1:BB:EUTRa:CLOCk:MODE SAMPle
```

Manual operation: See "Clock Mode" on page 511

[:SOURce<hw>]:BB:EUTRa:CLOCk:SOURce <Source>

Selects the clock source.

Parameters:

<Source> INTernal | EXTernal

*RST: INTernal

Example:
```
SOURce1:BB:EUTRa:CLOCk:SOURce EXTernal
SOURce1:BB:EUTRa:CLOCk:MODE SAMP
// selects an external clock reference
// specifies that a sample clock is supplied
```

Manual operation: See "Clock Source" on page 511

[:SOURce<hw>]:BB:EUTRa:CLOCk:MULTiplier <Multiplier>

Specifies the multiplier for clock type multiplied.

Parameters:

<Multiplier> integer

Range: 1 to 64
*RST: 4

Example: SOURce1:BB:EUTRa:CLOCk:SOURce EXT
SOURce1:BB:EUTRa:CLOCk:MODE MSAMple
Selects clock type
SOURce1:BB:EUTRa:CLOCk:MULTiplier 12
The multiplier for the external clock rate is 12.

Manual operation: See "Clock Multiplier" on page 511

[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:MODE <Mode>

If several R&S SMBVs are connected to generate precise synchronous signal, sets the synchronization mode of each instrument.

Parameters:
<Mode> NONE | MASTer | SLAVe
*RST: NONE

Example: See [:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:EXECute on page 529.

Manual operation: See "Sync. Mode" on page 510
See "Set Synchronization Settings" on page 511

[:SOURce<hw>]:BB:EUTRa:CLOCk:SYNChronization:EXECute

Adjusts the R&S SMBV settings according to the selected synchronization mode.

Example: SOURce:BB:EUTRa:CLOCk:SYNChronization:MODE MASTer
SOURce:BB:EUTRa:CLOCk:SYNChronization:EXECute

9.4 Timing Configuration

[:SOURce<hw>]:BB:EUTRa:TIMC:NTAoffset <NtaOffset>

Sets the parameter $N_{TA\ offset}$ as defined in the 3GPP TS 36.211.

Parameters:
<NtaOffset> NTA0 | NTA624
*RST: NTA0

Example: BB:EUTR:TIMC:NTA NTA0
Sets parameter $N_{TA\ offset}$

9.5 Trigger

EXTernal<ch>

The numeric suffix to EXTernal<ch> distinguishes between the external trigger via the [TRIGGER 1] (suffix 1) and [TRIGGER 2] (suffix 2) connector.

[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence 530
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce 530
[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute 531
[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT 531
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute 531
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut 531
[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe? 531
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit 532
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth 532
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay 532
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:INHibit 533
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay? 533
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay 533

[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence <TriggerMode>

Selects the trigger mode:

- AUTO = auto
- RETRigger = retrigger
- AAUTo = armed auto
- ARETrigger = armed retrigger
- SINGle = single

Parameters:

<TriggerMode> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

*RST: AUTO

Example: BB:EUTR:SEQ AAUT
Sets the "Armed_auto" trigger mode

Manual operation: See "Trigger Mode" on page 505

[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce <Source>

Selects the trigger source:

- INTernal: manual trigger or *TRG.
- EXTernal: trigger signal on the TRIGGER connector.

Parameters:

<Source> INTernal|EXTernal

*RST: INTernal

Example: SOURce1:BB:EUTRa:TRIGger:SOURce EXTernal
Sets external triggering via the TRIGGER connector.

Manual operation: See "Trigger Source" on page 506

[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute

Stops signal generation; a subsequent trigger event restarts signal generation.

Example:
```
SOURce1:BB:EUTRa:TRIGger:SOURce INT
SOURce1:BB:EUTRa:TRIGger:SEQuence ARETrigger
SOURce1:BB:EUTRa:TRIGger:EXEcute
// executes a trigger, signal generation starts
SOURce1:BB:EUTRa:TRIGger:ARM:EXECute
// signal generation stops
SOURce1:BB:EUTRa:TRIGger:EXEcute
// executes a trigger, signal generation starts again
```

Usage: Event

Manual operation: See "Arm" on page 67

[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT <DelUnit>

Sets the units in that the trigger delay is expressed.

Parameters:

<DelUnit> SAMPle | TIME

*RST: SAMPle

Example: `SOURce1:BB:EUTRa:TRIGger:DELay:UNIT SAMPle`
Sets the external trigger delay to samples.

Manual operation: See "Trigger Delay Unit" on page 508

[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute

Executes a trigger.

Usage: Event

Manual operation: See "Execute Trigger" on page 67

[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut <OutputState>

Enables signal output synchronous to the trigger event.

Parameters:

<OutputState> 0 | 1 | OFF | ON

*RST: 1

Manual operation: See "Sync. Output to External Trigger" on page 507

[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODe?

Queries the signal generation status.

Return values:
<RunMode> STOP | RUN

Example: `SOURce1:BB:EUTRa:TRIGger:RMODe?`

Usage: Query only

Manual operation: See "Running/Stopped" on page 506

[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit <SeqLenUnit>

Defines the unit for the entry of the signal sequence length.

Parameters:
<SeqLenUnit> SEQuence | FRAMe | SUBFrame | SLOT | SAMPle

FRAMe
A single frame is generated after a trigger event.

SEQuence
A single sequence is generated after a trigger event.

SUBFrame
A single subframe is generated after a trigger event.

SLOT
A single slot is generated after a trigger event.

SAMPle
Number of samples are generated after a trigger event.

*RST: SEQuence

Example: See `[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth` on page 532

Manual operation: See "Signal Duration Unit" on page 506

[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth <SequenceLength>

Defines the length of the signal sequence that is output in the `SINGle` trigger mode.

Parameters:
<SequenceLength> integer

Range: 1 to 4294967295
*RST: 1

Example:
```
SOURce1:BB:EUTRa:TRIGger:SEQuence SING
SOURce1:BB:EUTRa:TRIGger:SLUNit FRAM
SOURce1:BB:EUTRa:TRIGger:SLENgth 2
```

Manual operation: See " Signal Duration " on page 506

[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay <Delay>

Specifies the trigger delay for external triggering.

Parameters:

<Delay> float

Range: 0 to 68719476735
Increment: 0.01
*RST: 0
Default unit: Samples

Example:
```
SOURce1:BB:EUTRa:TRIGger:SOURce EXT
SOURce1:BB:EUTRa:TRIGger:EXTernal:DELay 50
```

Manual operation: See "Trigger Delay" on page 508

[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering.

Parameters:

<Inhibit> integer

Range: 0 to dynamic
*RST: 0

Example:
```
SOURce1:BB:EUTRa:TRIGger:SOURce EXT
SOURce1:BB:EUTRa:TRIGger:EXTernal:INHibit 200
```

Manual operation: See "Trigger Inhibit" on page 508

[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?

Queries the actual external trigger delay (expressed in time unit).

Return values:

<ExtResultDelay> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

Example:
```
BB:EUTR:TRIG:EXT:RDEL?
```
Response: `5.12E-6` the resulting delay of the external trigger signal is 5.12 micro seconds.

Usage: Query only

Manual operation: See "Actual External Delay" on page 508

[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay <Delay>

Defines the trigger delay (expressed in time units) for external triggering.

Parameters:

<Delay> float

Range: 0 to depends on other values
Increment: 250E-12
*RST: 0
Default unit: s

Example: `BB:EUTR:TRIG:EXT:TDEL 5E-6`
Sets a delay of 5 micro seconds for the trigger.

Manual operation: See "Trigger Delay" on page 508

9.6 Marker

Example: Configure and enable standard marker signals

```
SOURce1:BB:EUTRa:TRIGger:OUTPut1:MODE FRAM
// selects a frame marker
SOURce1:BB:EUTRa:TRIGger:OUTPut1:ROFFset 20
// sets a rise offset of 20 samples
SOURce1:BB:EUTRa:TRIGger:OUTPut1:FOFFset 200
// sets a fall offset of 200 samples

SOURce1:BB:EUTRa:TRIGger:OUTPut2:MODE RAT
SOURce1:BB:EUTRa:TRIGger:OUTPut2:ONTime 20
SOURce1:BB:EUTRa:TRIGger:OUTPut2:OFFTime 200

SOURce1:BB:EUTRa:TRIGger:OUTPut3:MODE PERiod
SOURce1:BB:EUTRa:TRIGger:OUTPut3:PERiod 1600
// sets a period of 1600 samples
//  the marker signal is repeated every 1600th sample

SOURce1:BB:EUTRa:TRIGger:OUTPut3:DELay 1000


SOURce1:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed 1
SOURce1:BB:EUTRa:TRIGger:OUTPut1:DELay:MINimum?
// 0
SOURce1:BB:EUTRa:TRIGger:OUTPut1:DELay:MAXimum?
// 2000
```

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE 535
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset 535
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset 535
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime 535
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime 535
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod 536
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay 536
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed 536

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?.....536
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?.....536

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE <Mode>

Defines the signal for the selected marker output.

Parameters:

<Mode> SUBFram | FRAM | RESTart | PERiod | RATio | FAP | SFNRestart | | TRIGger

TRIGer
A received internal or external trigger signal is output at the marker connector.

*RST: FRAM

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See "Marker Mode" on page 509

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset <FallOffset>
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset <RiseOffset>

Sets the rise offset for on/off ratio marker in number of samples.

Parameters:

<RiseOffset> integer

Range: -640000 to 640000
*RST: 0

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See " Rise/Fall Offset " on page 509

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime <OnTime>
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime <OffTime>

Sets the number of samples during which the marker output is on or off.

Parameters:

<OffTime> integer

Range: 1 to 16777215
*RST: 1

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See "Marker Mode" on page 509

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod <Period>

Sets the repetition rate for the signal at the marker outputs.

Parameters:

<Period> unsigned integer

Range: 1 to 4294967295
Increment: 1
*RST: 2
Default unit: Samples

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See "Marker Mode" on page 509

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay <Delay>

Defines the delay between the signal on the marker outputs and the start of the signals.

Parameters:

<Delay> float

Range: 0 to 16777215
Increment: 1E-3
*RST: 0

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See "Marker x Delay" on page 510

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed <Fixed>

Restricts the marker delay setting range to the dynamic range.

Parameters:

<Fixed> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "Configure and enable standard marker signals" on page 534.

Manual operation: See "Fix marker delay to current range" on page 510

[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?

Queries the min/max marker delay.

Return values:

<Maximum> float

Example: See Example "Configure and enable standard marker signals" on page 534.

Usage: Query only

Manual operation: See "Current Range without Recalculation" on page 510

9.7 General TDD Commands

[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf 537
[:SOURce<hw>]:BB:EUTRa:TDD:UDConf 537
[:SOURce<hw>]:BB:EUTRa:TDD:UPTS 537

[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf <SpecSubfrConf>

In TDD mode, sets the special subframe configuration number.

Parameters:

<SpecSubfrConf> integer

Range: 0 to 9
*RST: 0

Example: `SOURce1:BB:EUTRa:TDD:SPSConf 2`

Options: R&S SMBV-K112: Special subframe configuration 9
R&S SMBV-K119: Special subframe configuration 10 (if "Mode = LTE")

Manual operation: See "TDD Special Subframe Config" on page 94

[:SOURce<hw>]:BB:EUTRa:TDD:UDConf <ULDLConf>

In TDD mode, sets the uplink/downlink configuration number.

Parameters:

<ULDLConf> integer

Range: 0 to 6
*RST: 0

Example: `:SOURce1:BB:EUTRa:TDD:UDConf 2`
Sets the UL/DL configuration

Manual operation: See "TDD UL/DL Configuration" on page 94

[:SOURce<hw>]:BB:EUTRa:TDD:UPTS <UpPtsSymbol>

If `[:SOURce<hw>]:BB:EUTRa:TDD:SPSConf` 10, sets the number of UpTPS symbols.

Parameters:

<UpPtsSymbol> 1 | 2

*RST: 1

Example:

```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce:BB:EUTRa:TDD:SPSConf 10
SOURce:BB:EUTRa:TDD:UPTS 2
```

Options: R&S SMBV-K119 (if "Mode = LTE")

Manual operation: See "Number of UpPTS Symbols" on page 95

9.8 General Downlink Commands

[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE ... 539
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration ... 539
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna ... 539
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates ... 540
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:REAL ... 540
[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:IMAGinary ... 541
[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer ... 541
[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE? ... 541
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna ... 542
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer ... 542
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer ... 542
[:SOURce<hw>]:BB:EUTRa:DL:BW ... 543
[:SOURce<hw>]:BB:EUTRa:DL:NORB ... 543
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[:SOURce<hw>]:BB:EUTRa:DL:FFT ... 544
[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth? ... 544
[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers? ... 544
[:SOURce<hw>]:BB:EUTRa:DL:LGS? ... 544
[:SOURce<hw>]:BB:EUTRa:DL:RGS? ... 545
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CID ... 545
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CIDGroup ... 545
[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:PLID ... 546
[:SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNti ... 546
[:SOURce<hw>]:BB:EUTRa:DL:CPC ... 546
[:SOURce<hw>]:BB:EUTRa:DL:ULCPc ... 546
[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB ... 547
[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa ... 547
[:SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa ... 547
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa ... 547
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW ... 547
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI ... 548
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS? ... 548
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS ... 548
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[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe 549
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS? 549
[:SOURce<hw>]:BB:EUTRa:DL:PRSS:MIPattern 550

[:SOURce<hw>]:BB:EUTRa:DL:CONF:MODE <Scheduling>

Determines how the scheduling of the different PDSCH allocations inside of the DL allocation table is performed.

Parameters:

<Scheduling> MANual | AUTO | ASEQuence

MANual
No cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings.
Configure the PDSCH allocations manually.

AUTO
Precoding for spatial multiplexing according to TS 36.211 and the selected parameters.

*RST: MANual

Example: `BB:EUTR:DL:CONF:MODE AUTO`
enables the generation of 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

Options: ASEQuence requires R&S SMBV-K112

Manual operation: See Chapter 4.2.1, "PDSCH Scheduling Settings", on page 70

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration <Configuration>

Sets the global MIMO configuration.

Parameters:

<Configuration> TX1 | TX2 | TX4 | SIBF

*RST: TX1

Example:
```
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1
SOURce1:BB:EUTRa:DL:MIMO:APM:MAPCoordinates CARTesian
SOURce1:BB:EUTRa:DL:MIMO:APM:CS:AP0:ROW0:REAL 1
```

Manual operation: See "Global MIMO Configuration" on page 118

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna <Antenna>

Sets the simulated antenna.

Parameters:

<Antenna> ANT1 | ANT2 | ANT3 | ANT4

*RST: ANT1

Example: See [:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration on page 539

Manual operation: See "Simulated Antenna" on page 119
See "Simulated Antenna Path A" on page 119

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates <Type>

Switches between the cartesian and cylindrical coordinates representation.

Parameters:
<Type> CARTesian | CYLindrical
*RST: CARTesian

Example: See [:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration on page 539

Manual operation: See "Mapping Coordinates" on page 164

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:REAL <AntPortMapDat>

Define the mapping of the antenna ports to the physical antennas.

Suffix:
<dir0> 0 | 1 | 2 | 3 | 4 | 6 | 15 to 46 | 2000 to 2001
Antenna port
AP0|1|2|3 can only be mapped to the TX0|1|2|3

<st0> 0 to 3

Parameters:
<AntPortMapDat> 0 | 1 (for AP = 0 to 3); float (for AP = 4 | 6 | 15 to 46)
The mapping of the first four APs AP0|1|2|3 follows the "one-hot" scheme; exactly one single antenna port can be mapped to a TX.
To map an AP, use the command SOURce1:BB:EUTRa:DL:MIMO:APM:CS:AP0|1|2|3:ROW0|1|2|3:**REAL 1**. The corresponding ...:CS:AP0|1|2|3:ROW0|1|2|3:IMAG command has no effect.
The REAL (Magnitude) and IMAGinary (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|REAL+j*IMAGinary| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.
Range: -1 to 360
Increment: 0.001
*RST: dynamic

Example: See [:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration on page 539.

Options: AP = 23 to 46 require R&S SMBV-119

Manual operation: See "Mapping table" on page 164

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:CS:AP<dir0>:ROW<st0>:IMAGinary <AntPortMapDat>

Define the mapping of the antenna ports to the physical antennas.

Suffix:

<dir0> 4 | 6 | 15 to 46 | 2000 to 2001
Antenna port

<st0> 0 to 3

Parameters:

<AntPortMapDat> float

The `REAL` (Magnitude) and `IMAGinary` (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|`REAL`+j*`IMAGinary`| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: dynamic

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFiguration` on page 539.

Options: AP = 23 to 46 require R&S SMBV-119

Manual operation: See "Mapping table" on page 164

[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer <Power>

Sets the reference signal power.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:REFSig:POWer -10.00
```

Manual operation: See "Reference Signal Power" on page 99

[:SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE?

Queries the RS Power per RE relative to Level Display.

Return values:
<RelToLevelDispl> float
Range: -1e3 to 1e3
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:REFS:EPRE?`
Queries the RS Power per RE relative to Level Display.

Usage: Query only

Manual operation: See "RS Power per RE relative to Level Display" on page 100

[:SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna <TxAntenna>

Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

Parameters:
<TxAntenna> NONE | ANT1 | ANT2 | ANT3 | ANT4 | ALL
*RST: ALL

Example: `BB:EUTR:DL:SYNC:TXAN ALL`
Enables all antenna ports to transmit P-/S-SYNC

Manual operation: See "P-/S-SYNC Tx Antenna" on page 100

[:SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer <PPower>

Sets the power of the primary synchronization signal (P-SYNC).

Parameters:
<PPower> float
Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:SYNC:PPOWer -10.00`
Sets the P-SYNC power to -10.00dB.

Manual operation: See "P-SYNC Power" on page 100

[:SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer <SPower>

Sets the power of the secondary synchronization signal (S-SYNC).

Parameters:
<SPower> float
Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:SYNC:SPOWer -10.00`
Sets the S-SYNC power to -10.00dB.

Manual operation: See "S-SYNC Power" on page 100

[:SOURce<hw>]:BB:EUTRa:DL:BW <Bw>

Sets the DL channel bandwidth.

Parameters:

<Bw> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00 | BW0_20 | USER
*RST: BW10_00

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Options: BW0_20 requires R&S SMBV-K115
USER requires R&S SMBV-K55

Manual operation: See "Channel Bandwidth" on page 92

[:SOURce<hw>]:BB:EUTRa:DL:NORB <Norb>

Selects the number of physical resource blocks per slot.

Parameters:

<Norb> integer
Range: 6 to 110
*RST: 50

Example:
```
SOURce1:BB:EUTRa:DL:BW USER
SOURce1:BB:EUTRa:DL:NORB 7
```

Example:
```
SOURce1:BB:EUTRa:DL:BW BW5_00
SOURce1:BB:EUTRa:DL:NORB?
// 25
```

Manual operation: See "Number of Resource Blocks Per Slot" on page 92

[:SOURce<hw>]:BB:EUTRa:DL:SRATe?

Queries the sampling rate.

Return values:

<SampleRate> float
Range: 192E4 to 3072E4
Increment: 1000
*RST: 1536E4

Example: `BB:EUTR:DL:SRAT?`
Queries the automatically set sampling rate.

Usage: Query only

Manual operation: See "Sampling Rate" on page 93

[:SOURce<hw>]:BB:EUTRa:DL:FFT <Fft>

Sets the FFT size.

Parameters:

<Fft> integer

Range: 64 to 2048
*RST: 1024

Example: `SOURce1:BB:EUTRa:DL:FFT?`

Manual operation: See "FFT Size" on page 93

[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?

Queries the occupied bandwidth.

Return values:

<OccupBandwidth> float

Example: `BB:EUTR:DL:OCCB?`
Queries the automatically set occupied bandwidth in downlink.

Usage: Query only

Manual operation: See "Occupied Bandwidth" on page 93

[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?

Queries the occupied subcarriers.

Return values:

<OccupSubcarr> integer

Range: 72 to 1321
*RST: 601

Example: `BB:EUTR:DL:OCCS?`
Queries the number of occupied subcarriers.

Usage: Query only

Manual operation: See "Number Of Occupied Subcarriers" on page 94

[:SOURce<hw>]:BB:EUTRa:DL:LGS?

Queries the number of left guard subcarriers.

Return values:

<Lgs> integer

Range: 28 to 364
*RST: 212

Example: `BB:EUTR:DL:LGS?`
Queries the number of left guard subcarriers.

Usage: Query only

Manual operation: See "Number Of Left/Right Guard Subcarriers" on page 94

[:SOURce<hw>]:BB:EUTRa:DL:RGS?

Queries the number of right guard subcarriers.

Return values:
<Rgs> integer
Range: 27 to 364
*RST: 211

Example: `BB:EUTR:DL:RGS?`
Queries the number of right guard subcarriers.

Usage: Query only

Manual operation: See "Number Of Left/Right Guard Subcarriers" on page 94

[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CID <CellId>

Sets the cell identity.

Parameters:
<CellId> integer
Range: 0 to 503
*RST: 0

Example: `BB:EUTR:DL:PLC:CID 100`
Sets the Cell ID.

Manual operation: See "Cell ID" on page 95

[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CIDGroup <CellIdGroup>

Sets the ID of the physical cell identity group.

Parameters:
<CellIdGroup> integer
Range: 0 to 167
*RST: 0

Example: `BB:EUTR:DL:PLC:CIDG 100`
Sets the ID of the physical cell identity group.

Manual operation: See "Physical Cell ID Group" on page 96

[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:PLID <PhysLayId>

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:PLCI]:CIDGroup`.

Parameters:

<PhysLayId> integer

Range: 0 to 2
*RST: 0

Example: `BB:EUTR:DL:PLC:PLID 2`
Sets the identity of the physical layer.

Manual operation: See "Physical Layer ID" on page 96

[:SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNti <RaRnti>

Sets the random-access response identity RA-RNTI.

The value selected here determines the value of the parameter "UE_ID/n_RNTI" in case a RA_RNTI "User" is selected.

Parameters:

<RaRnti> integer

Range: 1 to 60
*RST: 1

Example: `SOURce1:BB:EUTRa:DL:CSETtings:RARNti 5`

Manual operation: See "RA_RNTI" on page 98

[:SOURce<hw>]:BB:EUTRa:DL:CPC <CyclicPrefix>

Sets the cyclic prefix length for all LTE subframes.

Parameters:

<CyclicPrefix> NORMal | EXTended | USER

*RST: NORMal

Example: `SOURce1:BB:EUTRa:DL:CPC NORM`

Example:
```
SOURce1:BB:EUTRa:DL:CPC USER
SOURce1:BB:EUTRa:DL:SUBF6:CYCP NORM
SOURce1:BB:EUTRa:DL:SUBF1:CYCP EXT
```

Manual operation: See "Cyclic Prefix (General DL Settings)" on page 96

[:SOURce<hw>]:BB:EUTRa:DL:ULCPc <GSCpcOppDir>

In TDD duplexing mode, sets the cyclic prefix for the opposite direction.

Parameters:
<GSCpcOppDir> NORMal | EXTended
*RST: NORMal

Example:
```
:SOURce1:BB:EUTRa:DUPLexing TDD
:SOURce1:BB:EUTRa:DL:ULCPc EXTended
```

Manual operation: See "UL/DL Cyclic Prefix" on page 96

[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB <Pb>

Sets the cell-specific ratio rho_B/rho_A according to TS 36.213.

Parameters:
<Pb> integer
Range: 0 to 3
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa` on page 547.

Manual operation: See "PDSCH P_B" on page 96

[:SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa <RatioPbPa>
[:SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa <RatioPbBa>
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa <RatioPbPa>

Sets the transmit energy ratio among the resource elements allocated for teh channel in the OFDM symbols containing reference signal (P_B) and such not containing one (P_A).

Parameters:
<RatioPbPa> float
Range: -10 to 10
Increment: 0.001
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:PDSCh:PB 1
SOURce1:BB:EUTRa:DL:PDSCh:RATBa?
// -0.969
SOURce1:BB:EUTRa:DL:PBCH:RATBa -5.0
SOURce1:BB:EUTRa:DL:PDCCh:RATBa -1.0
```

Manual operation: See "PDSCH/PDCCH/PBCH Ratio rho_B/rho_A" on page 97

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:BW <PrsBandwidth>

Defines the bandwidth in which the PRS is transmitted.

Parameters:

<PrsBandwidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

*RST: BW1_40

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Options: R&S SMBV-K84/K284

Manual operation: See "PRS Bandwidth" on page 106

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:CI <ConfIdx>

Sets the PRS Configuration Index I_{PRS} as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Parameters:

<ConfIdx> integer

Range: 0 to 2399

*RST: 0

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Options: R&S SMBV-K84/K284

Manual operation: See "PRS Configuration Index" on page 105

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?

Queries the subframe offset of the PRS generation ($Delta_{PRS}$) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Return values:

<DeltaPRS> integer

Range: 0 to 1279

*RST: 0

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Usage: Query only

Options: R&S SMBV-K84/K284

Manual operation: See "PRS Subframe offset Delta_PRS" on page 106

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS <NumberPRS>

Defines the number of consecutive DL subframes in that PRS are transmitted.

Parameters:

<NumberPRS> 1 | 2 | 4 | 6

*RST: 1

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Options: R&S SMBV-K84

Manual operation: See "Number of PRS DL Subframes (N_PRS)" on page 106

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW <PrsPower>

Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

Parameters:

<PrsPower> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Options: R&S SMBV-K84/K284

Manual operation: See "PRS Power" on page 106

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe <PrsState>

Enables the generation of the PRS.

Parameters:

<PrsState> 0 | 1 | OFF | ON

*RST: OFF

Example:

```
:SOURce1:BB:EUTRa:DL:PRSS:CI 1
:SOURce1:BB:EUTRa:DL:PRSS:BW BW1_40
:SOURce1:BB:EUTRa:DL:PRSS:POW 0
:SOURce1:BB:EUTRa:DL:PRSS:MIPattern #H1,2
:SOURce1:BB:EUTRa:DL:PRSS:NPRS 2
:SOURce1:BB:EUTRa:DL:PRSS:STATe 1
```

Options: R&S SMBV-K84/K284

Manual operation: See "PRS State" on page 105

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS? <PeriodicityTPRS>

Queries the periodicity of the PRS generation (T_{PRS}) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

Parameters:

<PeriodicityTPRS> integer

Range: 160 to 1280
*RST: 160

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Usage: Query only

Options: R&S SMBV-K84/K284

Manual operation: See "PRS Periodicity T_PRS" on page 105

[:SOURce<hw>]:BB:EUTRa:DL:PRSS:MIPattern <PrsMutingInfo>, <BitCount>

Specifies a bit pattern that defines the muted and not muted PRS.

Parameters:

<PrsMutingInfo> numeric

Each bit defines the PRS state of one PRS occasion

0
PRS is muted

1
PRS is transmitted

*RST: #H3

<BitCount> integer

2, 4, 8 or 16 bits

Range: 2 to 16
*RST: 2

Example: See [:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe on page 549

Options: R&S SMBV-K84

Manual operation: See "PRS Muting Info" on page 106

9.9 General Uplink Commands

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[:SOURce<hw>]:BB:EUTRa:UL:NORB 551
[:SOURce<hw>]:BB:EUTRa:UL:SRATe? 552
[:SOURce<hw>]:BB:EUTRa:UL:FFT 552
[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth? 552
[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers? 553
[:SOURce<hw>]:BB:EUTRa:UL:LGS? 553
[:SOURce<hw>]:BB:EUTRa:UL:RGS? 553
[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CID 553
[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CIDGroup 554
[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:PLID 554
[:SOURce<hw>]:BB:EUTRa:UL:CPC 554
[:SOURce<hw>]:BB:EUTRa:UL:DLCPc 555
[:SOURce<hw>]:BB:EUTRa:UL:SOFFset 555

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping....555
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping....555
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift....556
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS....556
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx....556
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs....556
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS....557
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?....557
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[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM....560
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB....560
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift....560
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS....560
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB....561
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax?....561
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[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N5Max?....562
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N4Max?....562
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max?....562

[:SOURce<hw>]:BB:EUTRa:UL:BW <BandWidth>

Sets the UL channel bandwidth.

Parameters:

<BandWidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00 | BW0_20 | USER

*RST: BW10_00

Example: `SOURce:BB:EUTRa:UL:BW BW20_00`

Options: BW0_20 requires R&S SMBV-K115
USER requires R&S SMBV-K55

Manual operation: See " Channel Bandwidth" on page 214

[:SOURce<hw>]:BB:EUTRa:UL:NORB <NumResBlocks>

Selects the number of physical resource blocks per slot.

Parameters:

<NumResBlocks> integer

Range: 6 to 110
*RST: 50

Example: `BB:EUTR:UL:BW USER`
Sets the bandwidth mode to USER in downlink.
`BB:EUTR:UL:NORB 7`
Sets the number of resource blocks to 7.

Manual operation: See " Number of Resource Blocks Per Slot" on page 215

[:SOURce<hw>]:BB:EUTRa:UL:SRATe?

Queries the sampling rate.

Return values:
<SampRate> float
Range: 192E4 to 3072E4
Increment: 1000
*RST: 1536E4

Example: `BB:EUTR:UL:SRAT?`
Queries the automatically set sampling rate.

Usage: Query only

Manual operation: See " Sampling Rate" on page 216

[:SOURce<hw>]:BB:EUTRa:UL:FFT <FftSize>

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

Parameters:
<FftSize> integer
Range: 64 to 2048
*RST: 1024

Example: `BB:EUTR:UL:FFT?`
Queries the automatically set FFT size.

Manual operation: See " FFT Size" on page 215

[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth?

Queries the occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

Return values:
<OccBandwidth> float
Default unit: MHz

Example: `BB:EUTR:UL:OCCB?`
Queries the automatically set occupied bandwidth in uplink.

Usage: Query only

Manual operation: See " Occupied Bandwidth" on page 216

[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers?

Queries the occupied subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Return values:
<OccSubcarriers> integer
Range: 72 to 1320
*RST: 600

Example: `BB:EUTR:UL:OCCS?`
Queries the number of occupied subcarriers.

Usage: Query only

Manual operation: See " Number Of Occupied Subcarriers" on page 216

[:SOURce<hw>]:BB:EUTRa:UL:LGS?

Queries the number of left guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Return values:
<LgSubCarr> integer
Range: 28 to 364
*RST: 212

Example: `BB:EUTR:UL:LGS?`
Queries the number of left guard subcarriers.

Usage: Query only

Manual operation: See " Number of Left/Right Guard Subcarriers" on page 216

[:SOURce<hw>]:BB:EUTRa:UL:RGS?

Queries the number of right guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Return values:
<RgSubCarr> integer
Range: 35 to 601
*RST: 211

Example: `BB:EUTR:UL:RGS?`
Queries the number of right guard subcarriers.

Usage: Query only

Manual operation: See " Number of Left/Right Guard Subcarriers" on page 216

[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CID <CellId>

Sets the cell identity.

Parameters:
<CellId> integer
Range: 0 to 503
*RST: 0

Example: `BB:EUTR:UL:PLC:CID 100`
Sets the cell ID.

Manual operation: See "Cell ID" on page 218

[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CIDGroup <PhysCellIdGroup>

Sets the ID of the physical cell identity group.

Parameters:
<PhysCellIdGroup> integer
Range: 0 to 167
*RST: 0

Example: `BB:EUTR:UL:PLC:CIDG 100`
Sets the UL physical cell ID group

Manual operation: See "Physical Cell ID Group" on page 218

[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:PLID <PhysicalLayerId>

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[:SOURce<hw>]:BB:EUTRa:UL[:PLCI]:CIDGroup`.

Parameters:
<PhysicalLayerId> integer
Range: 0 to 2
*RST: 0

Example: `BB:EUTR:UL:PLC:PLID 2`
Sets the UL physical layer ID

Manual operation: See "Physical Layer ID" on page 218

[:SOURce<hw>]:BB:EUTRa:UL:CPC <CyclicPrefix>

Sets the cyclic prefix length for all subframes.

Parameters:
<CyclicPrefix> NORMal | EXTended | USER
*RST: NORMal

Example: `SOURce1:BB:EUTRa:UL:CPC NORM`

Options: R&S SMBV-K55: USER

Manual operation: See "Cyclic Prefix" on page 218

[:SOURce<hw>]:BB:EUTRa:UL:DLCPc <GSCpcOppDir>

In TDD mode, determines the cyclic prefix for the appropriate opposite direction.

Parameters:
<GSCpcOppDir> NORMal | EXTended
*RST: NORMal

Example:
```
:SOURce1:BB:EUTRa:DUPLexing TDD
:SOURce1:BB:EUTRa:UL:DLCPc EXTended
```

Manual operation: See "UL/DL Cyclic Prefix" on page 96

[:SOURce<hw>]:BB:EUTRa:UL:SOFFset <SfnOffset>

Set the start SFN value.

Parameters:
<SfnOffset> integer
Range: 0 to 4095
*RST: 0
Default unit: Frames

Example:
```
:SOURce1:BB:EUTRa:UL:SOFFset 10
```
Sets the SFN start value

Manual operation: See "SFN Offset" on page 219

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping <GroupHopping>

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Parameters:
<GroupHopping> 0 | 1 | OFF | ON
*RST: 0

Example:
```
BB:EUTR:UL:REFS:GRPH ON
```
Enables group hopping

Manual operation: See "Group Hopping" on page 220

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping <SequenceHopping>

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Parameters:
<SequenceHopping> 0 | 1 | OFF | ON
*RST: OFF

Example:
```
BB:EUTR:UL:REFS:SEQH ON
```
Enables sequence hopping

Manual operation: See "Sequence Hopping" on page 220

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift <DeltaSeqShift>

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

Parameters:

<DeltaSeqShift> integer

Range: 0 to 29
*RST: 0

Example: `BB:EUTR:UL:REFS:DSSH 3`
Sets the delta sequence shift for PUSCH

Manual operation: See "Delta Sequence Shift for PUSCH" on page 221

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS <DrsDmrs>

Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

Parameters:

<DrsDmrs> integer

Range: 0 to 11
*RST: 0

Example: `BB:EUTR:UL:REFS:DMRS 4`
Sets the demodulation reference signal index to 4

Manual operation: See "n(1)_DMRS" on page 221

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx <AnSrsSimTxState>

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

Parameters:

<AnSrsSimTxState> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:EUTR:UL:REFS:SRS:ANST ON`

Manual operation: See " A/N + SRS simultaneous Tx " on page 227

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs <MaxUpPts>

Enables/disables the cell-specific parameter srsMaxUpPts.

Parameters:
<MaxUpPts> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:EUTR:UL:REFS:SRS:MUPT ON`

Manual operation: See " SRS MaxUpPTS " on page 227

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS <Csrs>

Sets the cell-specific parameter SRS bandwidth configuration (C_{SRS}).

Parameters:
<Csrs> integer
Range: 0 to 7
*RST: 0

Example: `BB:EUTR:UL:REFS:SRS:CSRS 4`
Sets the SRS bandwidth configuration

Manual operation: See " SRS Bandwidth Configuration C_SRS " on page 227

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?

Queries the value for the cell-specific parameter transmission offset $Delta_{SFC}$ in subframes, depending on the selected SRS subframe configuration (`[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS`) and the dduplexing mode (`[:SOURce<hw>]:BB:EUTRa:DUPLexing`).

Return values:
<DeltSFC> string

Example: `BB:EUTR:UL:REFS:SRS:SUC 4`
Sets the SRS configuration
`BB:EUTR:UL:REFS:SRS:DSFC?`
Queries the Delta_SFC parameter

Usage: Query only

Manual operation: See " Transmission Offset Delta_SFC " on page 227

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration <SubFrameConfig>

Sets the cell-specific parameter SRS subframe configuration.

Parameters:
<SubFrameConfig> integer
Range: 0 to 15
*RST: 15

Example: `BB:EUTR:UL:REFS:SRS:SUC 4`
Sets the SRS configuration

Manual operation: See " SRS Subframe Configuration " on page 226

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?

Queries the value for the cell-specific parameter configuration period T_{SFC} in subframes, depending on the selected SRS subframe configuration ([:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS) and the duplexing mode ([:SOURce<hw>]:BB:EUTRa:DUPLexing).

Return values:
<Tsfc> string

Example: BB:EUTR:UL:REFS:SRS:SUC 4
Sets the SRS configuration
BB:EUTR:UL:REFS:SRS:TSFC?
Queries the T_SFC parameter

Usage: Query only

Manual operation: See " Configuration Period T_SFC " on page 227

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:CONFiguration <Configuration>

Sets the PRACH configuration number.

Parameters:
<Configuration> integer
Range: 0 to 63
*RST: 0

Example: BB:EUTR:UL:PRAC:CONF 10
Sets the PRACH configuration

Manual operation: See " PRACH Configuration " on page 221

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset <FrequencyOffset>

Sets the prach-FrequencyOffset $n^{RA}_{PRBoffset}$

Parameters:
<FrequencyOffset> integer
Range: 0 to dynamic
*RST: 0

Example: BB:EUTR:UL:PRAC:FOFF 2
Sets the frequency offset

Manual operation: See " PRACH Frequency Offset " on page 221

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:RSET <RestrictedSet>

Enables/disables using of a restricted preamble set.

Parameters:

<RestrictedSet> URES | ARES | BRES | OFF | ON

URES|OFF
Unrestricted preamble set.

ARES|ON
Restricted set type A.

BRES
Restricted set type B.

*RST: URES

Example: `SOURce1:BB:EUTRa:UL:PRACh:RSET ARES`
Enables using of restricted set type A

Manual operation: See " PRACH Restricted Set " on page 223

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHMode <FreqHoppingMode>

Sets the frequency hopping mode for PUSCH.

Parameters:

<FreqHoppingMode> INTRa | INTer

*RST: INTRa

Example: `BB:EUTR:UL:PUSC:FHM INT`
Selects inter-subframe hopping mode

Manual operation: See " Frequency Hopping Mode " on page 223

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHOFfset <FHoppOffset>

Sets the PUSCH Hopping Offset N_{RB}^{HO}.

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

Parameters:

<FHoppOffset> integer

Range: dynamic to dynamic
*RST: 0

Example: `BB:EUTR:UL:PUSC:FHOF 2`
Set the PUSCH hopping offset

Manual operation: See " PUSCH Hopping Offset " on page 223

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM <SubBandCount>

Sets the number of sub-bands (Nsb) into that the total range of physical resource blocks available for PUSCH transmission is divided. The frequency hopping is performed at sub-band level.

Parameters:

<SubBandCount> integer

Range: 1 to 110
*RST: 4

Example: `BB:EUTR:UL:PUSC:NOSM 3`
Sets the number of sub-bands

Manual operation: See " Number of Sub-bands " on page 223

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB <RbCount>

Sets the PUCCH region in terms of reserved resource blocks, at the edges of the channel bandwidth.

Parameters:

<RbCount> integer

Range: 0 to 110
*RST: 4

Example: `BB:EUTR:UL:PUCC:NORB 3`
Reserves 3 RBs for PUCCH

Manual operation: See " Number of RBs used for PUCCH " on page 224

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift <DeltaShift>

Sets the delta shift parameter.

Parameters:

<DeltaShift> integer

Range: 1 to 3
*RST: 2

Example: `BB:EUTR:PUCC:DESH 3`
Sets the delta shift parameter

Manual operation: See " Delta Shift " on page 224

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS <N1Cs>

Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Parameters:

<N1Cs> integer

Range: 0 to dynamic
*RST: 6

Example: `BB:EUTR:UL:PUCC:N1CS 5`
5 cyclic shifts are used for PUCCH format 1/1a/1b in an RB used for a combination of the PUCCH formats 1/1a/1b and 2/2a/2b

Manual operation: See " N(1)_cs " on page 225

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB <N2Rb>

Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

Parameters:

<N2Rb> integer

Range: 0 to dynamic
*RST: 1

Example: `BB:EUTR:UL:PUCC:N2RB 3`
Reserves 3 RB for PUCCH formats 2/2a/2b

Manual operation: See " N(2)_RB " on page 225

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax?

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and for normal CP.

Return values:

<N1NormCP> integer

Range: 0 to 110
*RST: 44

Example: `BB:EUTR:UL:PUCC:N1NM?`
Queries the range of the possible PUCCH formats 1/1a/1b transmissions.
`Response: 24`

Usage: Query only

Manual operation: See " Range n(1)_PUCCH (Normal/Extended CP) " on page 225

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax?

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and for extended CP.

Return values:
<N1emax> integer
Range: 0 to 110
*RST: 29

Example: `BB:EUTR:UL:PUCC:N1EM?`
Queries the range of the possible PUCCH formats 1/1a/1b transmissions.
`Response: 10`

Usage: Query only

Manual operation: See " Range n(1)_PUCCH (Normal/Extended CP) " on page 225

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max?

Queries the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

Return values:
<N2Max> integer
Range: 0 to 110
*RST: 15

Example: `BB:EUTR:UL:PUCC:N2M?`
Queries the range of the possible PUCCH formats 2/2a/2b transmissions.
`Response: 16`

Usage: Query only

Manual operation: See " Range n(2)_PUCCH " on page 225

[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N5Max?
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N4Max?
[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max?

Queries the range of possible number of PUCCH format x transmissions from different users in one subframe.

Return values:
<N3Max> integer
Range: 0 to 549
*RST: 19

Usage: Query only

Options: N4Max|N5Max require R&S SMBV-K119

Manual operation: See " Range n(3)_PUCCH" on page 225

9.10 DL Frame Configuration

[:SOURce<hw>]:BB:EUTRa:DL:BUR 563
[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes 563
[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame 564
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix 564
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount 564
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords 565
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation 565
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP 565
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount 566
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount 566
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset 567
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset 567
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC 567
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits? 568
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA 568
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern 569
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect 569
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer 569
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType? 570
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe 570
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict 570
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits? 571

[:SOURce<hw>]:BB:EUTRa:DL:BUR <Bur>

Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

In "Mode > eMTC/NB-IoT", unused resource elements are filled in with DTX.

Parameters:

<Bur> DUData | DTX

*RST: DUData

Example: `SOURce1:BB:EUTRa:DL:BUR DUData`
The unscheduled resource elements are filled with dummy data.

Manual operation: See "Behavior In Unscheduled REs (OCNG)" on page 122

[:SOURce<hw>]:BB:EUTRa:DL:CONSubframes <ConSubFrames>

Sets the number of configurable subframes.

Parameters:

<ConSubFrames> integer

Range: 1 to 40
*RST: 10

Example: `BB:EUTR:DL:CONS 10`
Ten subframes are configurable in downlink.

Manual operation: See "No Of Configurable (DL) Subframes" on page 121

[:SOURce<hw>]:BB:EUTRa:DL:RSTFrame

Resets all subframe settings of the selected link direction to the default values.

Example: `BB:EUTR:DL:RSTF`
Resets the downlink subframe parameters of path A to the default settings.

Manual operation: See "Reset All Subframes" on page 122

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix <CycPrefix>

(enabled for `BB:EUTR:DL:CPC USER` only)

Sets the cyclic prefix for the according subframe.

Parameters:
<CycPrefix> NORMal | EXTended
*RST: NORMal

Example: `BB:EUTR:DL:CPC USER`
The cyclic prefix has to be adjusted on subframe basis.
`BB:EUTR:DL:SUBF6:CYCP NORM`
A normal prefix is used in subframe 6 in downlink.

Manual operation: See "Cyclic Prefix" on page 141

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount <AllocCount>

Sets the number of scheduled allocations in the selected subframe. The maximum number of allocations that can be scheduled depends on the number of the selected resource blocks.

Parameters:
<AllocCount> integer
Range: 0 to dynamic
*RST: 2 (SUBF0, SUBF10,SUBF20,SUBF30); 1(all other subframes)

Example: `BB:EUTR:DL:SUBF4:ALC 5`
Five scheduled allocations are assigned to subframe four.

Manual operation: See "No. Of Used Allocations" on page 141

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords <CodeWords>

Sets the number of codewords for an allocation.

Two codewords are available for global MIMO configuration with two or more antennas.

Parameters:

<CodeWords> 1 | 2

Range: 1 to 2
*RST: 1

Manual operation: See "Codeword" on page 142
See "Codeword" on page 150

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation <Modulation>

Sets the modulation scheme for the allocation.

Parameters:

<Modulation> QPSK | QAM16 | QAM64 | QAM256

*RST: QPSK

Example: `BB:EUTR:DL:SUBF4:ALL5:CW2:MOD QPSK`
Selects QPSK as modulation scheme for the allocation.

Example:
```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD QPSK
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD?
Response: QPSK
```

Options: QAM256 requires option R&S SMBV-K113

Manual operation: See "Modulation" on page 143

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP <VrbGap>

Enables/disables the unitization of distributed Virtual Resource Blocks (VBR) and determines whether the first or the second VRB gap is applied.

Parameters:

<VrbGap> integer

0
A **localized distribution** is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.

1
Enables a **distributed** resource block allocation. The first VRB gap is used.

2
Enabled for "Channel Bandwidths" greater than 50 RBs.
The mapping is based on the second (smaller) VRB gap.

Range: 0 to 2
*RST: 0

Example:
```
SOUR:BB:EUTR:DL:BW BW10_00
SOUR:BB:EUTR:SUBF0:ALL2:GAP2
```

Manual operation: See "VRB Gap" on page 143

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount <ResBlockCount>

Sets the size of the selected allocation in resource blocks (per slot).

For allocations with two codewords, the number of resource blocks for the second codeword is automatically set to the number of resource blocks set for the first one.

Parameters:
<ResBlockCount> integer

AUTO
Indicates automatically calculated value depending on other settings

Range: 1 to 110
*RST: 1

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:RBC 3
```

Manual operation: See "No. RB (Resource Blocks)" on page 145

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount <SymCount>

Sets the size of the selected allocation in OFDM symbols.

For content type PBCH, PDCCH and PDSCH, this value is set automatically.

For allocations with two codewords, the number of symbols for the second codeword is automatically set to number of symbols set for the first one.

Parameters:
<SymCount> integer

Range: 1 to 14
*RST: 6 (PBCH); 12 (PDSCH)

Example: For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.
```
SOUR:BB:EUTR:DL:SUBF1:CYCP NORM
SOUR:BB:EUTR:DL:SUBF2:ALL2:CW2:SYM 2
SOUR:BB:EUTR:DL:SUBF1:ALL2:CW2:SYMC 12
```

Manual operation: See "No. Sym." on page 146

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOFfset
<ResBlockOffset>

Queries the start resource block of the selected allocation.

Parameters:

<ResBlockOffset> integer

AUTO
Indicates automatically calculated value depending on other settings

Range: 0 to dynamic
*RST: dynamic

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:RBOF?`

Manual operation: See "Offset RB" on page 146

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset
<SymOffset>

Sets the start OFDM symbol of the selected allocation.

Parameters:

<SymOffset> integer

Range: 0 to 13
*RST: 2

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:SYM 5`
OFDM symbol five is the start OFDM symbol for allocation five in subframe four.

Manual operation: See "Offset Sym." on page 147

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC
<Aoc>

Sets whether automatic offset calculation is used or not.

Parameters:

<Aoc> 0 | 1 | OFF | ON

*RST: ON

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:AOC ON`
Activates the automatic offset calculation for the selected allocation.

Manual operation: See "Auto" on page 147

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

Return values:

<PhysicalBits> integer

AUTO
Indicates automatically calculated value depending on other settings

Range: 0 to 105600
*RST: 0

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PHYS?`
Queries the number of physical bits for allocation five in subframe four.

Usage: Query only

Manual operation: See "Phys. Bits" on page 147
See "Number of Physical Bits (DL)" on page 158

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA <Data>

Sets the data source for the selected allocation.

For allocations with two codewords, the data source for the second codeword is automatically set to the data source set for the first one.

Parameters:

<Data> USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE | MIB | MCCH | MTCH

MIB
(Result parameter)
Indicates that the PBCH transmits real MIB data.
(See also `[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 606)

MCCH|MTCH
(Result parameter)
Indicates allocations in the MBSFN subframes, if MBSFN is used.
(See also `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE` on page 578)

*RST: dynamic

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:DATA PN9`
PN9 is the data source for the selected allocation.

Manual operation: See "Data List Management" on page 62
See "Data Source" on page 148

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern
<Pattern>, <BitCount>

Sets a bit pattern as data source.

Parameters:
<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:DATA PATT
BB:EUTR:DL:SUBF4:ALL5:CW:PATT #H3F,8
```

Manual operation: See "Data Source" on page 148

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSELect
<DSelect>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:
<DSelect> string
Filename incl. file extension or complete file path

Example:
```
BB:EUTR:DL:SUBF2:ALL5:CW:DATA DLISt
BB:EUTR:DL:SUBF2:ALL5:CW:DSELect
"/var/user/eutra_list1"
```

Manual operation: See "Data List Management" on page 62
See "Data Source" on page 148

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWer
<Power>

Sets the power P_{PDSCH} respectively P_{PBCH} for the selected allocation. The power of the PDCCH allocation P_{PDCCH} is read-only. The value is set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer`.

For allocations with two codewords, the power for the second codeword is automatically set to the power set for first one.

Parameters:
<Power> float
Range: -80 to 10
Increment: 0.001
*RST: 0

Example: P_{PDSCH}, P_{PBCH}
```
SOUR:BB:EUTR:DL:SUBF1:ALL2:POW 10.00
```

Example: P_{PDCCH}
```
SOUR:BB:EUTR:DL:SUBF1:ENCC:PDCC:POW 2.00
SOUR:BB:EUTR:DL:SUBF1:ALL1:POW?
Response: 2
```

Manual operation: See "Rho A" on page 148

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType?

Queries the type for the selected allocation.

PBCH can be configured in subframe 0 only.

Return values:

<ConType> PDSCh | PBCH | PDCCh | PMCH
*RST: PDSCh

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:CONT?
Response: PDSC
```

Usage: Query only

Options: PMCH requires R&S SMBV-K84

Manual operation: See "Content Type" on page 149

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe <State>

Sets the allocation state to active or inactive.

Parameters:

<State> 0 | 1 | OFF | ON
*RST: OFF

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:STAT OFF
```
Deactivates the selected allocation.

Manual operation: See "State" on page 149

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlict <Conflict>

Indicates a conflict between two allocations.

Parameters:

<Conflict> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:EUTR:DL:SUBF4:ALL5:CW2:CONF?`
Queries for the selected allocation whether there is a conflict with another allocation.

Manual operation: See "Conflict" on page 149

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?

Queries the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority.

If a User 1...4 is selected for the "Data Source" in the allocation table for the corresponding allocation, the value of the parameter "Number of Physical Bits" is the sum of the "Physical Bits" of all single allocations that belong to the same user in the selected subframe.

Return values:
<PhysicalBits> integer
Range: 0 to 100000
*RST: 0

Example: `BB:EUTR:DL:SUBF1:USER3:PHYS?`
Queries the number of physical bits

Usage: Query only

Manual operation: See "Number of Physical Bits (DL)" on page 158

9.11 DL MBFSN

Option: R&S SMBV-K84.

Example: Enabling and configuring MBSFN transmission
The following is a simple example on how to configure an MBSFN signal.

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:SLENgth 512
SOURce1:BB:EUTRa:DL:BW BW1_40
SOURce1:BB:EUTRa:DL:MBSFn:MODE MIX
SOURce1:BB:EUTRa:DL:MBSFn:UEC C5
SOURce1:BB:EUTRa:DL:MBSFn:RHOA 0

SOURce1:BB:EUTRa:DL:MBSFn:SC:APER AP8
SOURce1:BB:EUTRa:DL:MBSFn:SC:AOFFset 2
SOURce1:BB:EUTRa:DL:MBSFn:SC:AMODe F4
SOURce1:BB:EUTRa:DL:MBSFn:SC:AVAL 11184810

SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe 1
SOURce1:BB:EUTRa:DL:MBSFn:AI:ID 0
```

```
SOURce1:BB:EUTRa:DL:MBSFn:AI:NMRL 2
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER RP128
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER MP512
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC NRC2
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI 4
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS 0
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS MCS2
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA PN9
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern #H0,1
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset 0
SOURce1:BB:EUTRa:DL:MBSFn:AI:NIND?
// Response:  2
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL?
// Response:  11184810
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?
Response:  QPSK
SOURce1:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?
// Response: 2216

SOURce1:BB:EUTRa:DL:MBSFn:MTCH:CSAP AP64
SOURce1:BB:EUTRa:DL:MBSFn:MTCH:NPMChs 3
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:SASTart 0
SOURce1:BB:EUTRa:DL:MBSFn:PMCH1:SPERiod SPRF8
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:MCSTwo 0
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:MCS 5
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:MOD?
// QPSK
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:MCSTwo 1
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:MOD?
// QAM16
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:DATA PN9
SOURce1:BB:EUTRa:DL:MBSFn:PMCH0:STATe 1
SOURce1:BB:EUTRa:DL:MBSFn:PMCH1:SPERiod SPRF8
SOURce1:BB:EUTRa:DL:MBSFn:PMCH2:SPERiod SPRF8

SOURce1:BB:EUTRa:STATe 1
```

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID 573
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL? 573
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation? 574
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER 575
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset 575
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern 575
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC 575
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI 576
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS 576
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern 576

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER....577
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe....577
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?....577
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND....577
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL....578
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE....578
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP....578
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs....579
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:STATe....579
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA....579
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt....579
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern....580
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCSTwo....580
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS....580
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MOD?....581
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod....581
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart....581
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd....581
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA....581
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe....582
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset....582
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER....582
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL....583
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC....583

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID <AreaID>

Defines the MBSFN area ID, parameter N_{id}^{MBSFN}.

Parameters:

<AreaID> integer

Range: 0 to 255
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Area ID (N_ID_MBSFN)" on page 86

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL? <AllocationValue>

Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

Parameters:

<AllocationValue> integer

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Usage: Query only

Manual operation: See "Allocation Value (HEX)" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA <DataSource>

Sets the data source used for the MCCH.

Parameters:

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH Data Source" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt <DataList>

Sets the data list used as data source for MCCH.

Parameters:

<DataList> string

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH Data Source" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS <MCS>

Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

Parameters:

<MCS> MCS19 | MCS13 | MCS7 | MCS2

*RST: MCS2

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH MCS" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation? <Modulation>

Queries the values as set with the command `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS`.

Parameters:

<Modulation> QPSK | QAM16 | QAM64

*RST: QPSK

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Usage: Query only

Manual operation: See "MCCH Modulation" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER <ModifPeriod>

Sets the MCCH Modification Period.

Parameters:
<ModifPeriod> MP512 | MP1024
*RST: MP512

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH Modification Period" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset <NotifOffset>

Defines, together with the `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC`, the radio frames in which the MCCH information change notification is scheduled.

Parameters:
<NotifOffset> integer
Range: 0 to 10
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Notification Offset" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern <NotifPattern>, <BitCount>

Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

Parameters:
<NotifPattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571.

Manual operation: See "Notification Pattern" on page 89

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC <NotifRepetCoeff>

Selects the current change notification repetition period common for all MCCHs that are configured.

Parameters:

<NotifRepetCoeff> NRC2 | NRC4

*RST: NRC2

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Notification Repetition Coefficient" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI <Index>

Defines the subframe used to transmit MCCH change notifications on PDCCH.

Parameters:

<Index> integer

In FDD: values 1 to 6 correspond with subframes #1, #2, #3, #6, #7 and #8
In TDD: values 1 to 5 correspond with subframe #3, #4, #7, #8 and #9

Range: 1 to dynamic
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Notification Subframe Index" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS <McchOffset>

Indicates, together with the `[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER`, the radio frames in which MCCH is scheduled.

Parameters:

<McchOffset> integer

Range: 0 to 10
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH Offset" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATTern <Pattern>, <BitCount>

Sets the pattern used as data source for the MCCH.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571.

Manual operation: See "MCCH Data Source" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER <RepetPeriod>

Defines the interval between transmissions of MCCH information in radio frames.

Parameters:
<RepetPeriod> RP64 | RP32 | RP128 | RP256
*RST: RP32

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH Repetition Period" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATe <McchState>

Enables/disables the MCCH.

Parameters:
<McchState> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCCH State" on page 87

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize? <TB_Size>

Queries the values as determined by the "MCCH MCS".

Parameters:
<TB_Size> integer

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Usage: Query only

Manual operation: See "MCCH Transport Block Size" on page 88

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND <NotifIndicator>

Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area.

Parameters:

<NotifIndicator> integer

Range: 0 to 7
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Notification Indicator" on page 86

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL <RegionLength>

Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

Parameters:

<RegionLength> integer

Range: 1 to 2
*RST: 2

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Non-MBSFN Region Length" on page 86

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE <MbsfnMode>

Enables the MBSFN transmission and selects a mixed MBSFN Mode.

Parameters:

<MbsfnMode> OFF | MIXed

*RST: OFF

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MBSFN Mode" on page 84

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP <AllocPeriod>

Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCH that are configured for this MBSFN area.

Parameters:

<AllocPeriod> AP4 | AP8 | AP16 | AP32 | AP64 | AP128 | AP256

*RST: AP4

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Common Subframe Allocation Period" on page 89

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs <NumOfPMCHs>

Defines the number of PMCHs in this MBSFN area.

Parameters:

<NumOfPMCHs> int

Range: 1 to 15
Increment: 1
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Number of PMCHs" on page 89

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:STATe <PmchState>

Enables/disables the selected PMCH/MTCH.

Parameters:

<PmchState> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "State" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA <DataSource>

Sets the data source for the selected PMCH/MTCH.

Parameters:

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Data Source" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt <DataList>

Sets the data list of the data source for the selected PMCH/MTCH.

Parameters:

<DataList> string

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Data Source" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTern <Pattern>, <BitCount>

Sets the pattern of the data source for the selected PMCH/MTCH.

Parameters:

<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Data Source" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCSTwo <PmchMcsTwo>

Defines which of the two tables defined in TS 36.213 is used to specify the used modulation and coding scheme.

Parameters:

<PmchMcsTwo> 0 | 1 | OFF | ON

0
Table 7.1.7.1-1 is used

1
Table 7.1.7.1-1A is used

*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Options: R&S SMBV-K113

Manual operation: See "Use Table 2" on page 90

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS <MCS>

Sets the modulation and coding scheme (MCS) applicable for the subframes of the (P)MCH.

Parameters:

<MCS> integer
Range: 0 to 28
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCS" on page 90

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MOD?

Queries the used modulation.

Return values:
<PmchMod> QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Usage: Query only

Options: QAM256 requires R&S SMBV-K113

Manual operation: See "Modulation" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod <SchedPeriod>

Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

Parameters:
<SchedPeriod> SPM | SPRF8 | SPRF16 | SPRF32 | SPRF64 | SPRF128 | SPRF256 | SPRF512 | SPRF1024
*RST: SPM

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MCH Scheduling Period" on page 91

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASTart <AllocStart>
[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd <AllocEnd>

Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

Parameters:
<AllocEnd> integer
Range: 0 to 1535
*RST: 23

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "SF Alloc Start/SF Alloc End" on page 89

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA <RhoA>

Defines the power of the MBSFN channels relative to the common Reference Signals.

Parameters:

<RhoA> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "MBSFN Rho A" on page 84

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODe <AllocationMode>

Defines whether MBSFN periodic scheduling is 1 or 4 frames.

Parameters:

<AllocationMode> F1 | F4

*RST: F1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Subframe Allocation Mode" on page 85

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset <Offset>

Sets the Radio Frame Allocation Offset

Parameters:

<Offset> integer

Range: 0 to 31
*RST: 0

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Radio Frame Allocation Offset" on page 85

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER <AllocPeriod>

Sets the Radio Frame Allocation Period.

Parameters:

<AllocPeriod> AP1 | AP2 | AP4 | AP8 | AP16 | AP32

*RST: AP1

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Radio Frame Allocation Period" on page 85

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL <AllocationValue>

Defines which MBSFN subframes are allocated.

Parameters:

<AllocationValue> integer

Range: 0 to #HFFFFFF
*RST: #H3F

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "Allocation value (HEX)" on page 85

[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC <UeCategory>

Defines the UE category as defined in TS 36.306.

Parameters:

<UeCategory> C1 | C2 | C3 | C4 | C5

*RST: C5

Example: See Example "Enabling and configuring MBSFN transmission" on page 571

Manual operation: See "UE Category" on page 84

9.12 DL Carrier Aggregation

Option: R&S SMBV-K55 and R&S SMBV-K85

[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe....584
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB....584
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW....584
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF....584
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq....584
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID....585
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DUPLexing....585
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:UDConf....585
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SPSConf....586
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex....586
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset....586
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart....587
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex....587
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay....587
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:DURation....587
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:NGParameter....588
[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe....588

[:SOURce<hw>]:BB:EUTRa:DL:CA:STATe <CaGlobalState>

Enables/disables the generation of several component carriers.

Parameters:
<CaGlobalState> 0 | 1 | OFF | ON
*RST: OFF

Manual operation: See "Activate Carrier Aggregation" on page 74

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB <BasebandPath>

Determines the baseband block that generates the selected component carrier.

Parameters:
<BasebandPath> A | B
*RST: A

Options: R&S SMx/AMU-K85

Manual operation: See "Baseband" on page 75

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW <Bandwidth>

Sets the bandwidth of the corresponding component carrier/SCell.

Parameters:
<Bandwidth> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00
*RST: BW10_00

Manual operation: See "Bandwidth" on page 75

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF <CifPresent>

Defines whether the CIF is included in the PDCCH DCI formats transmitted from the corresponding SCell.

Parameters:
<CifPresent> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "CIF Present" on page 76

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq <DeltaFreq>

Sets the frequency offset between the central frequency of the SCell and the frequency of the PCell.

Parameters:

<DeltaFreq> float

Value range depends on the installed options, the number of cells and the cell bandwidth.

Range: -40 to 40
Increment: 0.1
*RST: 0
Default unit: MHz

Manual operation: See "delta f / MHz" on page 76

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID <PhysicalCellId>

Sets the physical Cell ID of the corresponding SCell.

Parameters:

<PhysicalCellId> integer

Range: 0 to 503
*RST: 0

Manual operation: See "Physical Cell ID" on page 75

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DUPLexing <DlDuplexmode>

Selects the duplexing mode of the component carriers.

Parameters:

<DlDuplexmode> TDD | FDD | LAA

*RST: FDD

Example:

```
SOURce1:BB:EUTRa:DL:CA:CELL0:DUPLexing TDD
SOURce1:BB:EUTRa:DL:CA:CELL1:UDConf 3
SOURce1:BB:EUTRa:DL:CA:CELL1:SPSConf 2

// SOURce1:BB:EUTRa:DL:CONF:MODE AUTO
// SOURce1:BB:EUTRa:DL:CA:CELL1:DUPLexing FDD
// SOURce1:BB:EUTRa:DL:CA:CELL2:DUPLexing TDD
// SOURce1:BB:EUTRa:DL:CA:CELL2:UDConf 1
// SOURce1:BB:EUTRa:DL:CA:CELL2:SPSConf
```

Options: TDD and FDD combination requires R&S SMBV-K113
LAA requires R&S SMBV-K119

Manual operation: See "Duplexing" on page 76

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:UDConf <DLCaTddULDLConf>

Sets the Uplink-Downlink Configuration number.

Parameters:
<DLCaTddULDLConf>integer

Range: 0 to 6
*RST: 0

Example: See [:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DUPLexing on page 585

Options: R&S SMBV-K112

Manual operation: See "TDD UL/DL Configuration" on page 76

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SPSConf <DLCaTddSSConf>

Sets the special subframe configuration number.

Parameters:
<DLCaTddSSConf> integer

Range: 0 to 10
*RST: 0

Example: See [:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DUPLexing on page 585

Options: R&S SMBV-K112
R&S SMBV-K119: special subframe configuration 10

Manual operation: See "TDD Special Subframe Config" on page 76

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDex <CellIndex>

Sets the cell index of the corresponding SCell.

The cell index of the PCell is always 0.

Parameters:
<CellIndex> integer

Range: 1 to 7
*RST: 1

Manual operation: See "Cell Index" on page 75

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset <PowerOffset>

Sets the power offset of the SCells relative to the power level of the PCell.

Parameters:
<PowerOffset> float

Range: -80 to 80
Increment: 0.01
*RST: 0

Options: R&S SMx/AMU-K85

Manual operation: See "Power / dB" on page 77

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PSTart <PdschStart>

Sets the starting symbol of the PDSCH for the corresponding SCell.

Parameters:

<PdschStart> integer

Range: 1 to 4
*RST: 2

Manual operation: See "PDSCH Start" on page 77

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINdex <SchedCellIndex>

Defines the component carrier/cell that signals the UL and DL grants for the selected SCell.

Parameters:

<SchedCellIndex> integer

Range: 0 to 7
*RST: 0

Manual operation: See "sched. Cell Index" on page 77

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDELay <TimeDelay>

Sets the time delay of the SCell relative to the PCell.

Parameters:

<TimeDelay> integer

Range: 0 to 700000
*RST: 0

Manual operation: See "Delay / ns" on page 77

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:DURation <Duration>

Sets the PHICH duration and defines the allocation of the PHICH resource element groups over the OFDM symbols.

Parameters:

<Duration> NORMal | EXTended

NORMal
The first OFDM symbol is allocated

EXTended
The first three OFDM symbols are allocated.

*RST: NORMal

Example:

```
SOURce1:BB:EUTRa:DL:CA:CELL0:PHICh:DURation
NORM
```

Manual operation: See "PHICH Duration" on page 97

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PHICh:NGParameter
<NgParameter>

Sets the parameter N_g according to TS 36.211.

Parameters:

<NgParameter> NG1_6 | NG1_2 | NG1 | NG2 | NGCustom

NG1_6 | NG1_2 | NG1 | NG2
Determines the number of PHICH groups.

NGCustom
The number of PHICH groups are set with the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:NOGRoups`.

*RST: NG1_6

Example:
```
SOURce1:BB:EUTRa:DL:CA:CELL0:PHICh:NGParameter NG2
```

Manual operation: See "PHICH N_g" on page 97

[:SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe <CellState>

Activates/deactivates the component carrier/SCell.

Parameters:

<CellState> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
:SOURce1:BB:EUTRa:DL:CA:CELL1:STATe ON
```

Manual operation: See "State" on page 77

9.13 CSI-RS

Example: Enabling a CSI-RS transmission

The following is a simple example on how to configure a CSI-RS transmission.

```
SOURce1:BB:EUTRa:PRESet
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:DL:CSIS:ZP 4112
SOURce1:BB:EUTRa:DL:CSIS:ZPI 5
SOURce1:BB:EUTRa:DL:CSIS:ZPDelta?
// Response: 0
SOURce1:BB:EUTRa:DL:CSIS:ZPT?
// Response: 10
```

```
SOURce1:BB:EUTRa:DL:CSIS:STATe ON
SOURce1:BB:EUTRa:DL:CSIS:NAP AP1
SOURce1:BB:EUTRa:DL:CSIS:SFI 1
SOURce1:BB:EUTRa:DL:CSIS:CONFig0 0
SOURce1:BB:EUTRa:DL:CSIS:SFDelta?
// Response: 1
SOURce1:BB:EUTRa:DL:CSIS:SFT?
// Response: 5
SOURce1:BB:EUTRa:DL:CSIS:POW 0.5

SOURce1:BB:EUTRa:DL:SFSelection 1
SOURce1:BB:EUTRa:DL:SUBF1:ALCount 2
SOURce1:BB:EUTRa:DL:SUBF1:ALLoc1:CW1:PHYSbits?
// Response: 276
SOURce1:BB:EUTRa:DL:SUBF1:ALLoc1:CAW ON
// Response: 272
SOURce1:BB:EUTRa:DL:USER1:CAW:STATe ON
SOURce1:BB:EUTRa:STATe 1
```

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CONFig[<st>] 589
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NAP 590
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:POW 590
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFDelta? 590
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFI 590
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFT? 591
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:STATe 591
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZP 591
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPDelta? 592
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPI 592
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPT? 593
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:DWPTs 593
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG 593
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SCID 594
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CDMType 594
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:FRDensity[<st>] 595
[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:TRANscomb[<st>] 595

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CONFig[<st>] <CsiRsConfig>

Defines the CSI-RS configuration used for the current cell and for which the UE assumes non-zero transmission power.

Suffix:

<st> 0
CSI-RS configuration number

Parameters:

<CsiRsConfig> integer

Range: 0 to 31
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85
Suffix <st> requires R&S SMBV-K119

Manual operation: See "Resource Configuration" on page 112

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NAP <CsiRsNumAp>

Defines the number of antenna ports the CSI-RS are transmitted on.

Parameters:
<CsiRsNumAp> AP1 | AP2 | AP4 | AP8
*RST: AP1

Example: See Example "Enabling a CSI-RS transmission" on page 588

Manual operation: See "Number of AP per CSI-RS Configuration" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:POW <CsiRsPow>

Boosts the CSI-RS power compared to the cell-specific reference signals.

Parameters:
<CsiRsPow> float
Range: -8 to 15
Increment: 0.001
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85

Manual operation: See "CSI-RS Power" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFDelta?

Sets the parameter subframe offset $\Delta_{CSI\text{-}RS}$ for cell-specific CSI-RS.

Return values:
<CsiRsOffs> integer
Range: 0 to 79
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Usage: Query only

Options: CELL<ch0> requires R&S SMBV-K85

Manual operation: See "Subframe Offset (Delta_CSI-RS)" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFI <CsiRsSfConf>

Sets the parameter $I_{CSI\text{-}RS}$ for cell-specific CSI-RS.

Parameters:
<CsiRsSfConf> integer
Range: 0 to 154
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85

Manual operation: See "Subframe Config (I_CSI-RS)" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SFT?

Queires the parameter subframe configuration period T_{CSI-RS} for cell-specific CSI-RS.

Return values:
<CsiRsPeriod> integer
Range: 5 to 80
*RST: 5

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Usage: Query only

Options: CELL<ch0> requires R&S SMBV-K85

Manual operation: See "Periodicity (T_CSI-RS)" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:STATe <CsiRsState>

Enables the transmission of a CSI-RS.

Parameters:
<CsiRsState> OFF | ON | 1 | 0
*RST: OFF

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85

Manual operation: See "CSI-RS State" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZP <ZeroPow>

Sets the used CSI-RS configurations in the zero transmission power subframes.

Suffix:
<st0> 0|1
Distinguishes between the primary (ZP CSI-RS #0) and the additional (ZP CSI-RS #1) zero-power CSI reference signal of a cell.

Parameters:

<ZeroPow> decimal value

In the user interface, the 16 bits are set as a hexadecimal value. In the remote control, as a decimal value.

Range: 0 to 65535
Increment: 1
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85
ZPRS<st0> requires R&S SMBV-K113

Manual operation: See "ZeroPowerCSI-RS (HEX)" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPDelta?

Sets the parameter subframe offset $\Delta_{CSI\text{-}RS}$ for CSI-RS with zero transmission power.

Suffix:

<st0> 0|1
Distinguishes between the primary (ZP CSI-RS #0) and the additional (ZP CSI-RS #1) zero-power CSI reference signal of a cell.

Return values:

<ZeroPowOffs> integer

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Usage: Query only

Options: CELL<ch0> requires R&S SMBV-K85
ZPRS<st0> requires R&S SMBV-K113

Manual operation: See "Subframe Offset (Delta_CSI-RS)" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPI <ZeroPowConf>

Sets the parameter $I_{CSI\text{-}RS}$ for CSI-RS with zero transmission power.

Suffix:

<st0> 0|1
Distinguishes between the primary (ZP CSI-RS #0) and the additional (ZP CSI-RS #1) zero-power CSI reference signal of a cell.

Parameters:

<ZeroPowConf> integer

Range: 0 to 154
*RST: 0

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: CELL<ch0> requires R&S SMBV-K85
ZPRS<st0> requires R&S SMBV-K113

Manual operation: See "Subframe Config (I_CSI-RS)" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>][:ZPRS<st0>]:ZPT?

Sets the parameter subframe configuration period T_{CSI-RS} for CSI-RS with zero transmission power.

Suffix:
<st0> 0|1
Distinguishes between the primary (ZP CSI-RS #0) and the additional (ZP CSI-RS #1) zero-power CSI reference signal of a cell.

Return values:
<ZeroPowPer> integer

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Usage: Query only

Options: CELL<ch0> requires R&S SMBV-K85
ZPRS<st0> requires R&S SMBV-K113

Manual operation: See "Periodicity (T_CSI-RS)" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:DWPTs <DwPTS>

Enables transmission of the CSI-RS in the Downlink Pilot Time Slot (DwPTS) parts of the TDD frame.

Parameters:
<DwPTS> 0 | 1 | OFF | ON
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG` on page 593.

Options: R&S SMBV-K119

Manual operation: See "CSI-RS in DwPTS" on page 110

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG <NumberOfConfigs>

Sets the number of CSI-RS configurations.

Parameters:
<NumberOfConfigs> 1 | 2 | 3 | 4 | 5 | 7
*RST: 1

Example:

```
SOURce1:BB:EUTRa:DL:CSIS:CELL0:STATe 1
SOURce1:BB:EUTRa:DL:CSIS:CELL0:DWPTs 1

SOURce1:BB:EUTRa:DL:CSIS:CELL0:NCFG 2
SOURce1:BB:EUTRa:DL:CSIS:CELL0:CDMType 4
SOURce1:BB:EUTRa:DL:CSIS:CELL0:NAP?
// AP8
SOURce1:BB:EUTRa:DL:CSIS:CELL0:CONFig0 1
SOURce1:BB:EUTRa:DL:CSIS:CELL0:FRDensity0 1
SOURce1:BB:EUTRa:DL:CSIS:CELL0:TRANscomb0 0
SOURce1:BB:EUTRa:DL:CSIS:CELL0:CONFig1 2
SOURce1:BB:EUTRa:DL:CSIS:CELL0:FRDensity1 D12
SOURce1:BB:EUTRa:DL:CSIS:CELL0:TRANscomb1 1
...
```

See also Example "Enabling a CSI-RS transmission" on page 588.

Options: R&S SMBV-K119

Manual operation: See "Number of CSI-RS Configurations" on page 111

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:SCID <ScramblingId>

Sets the additional scrambling identity n_ID used to generate the NonZeroTxPower CSI-RS.

Parameters:

<ScramblingId> integer

Range: 0 to 503

Example: See Example "Enabling a CSI-RS transmission" on page 588.

Options: R&S SMBV-K112

Manual operation: See "Scrambling Identity (n_ID)" on page 112

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:CDMType <CDMType>

Sets the higher-level parameter `CDMType` that influence the antenna port mapping of the CSI-RS.

Parameters:

<CDMType> 2 | 4 | 8

*RST: 2

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG` on page 593.

Options: R&S SMBV-K119

Manual operation: See "CDMType" on page 112

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:FRDensity[<st>]
<CsiRFreqDensity>

Sets the parameter `NZP-FrequencyDensity`.

Parameters:
<CsiRFreqDensity> D1 | D12 | D13
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG` on page 593.

Options: R&S SMBV-K119

Manual operation: See "Frequency Density" on page 113

[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:TRANscomb[<st>]
<CsiRsTransComb>

Sets the parameter `NZP-TransmissionComb`.

Parameters:
<CsiRsTransComb> 0 | 1 | 2
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:CSIS[:CELL<ch0>]:NCFG` on page 593.

Options: R&S SMBV-K119

Manual operation: See "Transmission Comb" on page 113

9.14 LAA and DRS

Option: R&S SMBV-K119

Example: Enabing a LAA SCell and configuring of one LAA burst
The following is a simple example on how to configure a LAA transmission.

```
SOURce1:BB:EUTRa:PRESet
SOURce1:BB:EUTRa:STDMode LTE
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN

// enable a LAA SCell
SOURce1:BB:EUTRa:DL:CONF:MODE AUTO
SOURce1:BB:EUTRa:DL:CA:CELL1:DUPLexing LAA
SOURce1:BB:EUTRa:DL:CA:CELL1:BW BW20_00
SOURce1:BB:EUTRa:DL:CA:CELL1:DFReq 70
SOURce1:BB:EUTRa:DL:CA:CELL1:CIF 1
```

```
SOURce1:BB:EUTRa:DL:CA:CELL1:STATe 1
SOURce1:BB:EUTRa:DL:CA:STATe 1
// configure the DRS
SOURce1:BB:EUTRa:DL:DRS:CELL1:PERiodicity P40
SOURce1:BB:EUTRa:DL:DRS:CELL1:OFFSet 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:DURation DUR1
SOURce1:BB:EUTRa:DL:DRS:CELL1:PATTern 0
SOURce1:BB:EUTRa:DL:DRS:CELL1:STATe 1
// SOURce1:BB:EUTRa:DL:DRS:CELL2:PERiodicity P80
// SOURce1:BB:EUTRa:DL:DRS:CELL2:DURation DUR5
// SOURce1:BB:EUTRa:DL:DRS:CELL2:PATTern 1,0,-1,4,5
SOURce1:BB:EUTRa:DL:DRS:CELL1:CDSTate 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:ZPNum 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:ZP 4
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:ZPI 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:ZPT?
// 5
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:ZPDelta?
// 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:NZPNum 2
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:NZSCid 1
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:NZConfig C2
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:NZSFoffset?
SOURce1:BB:EUTRa:DL:DRS:CELL1:CSIRs1:NZQoffset M2

// set Tx mode and UL carrier
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M2
SOURce1:BB:EUTRa:DL:USER1:CELL1:TXM M2
SOURce1:BB:EUTRa:DL:USER1:ULCA0:STATe 1

// configure the LAA burst
SOURce1:BB:EUTRa:DL:LAA:CELL1:NUMBursts 1
SOURce1:BB:EUTRa:DL:LAA:CEINdex SC1
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:STSFrame 5
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:STSLot SEC
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:DURation 3
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:LSFSymbols SY11
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:C1Mode N1N
SOURce1:BB:EUTRa:DL:LAA:CELL1:BURSt0:EPDCch F2
// configure the DCI format 1C
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:SITem 0
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:USER CCRNti
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:UEID?
// 65532

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIFmt?
// F1C
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:SESPace?
// COMM
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:CELL 1
```

```
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PDCChtype?
// PDCC
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PFMT 2
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIConf:LAASubframe 1
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIConf:BITData?
// "000 1000 0000 0000"

// generate a waveform and save the configuration
SOURce1:FREQuency:CW 2143000000
SOURce1:BB:EUTRa:SLENgth 40
SOURce1:BB:EUTRa:STATe 1
SOURce1:BB:EUTRa:WAVeform:CREate "/var/user/laa.wv"
SOURce1:BB:EUTRa:SETTing:STORe "/var/user/LAA"
```

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:STATe 597
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PERiodicity 598
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:OFFSet 598
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:DURation 598
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PATTern 598
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CDSTate 599
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum 599
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum 599
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZP 599
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPI 600
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPT? 600
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPDelta? 601
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSCid 601
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZConfig 602
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSFoffset 602
[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZQoffset 602
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CEINdex 603
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:NUMBursts 603
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSFrame 603
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSLot 604
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:DURation 604
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:ENSFrame? 604
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:LSFSymbols 605
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:C1Mode 605
[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:EPDCch 605
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:LAASubframe 605

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:STATe <DrsState>

Enables the selected DRS occasion configuration.

Parameters:

<DrsState> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "State" on page 115

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PERiodicity <DrsPeriodicity>

Sets the DRS periodictity.

Parameters:

<DrsPeriodicity> P40 | P80 | P160

*RST: P40

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Periodicity" on page 115

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:OFFSet <DrsOffset>

Offsets the DRS start within the DRS occasion.

Parameters:

<DrsOffset> integer

Range: 0 to 159
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Offset" on page 115

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:DURation <DrsDuration>

Sets the DRS duration.

Parameters:

<DrsDuration> DUR1 | DUR2 | DUR3 | DUR4 | DUR5

DUR1
For LAA SCells, the DRS is always 1 ms long

DUR2|DUR3|DUR4|DUR5
In FDD mode, sets duration of 2 ms to 5 ms

*RST: DUR1

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Duration" on page 116

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:PATTern

Defines the subframes in that DRS is transmitted for up to 20 DRS occasions.

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Pattern" on page 116

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CDSTate <CsiRsState>

Enables defining the CSI-RS part of the DRS.

Parameters:
<CsiRsState> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "CSI-RS Part of DRS" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum <NumZeroPwrConf>

Enables up to 5 ZeroTxPower CSI-RS within the DRS period.

Parameters:
<NumZeroPwrConf> integer
Range: 0 to 5

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "ZeroTxPower/NonZeroTxPower CSI-RS Structure>Number of CSI-RS Configurations" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum <NumNonZeroPwrCo>

Enables up to 96 NonZeroTxPower CSI-RS within the DRS period.

Parameters:
<NumNonZeroPwrCo> integer
Range: 0 to 96

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "ZeroTxPower/NonZeroTxPower CSI-RS Structure>Number of CSI-RS Configurations" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZP <ZeroPower>

Sets the used CSI-RS configurations in the zero transmission power subframes.

Suffix:
<st> 1 to 5
Selects the zero-power CSI reference signal (ZeroTxPower CSI-RS)
Value range depends on the value set with the command [:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum

Parameters:
<ZeroPower> integer
In the user interface, the 16 bits are set as a hexadecimal value. In the remote control, as a decimal value.
Range: 0 to 16 bit

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "ZeroPower CSI-RS" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPI <SfConfig>

Sets the parameter I_{CSI-RS}.

Suffix:
<st> 1 to 5
Selects the zero-power CSI reference signal (ZeroTxPower CSI-RS)
Value range depends on the value set with the command [:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum

Parameters:
<SfConfig> integer
Range: 0 to 154

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Subframe Config (I_CSI-RS)" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPT?

Queries the subframe configuration period T_{CSI-RS} value.

Suffix:
<st> 1 to 5
Selects the zero-power CSI reference signal (ZeroTxPower CSI-RS)
Value range depends on the value set with the command [:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum

Return values:
<Periodicity> integer
Range: 5 to 80

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Usage: Query only

Manual operation: See "Periodicity (T_CSI-RS)" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:ZPDelta?

Queries the subframe offset $\Delta_{CSI\text{-}RS}$ value.

Suffix:

<st> 1 to 5
Selects the zero-power CSI reference signal (ZeroTxPower CSI-RS)
Value range depends on the value set with the command `[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:ZPNum`

Return values:

<SFOffset> integer
Range: 0 to 80

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Usage: Query only

Manual operation: See "Subframe Offset (Delta_CSI-RS)" on page 117

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSCid
<ScramblingId>

Sets the individual scrambling identity of the NonZeroTxPower CSI-RS.

Suffix:

<st> 1 to 96
Selects the non-zero-power CSI reference signal (NonZeroTx-Power CSI-RS).
Value range depends on the value set with the command `[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum`

Parameters:

<ScramblingId> integer
Range: 0 to 503
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Scrambling Identity (n_ID)" on page 118

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZConfig
<NonZeroPwrConf>

Sets the CSI-RS configuration.

Suffix:
<st> 1 to 96
Selects the non-zero-power CSI reference signal (NonZeroTx-Power CSI-RS)
Value range depends on the value set with the command `[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum`

Parameters:
<NonZeroPwrConf> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31
Values outside the permitted discrete values are rounded down.
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "CSI-RS Configuration" on page 118

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZSFoffset
<NonZeroPSfOffs>

Queries the subframe offset between the SSS and the CSI-RS in a DRS.

Suffix:
<st> 1 to 96
Selects the non-zero-power CSI reference signal (NonZeroTx-Power CSI-RS).
Value range depends on the value set with the command `[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum`

Parameters:
<NonZeroPSfOffs> integer
Range: 0 to 4

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Subframe Offset with SSS" on page 118

[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:CSIRs<st>:NZQoffset
<NonZeroPQOffs>

Sets the Q-offset.

Suffix:
<st> 1 to 96
Selects the non-zero-power CSI reference signal (NonZeroTx-Power CSI-RS)
Value range depends on the value set with the command `[:SOURce<hw>]:BB:EUTRa:DL:DRS:CELL<ch0>:NZPNum`

Parameters:
<NonZeroPQOffs> -24 | -22 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24
Positive values outside the permitted discrete values are rounded down; negative values are rounded up.
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Q-Offset" on page 118

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CEINdex <CellIndex>

Selects the LAA SCell for that the LAA is configured.

Parameters:
<CellIndex> SC1 | SC2 | SC3 | SC4 | NONE
*RST: SC1

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "LAA Cell" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:NUMBursts <NumberOfBursts>

Set the number of LAA bursts.

Parameters:
<NumberOfBursts> integer
Range: 0 to 10
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Number of LAA Bursts" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSFrame <StartingSF>

Sets the first subframe of the LAA bust.

Parameters:
<StartingSF> integer
Range: 0 to 39
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Starting Subframe" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:STSLot
<StartingSlots>

Sets the starting slot.

Parameters:
<StartingSlots> FIRSt | SECond

FIRSt
s0: first slot of a subframe

SECond
s7: second slot of a subframe

*RST: FIRSt

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Starting Symbol" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:DURation
<Duration>

Sets the duration of the LAA burst.

Parameters:
<Duration> integer
Range: 1 to 10
*RST: 10

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Burst Duration (ms)" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:ENSFrame?

Queries the number of the last subframe of the LAA burst.

Return values:
<EndingSubframe> integer
Range: 0 to 39
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Usage: Query only

Manual operation: See "Ending Subframe" on page 140

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:LSFSymbols <LastSFSymb>

Sets the number of OFDM symbols in the last subframe of the LAA burst.

Parameters:

<LastSFSymb> SY3 | SY6 | SY9 | SY10 | SY11 | SY12 | SY14

*RST: SY14

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "Number of Ending Symbols" on page 139

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:C1Mode <DCI1CMode>

Defines how the DCI format 1C is sent.

Parameters:

<DCI1CMode> MANual | N1 | N | N1N

*RST: N1N

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "LAA DCI 1C Mode" on page 140

[:SOURce<hw>]:BB:EUTRa:DL:LAA:CELL<ch0>:BURSt<st0>:EPDCch <EpdcchFormat>

Sets the (E)PDCCH format.

Parameters:

<EpdcchFormat> F2 | F3

*RST: F2

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "(E)PDCCH Format" on page 140

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:LAASubframe <DciLaaConf>

Sets the DCI format 1C field subframe configuration for LAA.

Parameters:

<DciLaaConf> integer

Range: 0 to 15
*RST: 0

Example: See Example "Enabing a LAA SCell and configuring of one LAA burst" on page 595.

Manual operation: See "DCI Format 1C for LAA" on page 190

9.15 Enhanced PBCH, PDSCH, PMCH

[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB....606
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset....607
[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MSPare....607
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW....607
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize....608
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex....608
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe....608
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize....609
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP....609
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM....610
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex[<dir>]....610
[:SOURce<hw>]:BB:EUTRa:DL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBUA....610
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD....611
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat....611
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers....612
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme....612
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID....612
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme....613
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe....613
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID....613

[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB <State>

Enables transmission of real MIB data.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: ON

Example:
```
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:CONType?
// PBCH
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:PBCH:MIB 1
SOURce1:BB:EUTRa:DL:PBCH:SOFFset 0
SOURce1:BB:EUTRa:DL:PBCH:SRPeriod PERS
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:CCODing:TBSize 24
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:PHYSbits?
// 480
SOURce1:BB:EUTRa:DL:PBCH:MSPare #H001,10
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc0:CW1:STATe 1
```

Manual operation: See "MIB (including SFN)" on page 158

[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset <SfnOffset>

Sets an offset for the start value of the SFN (System Frame Number).

Parameters:

<SfnOffset> integer

Range: 0 to 1020
Increment: 4
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 606

Manual operation: See "SFN Offset" on page 159

[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MSPare <MibSpareBits>

Sets the 10 spare bits in the PBCH transmission.

Parameters:

<MibSpareBits> 64 bit

*RST: #H0,1

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB` on page 606

Manual operation: See "MIB Spare Bits" on page 159

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CAW <DlCsiAware>

Determines the way the PDSCH is processed.

Parameters:

<DlCsiAware> OFF | ON | 1 | 0

*RST: OFF

Example: See Example "Enabling a CSI-RS transmission" on page 588

Manual operation: See "CSI Awareness" on page 156

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize <SoftBufSize>

Sets the size of the IR soft buffer.

Parameters:

<SoftBufSize> integer

Range: 800 to 3667200
*RST: 3667200

Example:

```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:ISBS 1600
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:ISBS?
Response: 1600
```

Manual operation: See "IR Soft Buffer Size (PDSCH)" on page 159

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex <RedundVersIndex>

Sets the redundancy version index.

Parameters:

<RedundVersIndex> integer

Range: 0 to 3
*RST: 0

Example:

```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:RVIN 2
```

Sets the redundancy version index to 2

Manual operation: See "Redundancy Version Index (PDSCH)" on page 159

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe <State>

Enables/disables channel coding for the selected allocation and codeword.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example:

```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:STAT OFF
```

Manual operation: See "State Channel Coding (DL)" on page 158

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize <TranspBlockSize>

Sets the size of the transport block.

Note: The parameter depends on the content type and the global MIMO configuration.

Parameters:

<TranspBlockSize> integer

Range: 1 to 1E7
*RST: 1500

Example:
```
BB:EUTR:DL:SUBF9:ALL5:PHYS?
```
Queries the number of physical bits of allocation 5
```
Response: 2400
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TBS 1500
```
Sets the transport block size to of allocation 5 to 1500 bits

Example:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:CCOD:TBS 1000
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:CCOD:TBS?
Response: 1000
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:TBS?
Response: 1500
```

Manual operation: See "Transport Block Size/Payload (DL)" on page 159

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP <AntennaPorts>

Sets the antenna port(s) for the selected transmission mode.

Parameters:

<AntennaPorts> AP7 | AP5 | AP8 | AP78 | AP79 | AP710 | AP711 | AP712 | AP713 | AP714 | AP107 | AP108 | AP109 | AP110 | AP107108 | AP107109 | AP11 | AP13 | AP1113 | AP7 | AP5 | AP8 | AP78 | AP79 | AP710 | AP711 | AP712 | AP713 | AP714 | AP11 | AP13 | AP1113 | AP107 | AP108 | AP109 | AP110 | AP107108 | AP107109

Antenna port or antenna ports combination; the designation AP78 for example means AP7 and AP8

*RST: AP5

Options: R&S SMBV-K84
AP11|AP13|AP1113|AP107|AP108|AP109|AP110|AP107108|AP107109 require R&S SMBV-K119

Manual operation: See "Antenna Ports" on page 154

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM <AntPortMap>

Sets the way that the logical antenna ports are mapped to the physical Tx-antennas.

See Chapter 4.5, "DL Antenna Port Mapping Settings", on page 160.

Parameters:

<AntPortMap> CB | RCB | FW

`CB` = codebook
`RCB` = random codebook
`FW` = fixed weights

*RST: CB

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBCI` on page 689

Options: R&S SMBV-K84

Manual operation: See "Antenna Port Mapping" on page 154

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex[<dir>] <CodeBookIndex>

Sets the codebook index for the selected allocation.

The combination of codebook index and the selected number of layers determines the codebook matrix used for precoding.

Parameters:

<CodeBookIndex> integer

Range: 0 to 15
*RST: 0

Example:

```
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:CONType PDSCh
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:DATA PN16
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW:PRECoding:SCHeme BF
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW:PRECoding:TRSCheme TM9
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW:PRECoding:CBINdex2 0
```

Example: See also `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBCI` on page 689

Manual operation: See "Codebook Index/Codebook Index 2" on page 155

[:SOURce<hw>]:BB:EUTRa:DL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBUA <CbUseAlt>

Applies the enhanced 4 Tx codebook.

Parameters:

<CbUseAlt> 0 | 1 | OFF | ON

OFF
Tthe normal codebook is used.

ON
Applied is the enhanced 4Tx codebook.

*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBUA` on page 689.

Options: R&S SMBV-K113

Manual operation: See "Use Alternative Codebooks" on page 154

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD <CyclicDelayDiv>

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected number of layers determines the precoding parameters for spatial multiplexing.

Parameters:

<CyclicDelayDiv> NOCDd | SMDelay | LADelay

NOCDd
Zero CDD

SMDelay
Small CDD

LADelay
Large CDD

*RST: NOCDd

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CDD SMD`
Selects small CDD

Manual operation: See "Cyclic Delay Diversity" on page 155

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat <DataFormat>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

Parameters:

<DataFormat> CARTesian | CYLindrical

*RST: CARTesian

Manual operation: See "Mapping Coordinates" on page 155

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers <NoLayers>

Sets the number of layers for the selected allocation.

Parameters:

<NoLayers> integer

Range: 1 to 8
*RST: 1

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:NOL 2`
Sets the number of layers to 2

Manual operation: See "Number of Layers" on page 153

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme <Scheme>

(available for the first codeword only)

Selects the precoding scheme.

The available selections depend on the selected content type.

Parameters:

<Scheme> NONE | SPM | TXD | BF

NONE
Disables precoding.

SPM
Spatial multiplexing

TXD
Transmit diversity

BF
Sets the PDSCH to transmission mode selected with the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme`.

*RST: NONE

Example:
```
SOURce1:BB:EUTRa:DL:SUBF4:ALLoc5:CONType PDSCh
SOURce1:BB:EUTRa:DL:SUBF4:ALLac5:CW1:PRECoding:SCHeme SPM
```
Sets the precoding scheme to spatial multiplexing

Manual operation: See "Precoding Scheme" on page 152

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID <ScrambIdentity>

Sets the scrambling identity according to 36.211, sec. 6.10.3.1.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

Parameters:

<ScrambIdentity> integer

Range: 0 to 1
*RST: 0

Manual operation: See "Scrambling Identity n_SCID" on page 154

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCheme <TransmissScheme>

Determines the transmission mode (see also Table 3-6).

Parameters:

<TransmissScheme> TM7 | TM8 | TM9 | TM10

*RST: TM7

Options: TM7|TM8 require R&S SMBV-K84
TM9 requires R&S SMBV-K85

Manual operation: See "Transmission Scheme" on page 152

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe <State>

Enables/disables the bit-level scrambling.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: ON

Example:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA PN9
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT ON
```
Enables scrambling

Example: If a "User 1..4" is selected for the Data Source for the corresponding allocation, this command is query only and the return value corresponds the state determined with the command `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe`.
```
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:USER3:SCR:STAT ON
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
Response: On
```

Manual operation: See "State Scrambling (DL)" on page 157

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID <Ueid>

Sets the user equipment identifier (n_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

Parameters:

<Ueid> integer

Range: 0 to 65535
*RST: 0

Example: `BB:EUTR:DL:SUBF0:ALL5:CW:UEID 120`
Sets the user equipment identifier.

Manual operation: See "UE ID/n_RNTI (PDSCH)" on page 157

9.16 Enhanced PCFICH, PHICH and PDCCH Configuration

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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern ... 624
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSELect ... 624
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource ... 624
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA ... 625
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect ... 625
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern ... 625
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:CONFlicts? ... 627
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:RAHR 642
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:RAType 642
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:RBA 643
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:RV 643
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:SRSRequest 643
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:SWAPflag 644
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:MCS 644
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB2:MCS 644
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:NDI 645
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB2:NDI 645
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:RV 645
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB2:RV 645
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:SID 645
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TPCC 646
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TPCinstr 646
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TPMI 647
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
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DCIConf:VRBA 648

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe <State>

Enables/disables the PDCCH, PCFICH and PHICH allocation.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: ON

Example: `BB:EUTR:DL:SUBF1:ENCC:STAT ON`

Enables PDCCH

Manual operation: See "State" on page 167

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:SCRambling:STATe <State>

Enables/disables the scrambling of the enhanced channels.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: ON

Example:
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:SCRambling:STATe ON
```

Manual operation: See "Scrambling State " on page 168

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme <Scheme>

Selects the precoding scheme for PDCCH.

Parameters:

<Scheme> NONE | TXD

NONE
Disables precoding.

TXD
Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters

*RST: NONE

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PREC:SCH TXD
```
Selects the precoding scheme

Manual operation: See "Precoding Scheme" on page 167

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?

Queries the number of layers for PDCCH.

This value is fixed to 1 for PDCCH.

Return values:

<LayerCount> integer

Range: 1 to 2
*RST: 1

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PREC:NOL?
```
Queries the number of layers
```
Response: 1
```

Usage: Query only

Manual operation: See "Number of Layers (Enhanced Channels)" on page 168

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer <Power>

Sets the power of the PCFICH (P_{PCFICH}).

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PCF:POW -5`
Sets the power of the PCFICH to -5 dBm

Manual operation: See "PCFICH Power" on page 168

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion <ControlRegion>

Sets the number of OFDM Symbols to be used for PDCCH.

Parameters:

<ControlRegion> integer

Range: 1 to 4
*RST: 2

Example: `BB:EUTR:PHIC:DUR NORM`
Selects PHICH normal duration
`BB:EUTR:DL:SUBF1:ENCC:PCF:CREG 1`
Sets the control region

Manual operation: See "Control Region for PDCCH (PCell)" on page 168

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODe <PowerMode>

Determines whether the PHICHs in a PHICH group are sent with the same power or enables the adjustment of each P_{PHICH} individually.

Parameters:

<PowerMode> CONSt | IND

CONSt
The power of a PHICH in a PHICH group is set with the command `SOUR:BB:EUTR:DL:ENCC:PHIC:POW`.

IND
The power of the individual PHICHs is set separatelly

*RST: CONSt

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PHIC:PMOD CONS
BB:EUTR:DL:SUBF1:ENCC:PHIC:POW -5
// All PHICHs in the PHICH group are sent with this power
```

Manual operation: See "Power Mode" on page 170

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer <Power>

Sets the power of one PHICH (P_{PHICH}) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs within this group.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: -3.010

Example:

```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:PMOD CONS
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:NOGR 1
SOUR:BB:EUTR:DL:SUBF2:CYCP NORM
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:ANP1 '1---1---'
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:POW - 3
// Sets the power of one PHICHs in a PHICH group to -3 dB
```

Manual operation: See "PHICH Power" on page 170

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:NOGRoups <GroupCount>

Queries the number of available PHICH groups.

Parameters:

<GroupCount> integer

Range: 0 to dynamic
*RST: 2

Example: See `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:GROup<gr0>:ITEM<user0>:POW` on page 620.

Options: CELL<ccidx> requires R&S SMBV-K112

Manual operation: See "Number of PHICH Groups" on page 169

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:CELL<ch0>:ANPattern<gr0> <AnPattern>

Sets the ACK/NACK pattern for the corresponding PHICH group.

Parameters:

<AnPattern> string

String of 8 values

1
Indicates an ACK

0
Indicates a NACK

-
Indicates DTX

Example: See [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:GROup<gr0>:ITEM<user0>:POW on page 620.

Options: CELL<ch0> requires R&S SMBV-K112

Manual operation: See "ACK/NACK Pattern Group x" on page 170

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh[:CELL<ccidx>]:GROup<gr0>:ITEM<user0>:POW <Power>

Sets the power of the individual PHICHs.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: -3.010

Example:

```
SOURce1:BB:EUTRa:DL:CA:STATe 1
SOURce1:BB:EUTRa:DL:CA:CELL0:PHICh:NGParameter NG1
SOURce1:BB:EUTRa:DL:CA:CELL0:PHICh:DURation NORM

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:PMODe CONS
// sets the power mode
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:POWer -5
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:NOGRoups?
// 7
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:ANPattern0 0-1-11--
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:GROup0:ITEM0:POW -5
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:GROup0:ITEM2:POW -4
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:GROup0:ITEM4:POW -6
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PHICh:CELL0:GROup0:ITEM5:POW 1
// sets the power of the PHICH#6 in the first PHICH group of the PCell
```

Options: CELL<ccidx> requires R&S SMBV-K112

Manual operation: See "Power Settings Config." on page 170

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer <Power>

Sets the power of the PDCCH (P_{PDCCH}).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:POW -5`
Sets the power of the PDCCH to -5dB

Manual operation: See "Power" on page 172

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS <PhysBits>

Defines the number of bits allocated for PDCCH.

Parameters:

<PhysBits> integer

Range: 0 to 1E5
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
Enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:BITS?`
Queries the number of bits
`Response: 3144`

Manual operation: See "Number of PDCCH Bits / REGs / CCEs" on page 172

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs
<AvailRegionCoun>

Defines the number of the REGs that are available for the PDCCH allocation.

Parameters:

<AvailRegionCoun> integer

Range: 0 to 1E5
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
Enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:AVR?`
Queries the number of REGs
`Response: 393`

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes
<AvailCceCount>

Queries the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

Parameters:
<AvailCceCount> integer
Range: 0 to 1E5
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:STAT ON`
Enables PDCCH.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:AVCC?`
Queries the number of CCEs
`Response 43`

Manual operation: See "Number of PDCCH Bits / REGs / CCEs" on page 172

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat <Format>

Sets the PDCCH format.

Parameters:
<Format> VAR | -1 | 0 | 1 | 2 | 3

VAR
Enables full flexibility by the configuration of the downlink control information (DCI) format and content.

-1
Proprietary format for legacy support.

0 | 1 | 2 | 3
One PDCCH is transmitted on one, two, four or eight CCEs

*RST: VAR

Example: `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
Sets the PDCCH format.

Manual operation: See "PDCCH Format" on page 171

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs
<PdcchCount>

Sets the number of PDCCHs to be transmitted.

Parameters:
<PdcchCount> integer
Range: 0 to dynamic
*RST: 0

Example: `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20`
Sets the number of PDCCHs.

Manual operation: See "Number of PDCCHs" on page 173

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs
<AllocRegionCoun>

Defines the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated$_{PDCCH}$).

Parameters:

<AllocRegionCoun> integer

Range: 0 to 1E5
*RST: 0

Example:
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20
```
Sets the number of PDCCHs.
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?
```
Queries the number of REGs
```
Response: 180
```

Manual operation: See "Number of REGs allocated to PDCCH" on page 174

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs
<DummyRegsCount>

Defines the number of REGs that are available for the PDCCH allocation but are not allocated.

Parameters:

<DummyRegsCount> integer

Range: 0 to 1E5
Increment: 1
*RST: 0

Example:
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20
```
Sets the number of PDCCHs.
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?
```
Queries the number of REGs
```
Response: 180
BB:EUTR:DL:SUBF2:ENCC:PDCC:DREG?
```
Queries the number of dummy REGs
```
Response: 213
```

Manual operation: See "Number of Dummy REGs" on page 174

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA <Data>

Selects the data source for PDCCH.

Parameters:

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: `BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PN9`
PN9 is selected as data source

Manual operation: See "Data Source" on page 174

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern <Pattern>, <BitCount>

Selects the bit pattern for the `PATT` selection.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example:
```
BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0
BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PATT
BB:EUTR:DL:SUBF1:ENCC:PDCC:PATT #H3F,8
```

Manual operation: See "Data Source" on page 174

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSELect <Filename>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<Filename> string

Filename incl. file extension or complete file path

Example:
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat 0
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:DATA DLISt
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:DSELect "/var/user/temp/pdcch"
```

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource <TranSource>

Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

Parameters:

<TranSource> DATA | DTX

*RST: DATA

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:TRS DATA`

Manual operation: See "Dummy CCE REGs" on page 175

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA
<Data>

Selects the data source for PDCCH.

Parameters:
<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE
*RST: PN9

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PN9`
PN9 is selected as data source

Manual operation: See "Dummy CCE Data Source" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSELect
<Filename>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:
<Filename> string
Filename incl. file extension or complete file path

Example: `SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VAR`
`SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:DCRegs:DATA DLISt`
`SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:DCRegs:DSELect "/var/user/temp/pdcch`

Manual operation: See "Dummy CCE Data Source" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern
<Pattern>, <BitCount>

Selects the bit pattern for the `PATT` selection.

Parameters:
<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PATT
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:PATT #H3F,8
```

Manual operation: See "Dummy CCE Data Source" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem
<SelectedItem>

Selects an PDCCH item, i.e. a row in the DCI table.

Parameters:

<SelectedItem> integer

Range: 0 to 39
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2
```
Selects the third row in the DCI table

Manual operation: See "Standard configuration functions" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend

Adds a new row at the end of the DCI table.

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:APP
```
Adds a new row

Manual operation: See "Standard configuration functions" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert

Insert a new row before the currently selected item.

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2
```
Selects the third row in the DCI table
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:INS
```
Inserts a new row before the third one

Manual operation: See "Standard configuration functions" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELete

Deletes the selected row.

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
Selects the third row in the DCI table
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:DEL`
Deletes the third row

Usage: Event

Manual operation: See "Standard configuration functions" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP

Moves the selected row down or up.

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`
Selects the third row in the DCI table
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:UP`
Moves the third row one row up

Manual operation: See "Standard configuration functions" on page 176

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:CONFlicts?

Queries the number of conflicts between the DCI formats.

To query whether there is a conflict in one particular PDCCH item, use the command `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?` on page 633.

Return values:
<NoOfConf> integer
Range: 0 to 20
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VARiable
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:CONFlicts?
```
Response: `1`
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:UITems?
```
Response: `2`
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM0:CONFlict?
```
Response: `0`
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:CONFlict?
```
Response: `1`
The DCI conflict is in the second PDCCH item
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:SOLVe
```

Usage: Query only

Manual operation: See "Resolve Conflicts" on page 177
See "Conflict (DCI)" on page 183

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe?

Triggers a built-in algorithm that re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained.

If the conflict cannot be resolved automatically, the values are left unchanged.

Example:
```
:SOURce:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:SOLVe
```

Usage: Query only

Manual operation: See "Resolve Conflicts" on page 177

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet

Resets the table.

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:RES
```
Resets the table

Manual operation: See "Reset" on page 177

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UITems <UsedItems>

Queries the number of used PDCCH items.

Parameters:

<UsedItems> integer

Range: 0 to 20
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VARiable
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:APPend
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:UITems?
```
Response: `2`

Manual operation: See "Number of Used (E)PDCCH Items" on page 177

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt <DciFormat>

Sets the DCI format for the selected PDCCH.

Parameters:

<DciFormat> F0 | F1 | F1A | F1B | F1C | F1D | F2 | F2A | F3 | F3A | F2B | F2C | F2D

*RST: F0

Example:
```
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VARiable
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:DCIFmt F1
```

Manual operation: See "DCI Format" on page 180

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID <Ueid>

Sets the n_RNTI for the selected PDCCH.

Parameters:

<Ueid> integer

Range: 0 to 100000
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:UEID 100
```
Sets the n_RNTI

Manual operation: See "UE_ID/n_RNTI" on page 178

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL <CellIdx>

Determines the component carrier the corresponding DCI is transmitted on.

Parameters:

<CellIdx> integer

Range: 0 to 7
*RST: 0

Options: R&S SMBV-K85

Manual operation: See "Cell Index" on page 178

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT <Format>

Sets the PDCCH format for the selected PDCCH.

Parameters:

<Format> integer

Range: 0 to 3
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets PDCCH format variable.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:PFMT 0`
Sets the PDCCH format.

Manual operation: See "(E)PDCCH Format (Variable)" on page 181

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes?

Queries the number of control channel elements used for the transmission of the PDCCH.

Return values:

<CceCount> integer

Range: 0 to 1E5
*RST: 1

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NCC?`
Queries the number of CCEs

Usage: Query only

Manual operation: See "Number (E)CCEs" on page 182

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINDex <CceIndex>

Sets the CCE start index.

Parameters:

<CceIndex> integer

Range: 0 to 1E5
*RST: 0

Example: `SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VAR`
Sets the PDCCH format.
`SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:CINDex 10`
Sets the CCE start index

Manual operation: See "(E)CCE Index" on page 182

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PDCChtype <PdcchType>

Sets if the DCI is carried by a PDCCH or by an EPDCCH set.

Parameters:

<PdcchType> PDCCh | EPD1 | EPD2

EPD1|EPD2
EPDCCH sets cannot be allocated TDD special subframes, if the combinations listed in Table 4-5 apply.

*RST: PDCCh

Example: `SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM1:PDCChtype?`
See Example "Configuring EPDCCH transmission" on page 698
See also `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HACK` on page 638.

Options: R&S SMBV-K112

Manual operation: See "(E)PDCCH" on page 179

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NDCCes?

Queries the number of dummy CCEs that are appended to the PDCCH.

Return values:

<DummyCceCount> integer

Range: 0 to 1E5
*RST: 25

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NDCC?`
Queries the number of dummy CCEs

Usage: Query only

Manual operation: See "No. Dummy (E)CCEs" on page 182

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER <User>

Selects the User the DCI is dedicated to.

The available DCI Formats depend on the value of this parameter.

Parameters:

<User> USER1 | USER2 | USER3 | USER4 | PRNTi | SIRNti | RARNti | NONE | U1E | U2E | U3E | UE4 | CCNRti

*RST: USER1

Return values:

<User> USER1 | USER2 | USER3 | USER4 | PRNTi | SIRNti | RARNti | NONE | U1SPs | U2SPs | U3SPs | U4SPs | U1E | U2E | U3E | UE4 | CCNRti

Range: USER1 to NONE
*RST: USER1

Example: `SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:USER USER2`
The DCI is dedicated to User 2

Options: U1E|U2E|U3E|UE4 require R&S SMBV-K113
CCNRti requires R&S SMBV-K119

Manual operation: See "User" on page 178

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:SESPace <SearchSpace>

If enabled, this parameter configures the PDCCH DCI to be transmitted within the common or UE-specific search space.

Parameters:

<SearchSpace> OFF | AUTO | COMMon | UE | ON | 0 | 1

COMMon|UE
Common and UE-specific search spaces, as defined in the 3GPP specification

OFF|AUTO
For backwards compatibility only.

*RST: AUTO

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:SESP UE`
The DCI is transmitted within the UE-specific search space.

Manual operation: See "Search Space" on page 180

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?

Indicates a conflict between two DCI formats.

Return values:
<Conflict> 0 | 1 | OFF | ON
*RST: OFF

Example: `SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:CONFlict?`
queries whether there is a conflict or not.

Usage: Query only

Manual operation: See "Conflict (DCI)" on page 183

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:APLayer <ApLayerId>

Sets the DCI Format 2C field antenna port(s), layer, scrambling Id.

Option:R&S SMBV-K119:

Table 9-1: Value range <ApLayerId>

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:DMRS:STATe	[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:SEOL:STATe	1 codeword	2 codewords
0	0	0 to 6	0 to 7
1	0	0 to 11	0 to 14
1	1	0 to 1	0 to 1

Parameters:
<ApLayerId> integer
Range: 0 to 7
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:TXM M9
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:FORMat VARiable
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:DCIFmt F2C
SOURce1:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:ITEM1:DCIConf:APLayer 2
```

Options: <ApLayerId> = 8 to 14 require R&S SMBV-K119

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:BITData?

Queries the resulting bit data as selected with the DCI format parameters.

Return values:
<BitData> string

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:BITD?`
Queries the bit data

Usage: Query only

Manual operation: See "Bit Data" on page 183

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField <CaIndField>

The CIF is present in **each** DCI Format and identifies the component carrier that carries the PDSCH or PUSCH for the particular PDCCH in the cross-carrier approach (see Figure 3-27).

Parameters:
<CaIndField> integer
Range: 0 to 7
*RST: 0

Example:
```
BB:EUTR:DL:CA:STAT ON
BB:EUTR:DL:USER2:CA:STAT ON
BB:EUTR:DL:CA:CELL0:CIF ON
BB:EUTR:DL:ENCC:PDCC:EXTC:ITEM1:DCIC:CIF 1
```

Options: R&S SMBV-K85

Manual operation: See "Carrier Indicator Field (CIF)" on page 179
See "DCI Format 0" on page 184
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode <Format1aMode>

Selects the mode of the DCI format.

Parameters:

<Format1aMode> PDSCh | PRACh

*RST: PDSCh

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:F1AM PRAC`
Sets the mode

Manual operation: See "DCI Format 1A" on page 186

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:PRINdex <PreambleIndex>

(PRACH mode only)

Sets the DCI Format 1A field Preamble index.

Parameters:

<PreambleIndex> integer

Range: 0 to 63
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC`
Sets the mode
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PRAC:PRIN 10`
Sets the preamble index

Manual operation: See "DCI Format 1A" on page 186

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACh:MINDex <MaskIndex>

(PRACH mode only)

Sets the DCI Format 1A field PRACH Mask Index.

Parameters:

<MaskIndex> integer

Range: 0 to 15
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC`
Sets the mode
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PRAC:MIND 10`
Sets the preamble index

Manual operation: See "DCI Format 1A" on page 186

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSIRequest <CsiRequest>

Sets the DCI Format 0 field CSI/CQI Request.

Parameters:
<CsiRequest> integer
Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSIR 1
```

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs <CyclicShftDmRs>

Sets the DCI Format 0 field cyclic shift for DMRS.

Parameters:
<CyclicShftDmRs> integer
Range: 0 to 7
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSDM 1`
Sets the cyclic shift

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex <DlAssignIndex>

(Enabled for TDD mode only)

Sets the DCI Format 0/1A/1B/1D/2/2A field downlink assignment index.

Parameters:

<DlAssignIndex> integer

Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:DUPL TDD
```
Selects TDD mode.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DLA 1
```
Sets the downlink assignment index

Manual operation: See "DCI Format 0" on page 184
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOFfset <DpOffset>

Sets the DCI Format 1D field downlink power offset.

Parameters:

<DpOffset> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1D
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DPOF ON
```
Enables downlink power offset

Manual operation: See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP <Gap>

Sets the DCI Format 1A/1B/1C/1D field GAP value.

Parameters:
<Gap> ON | OFF
*RST: OFF

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1C`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:GAP ON`
Enables gap value

Manual operation: See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1C" on page 189
See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN <HarqProcessNumb>

Sets the DCI Format 1/1A/1B/1D/2/2A field HARQ process number.

Parameters:
<HarqProcessNumb> integer
Range: 0 to 15
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:HPN 5`
Sets the HARQ process number

Manual operation: See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HACK <HarqAck>

Sets the DCI Format 2C/2D field HARQ-ACK resource offset.

Parameters:
<HarqAck> integer
Range: 0 to 3
*RST: 0

Example:
```
SCONfiguration:APPLy
SCONfiguration:MODE ADV
SCONfiguration:FADing MIMO4X4
SCONfiguration:BASeband:SOURce COUP
SCONfiguration:APPLy

SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M10

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:SITem 0
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PDCChtype EPD1
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIFmt F2D
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIConf:PDRE 0

SOURce1:BB:EUTRa:DL:USER1:EPDCch1:STAT 1
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIConf:HACK 1
```

Options: R&S SMBV-K112

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR <Mcsr>

Sets the DCI formats 1/1B/1D/2/2A/2B/2C/2D field modulation and coding scheme.

Parameters:

<Mcsr> integer

Range: 0 to depends on the installed options
*RST: 0
Option: R&S SMBV-K55
max = 31
Option: R&S SMBV-K119
max = 63
Values 32 to 63 available if `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:MCS` T4.

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:MCSR 5
```

Options: Values 32 to 63 require R&S SMBV-K119

Manual operation: See "DCI Format 0" on page 184
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1C" on page 189
See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI <NewDataIndicat>

Sets the DCI Format 0/1/1A/1B/1D field New Data Indicator.

Parameters:

<NewDataIndicat> ON | OFF

*RST: OFF

Example:

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```

Sets the PDCCH format.

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
```

Sets the DCI format

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:NDI ON
```

Sets the New Data Indicator

Manual operation: See "DCI Format 0" on page 184
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PDRE <PdschRe>

Sets the DCI Format 2D field PDSCH RE mapping and QCL indicator.

Parameters:

<PdschRe> integer

Range: 0 to 3

*RST: 0

Example:

```
SCONfiguration:APPLy
SCONfiguration:MODE ADV
SCONfiguration:FADing MIMO4X4
SCONfiguration:BASeband:SOURce COUP
SCONfiguration:APPLy

SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M10
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:SITem 0
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIFmt F2D
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIConf:PDRE 0
```

Options: R&S SMBV-K112

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping <FreqHopState>

Sets the DCI Format 0 field PUSCH Frequency Hopping.

Parameters:

<FreqHopState> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PFH ON`
Enables PUSCH Frequency Hopping

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI <PmiState>

Sets the DCI Format 1B field PMI Confirmation for Precoding.

Parameters:

<PmiState> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PMI ON
```

Manual operation: See "DCI Format 1B" on page 188

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRECinfo <PrecodingInfo>

Sets the DCI Format 2/2A field Precoding Information.

Parameters:

<PrecodingInfo> integer

Range: 0 to 63
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PREC 10`
Sets Precoding Information

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH <ResAllocHeader>

(Enabled for Channel Bandwidth > 10RBs)

Sets the DCI Format 1/2/2A field Resource Allocation Header.

Parameters:

<ResAllocHeader> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAH ON
```

Manual operation: See "DCI Format 1" on page 185
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR <Rahr>

Sets the DCI Format 0 field Resource Block Assignment and Hopping Resource Allocation.

Parameters:

<Rahr> integer

Range: 0 to dynamic
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAHR 100
```
Sets Resource Block Assignment and Hopping Resource Allocation

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAType <ResAllocType>

Sets the DCI Format 0 field Resource Allocation Type.

Parameters:

<ResAllocType> integer

Range: 0 to 1
*RST: 0

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA <ResBlockAssign>

Sets the DCI Format 0/1/1A/1B/1C/1D/2/2A field Resource Block Assignment.

Parameters:

<ResBlockAssign> integer

Range: 0 to 268435455
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RBA 100
```
Sets Resource Block Assignment

Manual operation:
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1C" on page 189
See "DCI Format 1D" on page 191
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV <RedundVersion>

Sets the DCI Format 1/1A/1B/1D field Redundancy Version.

Parameters:

<RedundVersion> integer

Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RV 1
```
Sets the Redundancy Version

Manual operation:
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SRSRequest <SrsRequest>

Sets the SRS Request filed.

Parameters:
<SrsRequest> integer
Range: 0 to 1
*RST: 0

Manual operation: See "DCI Format 0" on page 184
See "DCI Format 1A" on page 186
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SWAPflag <SwapFlag>

Sets the DCI Format 2/2A field Transport Block to Codeword Swap Flag.

Parameters:
<SwapFlag> ON | OFF
*RST: OFF

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SWAP ON`
Enables Transport Block to Codeword Swap Flag

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:MCS <Mcs>
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:MCS <Mcs>

Sets the DCI Format 2/2A field Modulation and Coding Scheme.

Parameters:
<Mcs> integer
Range: 0 to 31
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:MCS 5`
Sets the Modulation and Coding Scheme for TB1

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:NDI <NewDataIndicat>
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI <NewDataIndicat>

Sets the DCI Format 2/2A field New Data Indicator.

Parameters:
<NewDataIndicat> ON | OFF
*RST: OFF

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB2:NDI ON
```
Sets the New Data Indicator for TB2

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:RV <RedundVersion>
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:RV <RedundVersion>

Sets the DCI Format 2/2A field Redundancy Version.

Parameters:
<RedundVersion> integer
Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:RV 1
```
Sets the Redundancy Version for TB1

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SID <ScramIdent>

Enables/disables the DCI Format 2B field Scrambling Identity.

Parameters:
<ScramIdent> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2B`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SID ON`
Enables the Scrambling Identity

Options: R&S SMx/AMU-K84/-K284

Manual operation: See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC <TpcCommand>

Sets the DCI Format 0/1/1A/1B/1D/2/2A field TPC Command for PUSCH.

Parameters:
<TpcCommand> integer
Range: 0 to 3
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPCC 1`
Sets the TPC Command for PUSCH

Manual operation: See "DCI Format 0" on page 184
See "DCI Format 1" on page 185
See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191
See "DCI Format 2/2A/2B/2C/2D" on page 192

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCinstr <TpcCommand>

Sets the DCI Format 3/3A field TPC Command.

Parameters:
<TpcCommand> bit pattern
The bit pattern length depends on the selected channel bandwidth and is automatically adjusted

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F3`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPC #B101,3`
Sets the TPC Command

Manual operation: See "DCI Format 3/3A" on page 195

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI <Tpmi>

Sets the DCI Format 1B/1D field TPMI Information for Precoding.

Parameters:

<Tpmi> integer

Range: 0 to 15
*RST: 0

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPMI 10`
Sets the TPMI Information for Precoding

Manual operation: See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULINdex <ULIndex>

(Enabled for TDD mode and UL/DL Configuration 0)

Sets the DCI Format 1B/1D field UL Index.

Parameters:

<ULIndex> integer

Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:DUPL TDD
```
Selects TDD mode.
```
BB:EUTR:TDD:UDC 0
```
Sets the UL/DL configuration
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
```
Sets the PDCCH format.
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
```
Sets the DCI format
```
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:ULIN
1
```
Sets the UL Index

Manual operation: See "DCI Format 0" on page 184

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULDLconf <DciUlDlConf>

Sets the UL/DL configuration numbers.

Each UL/DL configuration number consists of 3 bits and indicates one of the configurations listed in Figure 3-5.

Parameters:
<DciUlDlConf> 64 bits

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:LINK DOWN

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:USER U1E
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:SESPace AUTO
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIFmt?
//  F1C
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM1:DCIConf:ULDL #H3AF,12
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PFMT 2
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:CINDex 0
```

Options: R&S SMBV-K113

Manual operation: See "DCI Format 1C for eIMTA" on page 189

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA <VrbAssignState>

Sets the DCI Format 1A/1B/1D field Localized/Distributed VRB Assignment.

Parameters:
<VrbAssignState> ON | OFF
*RST: OFF

Example: `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`
Sets the PDCCH format.
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B`
Sets the DCI format
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:VRBA ON`
Enables the Localized VRB Assignment

Manual operation: See "DCI Format 1A" on page 186
See "DCI Format 1B" on page 188
See "DCI Format 1D" on page 191

9.17 Auto Sequence

Option: R&S SMBV-K112

Example: How to enable and configure the auto sequence mode

```
SOURce1:BB:EUTRa:DL:CONF:MODE ASEQ
SOURce1:BB:EUTRa:DL:CA:CELL0:CIF 1
SOURce1:BB:EUTRa:DL:CA:CELL1:CIF 1
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M10
SOURce1:BB:EUTRa:DL:USER1:CELL1:TXM M9
SOURce1:BB:EUTRa:DL:USER2:CELL0:TXM M7
SOURce1:BB:EUTRa:DL:USER2:CELL1:TXM M7

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM1:DCIFmt F2D

SOURce1:BB:EUTRa:DL:USER1:STATe 1
SOURce1:BB:EUTRa:DL:USER2:STATe 1

SOURce1:BB:EUTRa:DL:USER1:AS:DL:AFSeq 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:NHIDs 8
SOURce1:BB:EUTRa:DL:USER1:AS:DL:NHTRans 4
SOURce1:BB:EUTRa:DL:USER1:AS:DL:INDI 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:SKPRocess 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:USUBframe0 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:USUBframe1 1
SOURce1:BB:EUTRa:DL:USER1:AS:UL:AFSeq 1
SOURce1:BB:EUTRa:DL:USER1:AS:UL:NHTRans 4
SOURce1:BB:EUTRa:DL:USER1:AS:UL:INDI 1
SOURce1:BB:EUTRa:DL:USER1:AS:APPLy
SOURce1:BB:EUTRa:DL:USER1:AS:ARBLen?
// 32
SOURce1:BB:EUTRa:DL:USER1:AS:ASLength

SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SLENgth?
// 320
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:MCSMode FIX
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:FMCS 30
```

```
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:RVCSequence "0,1,2,3"
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem0:SUBFrame?
// 0
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem0:HARQ?
// 0
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem0:TB1:NDI?
// 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem1:TB1:NDI?
// 1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem0:TB1:RV?
// 0
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:URLCounter?
// 0

SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SEQelem0:PDRE?
// 0

SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SLENgth?
// 320
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:VULTxpow 1
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SEQelem2:SUBFrame?
// 2
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SEQelem2:RBA?
// 0
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SEQelem2:NDI?
// 1
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SEQelem2:PTPC 2
SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL0:SEQelem2:CONFlict?
// 0

SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL1:MCSMode TCR
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL1:TCR 0.333
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL1:TMOD QAM64
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL1:SELement 2
```

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ARBLen? 651
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ASLength 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:AFSeq 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:AFSeq 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHIDs 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHTRans 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:NHTRans 652
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:SKPRocess 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:INDI 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:INDI 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL[:CELL<ccidx>]:USUBframe<dir0> 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:APPLy 653
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:MCSMode 654
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:FMCS 654
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TCR 654
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TMOD 654
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RVCSequence 655

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:HARQ..... 655
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:PDRE.....655
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SLENgth?.....656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SLENgth?.....656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:
SUBFrame.....656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:
SUBFrame.....656
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:MCS....657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:MCS....657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:NDI..... 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:NDI..... 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:NDI..... 657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:
RLCCounter.....657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:
RLCCounter.....657
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:RV..... 658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:RV..... 658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:CONFlict?...658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:CONFlict?...658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:URLCounter.....658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:RBA..... 658
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:PTPC..... 659
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:ULINdex..... 659
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:VULTxpow..... 659
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SELement.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:APPend.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:APPend.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:INSert.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:INSert.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:DELete.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:DELete.....660
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:RESet..... 661
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RESet..... 661

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ARBLen?

Queries the suggested ARB sequence length.

Return values:

<SugArbLen> integer

Range: 1 to 1E4
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Usage: Query only

Manual operation: See "ARB Sequence Length > Suggested, Adjust Length" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:ASLength

Adjusts the ARB sequence length.

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Usage: Event

Manual operation: See "ARB Sequence Length > Suggested, Adjust Length" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:AFSeq <AutofillSeq>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:AFSeq <AutofillSeq>

Enables the automatic configuration of the DCIs.

Parameters:
<AutofillSeq> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Autofill DL/UL Sequence" on page 128

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHIDs <NumHARQIds>

Sets the number of HARQ process IDs.

Parameters:
<NumHARQIds> integer
Range: 1 to 15
*RST: 8

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Number of HARQ Process IDs" on page 128

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:NHTRans <NumHARQTrans>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:NHTRans <NumHARQTrans>

Sets the number of HARQ transmissions.

Parameters:
<NumHARQTrans> integer
Range: 1 to 32
*RST: 4

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Number of HARQ Transmissions" on page 128

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:SKPRocess <SkipProc>

Skips HARQ process at unused subframes.

Parameters:

<SkipProc> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Skip Process at Unused Subframes" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:INDI <StartingNDI>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:INDI <StartingNDI>

Sets the new data indicator flag at the beginning of the sequence.

Parameters:

<StartingNDI> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Initial NDI" on page 128

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL[:CELL<ccidx>]:
USUBframe<dir0> <UseSubfr>

Sets the downlink subframes to be used for the HARQ transmission.

Suffix:

<dir0> 0 to 9
DL subframe number

Parameters:

<UseSubfr> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Subframes to Use:" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:APPLy

Applies the selected auto sequence settings.

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Usage: Event

Manual operation: See "Apply" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:MCSMode
<McsMode>

Sets how the Modulation and Coding Scheme is configured.

Parameters:

<McsMode> MANual | FIXed | TCR
*RST: TCR

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "MCS Mode" on page 129

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:FMCS <FixedMcs>

Sets the MCS value.

Parameters:

<FixedMcs> integer
Range: 0 to 31
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "MCS" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TCR <TargetCR>

Sets the target code rate.

Parameters:

<TargetCR> float
Range: 0 to 1
Increment: 0.001
*RST: 0.333

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Target Code Rate, Target Modulation" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:TMOD <TargetMod>

Sets the target moduilation.

Parameters:

<TargetMod> QPSK | QAM16 | QAM64 | QAM256

*RST: QPSK

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Options: QAM256 requires R&S SMBV-K113

Manual operation: See "Target Code Rate, Target Modulation" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RVCSequence <RVCodingSeq>

Sets the redundancy version sequence.

Parameters:

<RVCodingSeq> string

Up to 30 comma-separated values

Range: 0 to 3 (for each value in the sequence)
*RST: "0,1,2,3"

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "RV coding Sequence" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:HARQ <HARQProc>

Sets the HARQ process.

Parameters:

<HARQProc> integer

Range: 0 to 15
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "DL DCI Sequence Table" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:PDRE <ReMapQCL>

Sets the PDSCH RE mapping and QCL (quasi-co-location) indicator.

See also `[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PDRE` on page 640

Parameters:
<ReMapQCL> integer
Range: 0 to 3
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Options: R&S SMBV-K112

Manual operation: See "DL DCI Sequence Table" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SLENgth?
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SLENgth?

Queries the sequence length as number of subframes.

Return values:
<ULSeqLength> integer
Range: 0 to max
*RST: 0
Default unit: Subframes

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Usage: Query only

Manual operation: See "DL DCI Sequence Table" on page 130
See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:
SUBFrame <DLSubfrNo>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:
SUBFrame <ASeqSubfrNo>

Sets the subframe number.

Parameters:
<ASeqSubfrNo> integer
Range: 0 to max
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:MCS <DlMcs>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:MCS <DlMcs>

Sets the MCS.

Parameters:

<DlMcs> integer

Range: 0 to 31
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:NDI <DlNdi>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:NDI <DlNdi>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:NDI <UlNDI>

Enables the new data indicator flag.

Parameters:

<UlNDI> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:RLCCounter <RLCCounter>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:RLCCounter <RLCCounter>

Sets the RLC counter.

Parameters:

<RLCCounter> integer

Range: 0 to 31
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB1:RV <DIRV>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:TB2:RV <DIRV>

Sets the redundancy version.

Parameters:

<DIRV> integer
Range: 0 to 3
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SEQelem<dir0>:CONFlict?
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:CONFlict?

Queries if there is conflict.

Return values:

<UlSeqConflict> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Usage: Query only

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:URLCounter <UseRLCCounter>

Enables/disables the use of RLC counter.

Parameters:

<UseRLCCounter> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Use RLC Counter" on page 130

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:RBA <UlRBA>

Sets the UL RBA.

Parameters:

<UlRBA> integer

Range: 0 to 2047
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:PTPC <PuschTpc>

Sets the PUSCH TPC.

Parameters:

<PuschTpc> integer

Range: 0 to 3
*RST: 0

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SEQelem<dir0>:ULINdex <UlIndex>

In TDD mode and with "UL/DL Configuration = 0", sets the parameter UL Index.

Parameters:

<UlIndex> integer

Range: 0 to 3
*RST: 0

Example:

```
:SOURce1:BB:EUTRa:TDD:UDConf 0
:SOURce1:BB:EUTRa:DL:USER1:AS:UL:CELL1:SEQelem1:ULINdex 0
```

Manual operation: See "UL DCI Sequence Table" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:VULTxpow <VaryULTxPow>

Enables variation of the UL Tx power.

Parameters:

<VaryULTxPow> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "How to enable and configure the auto sequence mode" on page 649

Manual operation: See "Vary UL TX Power and RBA" on page 131

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:SELement
<SelElem>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement
<SelElem>

Selects a table element (i.e. table row).

Parameters:

<SelElem> integer
Range: 0 to 1499
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:APPend
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SELement
1
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:INSert
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:SELement
3
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:DELete
SOURce1:BB:EUTRa:DL:USER1:AS:DL:CELL0:RESet
```

Manual operation: See "Append, Insert, Delete, Reset" on page 132

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:APPend
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:APPend

Appends a table element at the end of the table.

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement` on page 660

Usage: Event

Manual operation: See "Append, Insert, Delete, Reset" on page 132

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:INSert
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:INSert

Inserts a table element before the selected one.

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement` on page 660

Usage: Event

Manual operation: See "Append, Insert, Delete, Reset" on page 132

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:DELete
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:DELete

Deletes the selected table element.

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement` on page 660

Usage: Event

Manual operation: See "Append, Insert, Delete, Reset" on page 132

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:UL:CELL<st0>:RESet
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:RESet

Resets the DCI table, i.e. removes all table elements.

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:AS:DL:CELL<st0>:SELement` on page 660

Usage: Event

Manual operation: See "Append, Insert, Delete, Reset" on page 132

9.18 UL Frame Configuration

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh....662
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh....662
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix....662
[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame....662
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType....663
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>][:PUSCh]:MODulation....663
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:PUCCh]:FORMat....663
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount....664
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?....664
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount....664
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset....664
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset....664
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?....665
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<gr>:RBOFfset?....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PHYSbits?....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?....665
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:PHYSbits?....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer....665
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer....665
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe....666
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe....666
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe....666

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?.....666
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?.....666
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:
CONFlict?.....666

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh <ConfSubf>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh <ConfSubframes>

Sets the number of configurable subframes.

Parameters:

<ConfSubframes> integer

Range: 1 to 40
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:ID 100
SOURce1:BB:EUTRa:UL:UE2:ID 100
SOURce1:BB:EUTRa:UL:UE1:CONSubframes:PUCCh 10
SOURce1:BB:EUTRa:UL:UE1:CONSubframes:PUSCh 10
SOURce1:BB:EUTRa:UL:UE2:CONSubframes:PUCCh 8
SOURce1:BB:EUTRa:UL:UE2:CONSubframes:PUSCh 8
```

Manual operation: See "Number Of PUCCH/PUSCH Configurations/Number Of Configurable Subframes" on page 229

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix <CyclicPrefix>

If `BB:EUTR:UL:CPC USER`, sets the cyclic prefix for the selected subframe.

Parameters:

<CyclicPrefix> NORMal | EXTended

*RST: NORMal

Example:
```
BB:EUTR:UL:CPC USER
BB:EUTR:UL:SUBF6:CYCP NORM
```
A normal prefix is used in subframe 6 in uplink.

Manual operation: See "Cyclic Prefix (UL)" on page 231

[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame

Resets all subframe settings of the selected link direction to the default values.

Example:
```
BB:EUTR:UL:RSTF
```
Resets the uplink subframe parameters of path A to the default settings.

Manual operation: See "Reset All Subframes" on page 232

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType <ContentType>

Selects the content type for the selected allocation.

Parameters:

<ContentType> PUSCh | PUCCh | EMTC | NIOT
*RST: PUSCh

Example:
```
BB:EUTR:UL:SUBF4:ALL2:CONT PUSC
```

Options: EMTC|NIOT require R&S SMBV-K115

Manual operation: See "Content (UL)" on page 232
See " UE/Content Type " on page 292

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>][:PUSCh]:MODulation <Modulation>

Selects the modulation scheme for the allocation.

Suffix:

<cwid> 1..2
Codeword

Parameters:

<Modulation> QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease R10
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:CONType PUSCh
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:CODWords 1
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:CW1:MODulation QPSK
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PHYSbits?
```

Options: QAM256 requires R&S SMBV-K119

Manual operation: See "Modulation/Format" on page 233

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:PUCCh]:FORMat <Format>

Sets the PUCCH Format.

Parameters:

<Format> F1 | F1A | F1B | F2 | F2A | F2B | F3 | F4 | F5
*RST: F1

Example:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUCC
SOUR:BB:EUTR:UL:SUBF4:ALL2:FORM F2A
```

Options: F4|F5 require R&S SMBV-K119

Manual operation: See "Modulation/Format" on page 233
See "PUCCH Format" on page 301

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount <ResBlockCount>
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount <NumberOfRBs>

Sets the size of the selected allocation in resource blocks (per slot).

Suffix:
<user> 1..2
Set

Parameters:
<NumberOfRBs> integer
Range: 0 to 110
*RST: 0

Example:
```
BB:EUTR:UL:UE1:REL R89
BB:EUTR:UL:SUBF0:ALL1:RBC 3
```

Example:
```
BB:EUTR:UL:UE2:REL R10
BB:EUTR:UL:SUBF0:ALL2:PUCC:RBC?
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:RBC 4
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:RBC 3
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:VRB 15
```

Manual operation: See "Set 1/Set 2 No. RB" on page 234

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset <VrbOffset>
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBoffset <NumberOfVRBs>

Sets the virtual resource block offset of the selected subframe.

Suffix:
<user> 1..2

Parameters:
<NumberOfVRBs> integer
Range: 0 to 49
*RST: 0

Example:
```
BB:EUTR:UL:SUBF0:ALL1:VRB 6
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5
BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 15
```

Manual operation: See "Set 1/Set 2 Offset VRB" on page 235

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFfset?
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFfset?
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<gr>:RBOFfset?

Queries the start resource block of the selected allocation in slot n of the subframe.

Suffix:
<user0> 0..1

<s2us> 1..2

Return values:
<RbOffs> integer

Range: 0 to 49
*RST: 2

Usage: Query only

Manual operation: See "Offset PRB Slot (n/n+1)" on page 236

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PHYSbits?
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:PHYSbits?

Queries the number of physical bits for the selected allocation.

Suffix:
<cwid> 1..2
Codeword

Return values:
<PuscPhysBits> integer

Range: -1 to 105600
*RST: -1

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:CW1:PUSCh:PHYSbits?
```

Usage: Query only

Manual operation: See " Phys. Bits / Total Number of Physical Bits " on page 236

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer <Power>
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer <PuccPower>
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer <PuscPower>

Sets the power for the selected allocation.

Parameters:

<PuscPower> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example:

```
BB:EUTR:UL:SUBF4:ALL1:POW 3.00
BB:EUTR:UL:SUBF4:ALL2:PUSC:POW -1.00
BB:EUTR:UL:SUBF4:ALL2:PUCC:POW -1.00
```

Manual operation: See "Power (UL)" on page 236

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe <State>
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe <PuccState>
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe <PuscState>

Sets the allocation state to active or inactive.

Note: Disabling an allocation deactivate the PUSCH/PUCCH and the corresponding demodulation reference signal, but does not affect other allocations of the UE or the sounding reference signal.

Parameters:

<PuscState> 0 | 1 | OFF | ON

*RST: dynamic

Options: AUTO requires R&S SMBV-K115

Manual operation: See "State (UL)" on page 236

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFlict?
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFlict?

Indicates a conflict between two allocations.

Return values:

<PuscConflict> 0 | 1 | OFF | ON

*RST: OFF

Usage: Query only

Manual operation: See "Conflict (UL)" on page 237

9.19 UL Carrier Aggregation

Option: R&S SMBV-K55 and R&S SMBV-K112.

Example: Activating UL carrier aggregation

```
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:CA:CELL0:DUPLexing FDD

SOURce1:BB:EUTRa:UL:CA:CELL1:INDex 5
SOURce1:BB:EUTRa:UL:CA:CELL1:ID 10
SOURce1:BB:EUTRa:UL:CA:CELL1:BW BW20_00
SOURce1:BB:EUTRa:UL:CA:CELL1:SUConfiguration 0
SOURce1:BB:EUTRa:UL:CA:CELL1:CSRS 7
SOURce1:BB:EUTRa:UL:CA:CELL1:DMRS 0
SOURce1:BB:EUTRa:UL:CA:CELL1:TDELay 0

SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:STATe 1
SOURce1:BB:EUTRa:STATe 1
OUTPut1:STATe 1
OUTPut2:STATe 1
```

[:SOURce<hw>]:BB:EUTRa:UL:CA:STATe <ULCaGlobState>

Enables UL carrier aggregation.

Parameters:

<ULCaGlobState> 0 | 1 | OFF | ON
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Activate Carrier Aggregation" on page 212

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:INDex <ULCaCellIndex>

Sets the cell index of the corresponding SCell.

Parameters:

<ULCaCellIndex> integer
Range: 1 to 7
*RST: 1

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Cell Index" on page 212

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:ID <ULCaPhyCellId>

Sets the physical Cell ID of the PCell and the SCells.

Parameters:

<ULCaPhyCellId> integer
Range: 0 to 503
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Physical Cell ID" on page 212

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:BW <ULCaBw>

Sets the bandwidth of the corresponding component carrier.

Parameters:
<ULCaBw> BW1_40 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00
*RST: BW10_00

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Bandwidth" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DFReq <ULCaDeltaF>

Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666.

Manual operation: See "delta f / MHz" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DUPLexing <ULCaDuplexMode>

Selects the duplexing mode of the component carriers.

Parameters:
<ULCaDuplexMode> TDD | FDD
*RST: FDD

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Duplexing" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:UDConf <ULCaTddULDLConf>

Sets the Uplink-Downlink Configuration number.

Parameters:
<ULCaTddULDLConf> integer
Range: 0 to 6
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "TDD UL/DL Configuration" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:SUConfiguration
<ULCaSrsSubfConf>

Sets the SRS subframe configuration per component carrier.

Parameters:
<ULCaSrsSubfConf> integer
Range: 0 to 15
*RST: 15

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See " SRS Subframe Configuration " on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:DMRS <ULCaN1Dmrs>

Sets the parameter n(1)_DMRS per component carrier.

Parameters:
<ULCaN1Dmrs> integer
Range: 0 to 11
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "n(1)_DMRS" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:SPSConf <ULCaTddSSConf>

Sets the special subframeconfiguration number.

Parameters:
<ULCaTddSSConf> integer
Range: 0 to 10
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666.

Options: R&S SMBV-K119: special subframe configuration 10

Manual operation: See "TDD Special Subframe Config" on page 213

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:CSRS <ULCaSrsCSRS>

Sets the parameter SRS Bandwidth Configuration per component carrier.

Parameters:
<ULCaSrsCSRS> integer
Range: 0 to 7
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See " SRS Bandwidth Configuration C_SRS " on page 214

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:TDELay <TimeDelay>

Sets the time delay of the SCell relative to the PCell.

Parameters:

<TimeDelay> integer

Range: 0 to 7E5
*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "Delay / ns" on page 214

[:SOURce<hw>]:BB:EUTRa:UL:CA:CELL<ch0>:STATe <ULCaCellState>

Activates the corresponding component carrier.

Parameters:

<ULCaCellState> 0 | 1 | OFF | ON

*RST: 0

Example: See Chapter 9.19, "UL Carrier Aggregation", on page 666

Manual operation: See "State" on page 214

9.20 UL Enhanced

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:SCHeme ... 671
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CODWords ... 672
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NOLayers ... 672
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NAPused ... 673
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBINdex ... 673
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:NDMRs<layer>? ... 673
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:MAPPing ... 674
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe ... 674
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE? ... 674
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits ... 675
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:CYCShift ... 675

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE 675
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled 676
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS 676
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:HARQ:CBITs? 676
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern 677
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs? 677
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS 678
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern 678
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CODWord? 678
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:RI:CBITs? 679
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS 679
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern 679
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:ULSCh:BITS? 680
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS<cw>? 680
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:TBSize 681
[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:RVINdex 681
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NAPused? 681
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR<ap> 682
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS 682
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs? 683
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTern 683
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs? 683
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS 684
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern 684
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:MRB 684
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NOC 685
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CYCShift 685
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR1 685
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR2? 686

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:SCHeme <PrecodingScheme>

Sets the PUSCH precoding scheme.

Parameters:
<PrecodingScheme> NONE | SPM
*RST: NONE

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease R10
SOURce1:BB:EUTRa:UL:UE1:PUSCh:TXMode M2
SOURce1:BB:EUTRa:UL:UE1:PUSCh:NAP AP2
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:PRECoding:SCHeme SPM
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:CODWords 2
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:PRECoding:NOLayers 4
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:PRECoding:NAPused?
// Response: AP2
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:PRECoding:CBINdex?
```

Options: R&S SMBV-K85

Manual operation: See "Precoding Scheme" on page 292

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CODWords <NumOfCodeWords>

Sets the number of the used codeword.

Parameters:
<NumOfCodeWords> integer
Range: 1 to 2
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:CELL0:SUBF0:ALLoc0:PUSCh:CODWords?
```

Options: R&S SMBV-K85/-K112

Manual operation: See "Codeword (UL)" on page 233
See "Number of Codewords" on page 293

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NOLayers <NumberOfLayers>

Sets the number of layers used by the PUSCh precoding.

Parameters:
<NumberOfLayers> integer
Range: 1 to 4
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:SCHeme` on page 671

Options: R&S SMBV-K85

Manual operation: See "Number of Layers" on page 293

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NAPused <NumUsedAntPorts>

Sets the number of antenna ports the PUSCH transmission uses.

Parameters:

<NumUsedAntPorts> AP1 | AP2 | AP4

*RST: AP1

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:NAPort` on page 716

Options: R&S SMBV-K85

Manual operation: See "Number of Used Antenna Port" on page 293

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:CBINdex <CodeBookIndex>

Sets the codebook index.

Parameters:

<CodeBookIndex> integer

Range: 0 to 23
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:SCHeme` on page 671

Options: R&S SMBV-K85

Manual operation: See "Codebook Index" on page 293

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:NDMRs<layer>?

Queries the parameter n(2)_DMRS,λ (Layer λ).

Suffix:

<st0> 0..39

<ch0> 0..3

<layer> 0..3
Layer

Return values:

<Ndmrs> integer

Range: 0 to 11
*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc1:PUSCh:DRS:
CYCShift 1
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc1:PUSCh:DRS:
NDMRs1?
Response: 6
```

Usage: Query only

Options: R&S SMBV-K85

Manual operation: See "n(2)_DMRS,λ (Layer λ)" on page 294

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:MAPPing <BitsDmrsMapping>

Sets the *Cyclic Shift Field mapping table for DMRS bit* field

Parameters:

<BitsDmrsMapping> 0 | 1 | OFF | ON

*RST: 0

Example:
```
// enabling mapping the DMRS sequence on each second subcarrier
SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:DRS:ENHanced 1
SOURce1:BB:EUTRa:UL:CELL0:SUBF0:ALLoc1:PUSCh:MAPPing 1
```

Manual operation: See "Bit for DMRS Mapping Table" on page 295

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe <State>

Enables/disables frequency hopping for PUSCH.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:STAT ON
```
Enables frequency hopping

Manual operation: See "Frequency Hopping" on page 293

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE?

Queries the frequency hopping type used, as defined in 3GPP TS36.213.

Return values:

<Type> TP1 | TP2 | NONE

*RST: NONE

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE?
```
Queries the frequency hopping type
```
Response: TP2
```

Usage: Query only

Manual operation: See "Hopping Type" on page 294

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits <InfoInHoppBits>

Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition.

Parameters:

<InfoInHoppBits> integer

Range: 0 to 3
*RST: 1

Example: `BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:IIHB 0`
Sets the information in hopping bits

Manual operation: See "Information in Hopping Bits" on page 294

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:CYCShift <Cyclicshift>

Sets the cyclic shift field in the uplink-related DCI formats.

Suffix:

<st0> 0..39
Subframe

<ch0> 0..3
Allocation

Parameters:

<Cyclicshift> int

Range: 0 to 7
Increment: 1
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:DRS:NDMRs<layer>?` on page 673

Options: R&S SMBV-K85

Manual operation: See "Cyclic Shift Field" on page 294

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE <Mode>

Sets the ACK/NACK mode to Multiplexing or Bundling according to 3GPP TS 36.212, chapter 5.2.2.6.

ACK/NACK mode Bundling is defined for TDD duplexing mode only.

Parameters:

<Mode> MUX | BUNDling

*RST: MUX

Example: `BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE MUX`
Selects multiplexing HARQ mode

Manual operation: See "ACK/NACK Mode" on page 296

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled <N_Bundled>

Sets the parameter N_bundled.

Parameters:

<N_Bundled> integer

Range: 1 to 6
*RST: 1

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE BUND
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:NBUN 2
```

Manual operation: See "N_bundled" on page 296

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS <Bits>

Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

Parameters:

<Bits> integer

Range: 0 to dynamic
*RST: 1

Example: `BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2`
Sets the number of A/N bits

Manual operation: See "Number of A/N Bits" on page 297

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:HARQ:CBITs?

Queries the number of coded ACK/NACK bits per codeword.

Suffix:

<cwid> 1..2
Codeword

Return values:
<Codedbits> integer
Range: 0 to max
Increment: 0
*RST: 2

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUSCh:HARQ:BITS 2
```
Sets the number of A/N bits
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:CW1:PUSCh:HARQ:CBITs?
Response: 8
```

Usage: Query only

Manual operation: See "Number of Coded A/N Bits (CW)" on page 297

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTern <Pattern>, <BitCount>

Sets the ACK/NACK pattern for the PUSCH.

Parameters:
<Pattern> 1024 bits
*RST: #H0

<BitCount> 1024 bits
Range: 1 to 64
*RST: 1

Example:
```
// Set 2-bit HARQ-ACK control information
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:PATT #B10,2
```

Manual operation: See "ACK/NACK Pattern" on page 297

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?

Queries the number of coded CQI bits.

Return values:
<CodedBits> integer
Range: 0 to max
*RST: 22

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUSCh:CQI:CBITs?
```
Queries the number of coded CQI bits

Usage: Query only

Manual operation: See "Number of Coded CQI Bits" on page 298

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS <Bits>

Sets the number of CQI bits before channel coding.

Parameters:

<Bits> integer

Range: dynamic to 1024
*RST: 10

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern` on page 678

Manual operation: See "Number of CQI Bits" on page 298

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTern <Pattern>, <BitCount>

Sets the CQI pattern for the PUSCH.

The length of the pattern is determined by the number of CQI bits (`[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS`).

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 1024
*RST: 1

Example:

```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUSCh:CQI:BITS 6
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUSCh:CQI:PATTern #H100100,6
```

Manual operation: See "CQI Pattern" on page 298

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CODWord?

Queries the codeword the CQI is mapped to.

Return values:

<CqiCodeWord> CW1 | CW2

*RST: CW1

Example:

```
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
:SOURce1:BB:EUTRa:UL:UE1:PUSCh:TXMode M2
:SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:STATe 1
:SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:MODE COMB
:SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:CODWords 2
:SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:CQI:CODWord?
// Response: CW1
```

Usage: Query only

Options: R&S SMBV-K85

Manual operation: See "CQI mapped to" on page 299

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:RI:CBITs?

Queries the number of coded RI bits per codeword.

Suffix:
<cwid> 1..2
Codeword

Return values:
<CodedRiBits> integer
Range: 0 to max
*RST: 4

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:RI:BITS 6
:SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:CW1:PUSCh:RI:CBITs?
// Response: 14
```

Usage: Query only

Manual operation: See "Number of Coded RI Bits (CW)" on page 298

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS <Bits>

Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

Parameters:
<Bits> integer
Range: 0 to 512
*RST: 1

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 2
```
Sets the number of RI bits

Manual operation: See "Number of RI Bits" on page 297

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTern <Pattern>, <BitCount>

Sets the RI pattern for the PUSCH.

Parameters:
<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 1024
*RST: 1

Example:
```
// Set the number of RI bits
BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:BITS 2
BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:PATT #H10,2
```

Manual operation: See "RI Pattern" on page 297

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:ULSCh:BITS?

Queries the number of physical bits used for UL-SCH transmission.

Suffix:
<cwid> 1..2
Codeword

Return values:
<PhysBitCount> integer
Range: 0 to max
*RST: 1500

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:CW1:PUSCh:ULSCh:BITS?
```
Queries the number of physical bits for UL-SCH
```
Response: 5688
```

Usage: Query only

Manual operation: See "Number of Coded UL-SCH Bits" on page 299

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS<cw>?

Queries the number of physical bits used for UL-SCH transmission.

Suffix:
<cw> 1..2
Codeword

Return values:
<PhysBitCount> integer
Range: 0 to max
Increment: 1
*RST: 1500

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:ULSCh:BITS1?
```
Queries the number of physical bits for UL-SCH
```
Response: 5688
```

Usage: Query only

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:TBSize <TranspBlockSize>

Sets the size of the transport block.

Suffix:
<cwid> 1 | 2
Codeword

Parameters:
<TranspBlockSize> integer
Range: 0 to 253440
*RST: 1500

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:CW0:PUSCh:CCODing:TBSize 100
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:CW2:PUSCh:CCODing:TBSize 1500
```

Manual operation: See "Transport Block Size/Payload (PUSCH)" on page 299

[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>[:CW<cwid>]:PUSCh:CCODing:RVINdex <RedundVersIndex>

Sets the redundancy version index.

Suffix:
<cwid> 1..2
Codeword

Parameters:
<RedundVersIndex> integer
Range: 0 to 3
*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:CW1:PUSCh:CCODing:RVINdex 2
```
Sets the redundancy version index

Manual operation: See "Redundancy Version Index (PUSCH)" on page 300

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NAPused?

Queries the number of antenna ports used for transmissions of the current PUCCH format.

Return values:
<NumAntennaPorts> integer
Range: 1 to 2
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease R10
SOURce1:BB:EUTRa:UL:UE1:PUCCh:F1Naport AP2
SOURce1:BB:EUTRa:UL:UE1:PUCCh:F2Naport AP1
SOURce1:BB:EUTRa:UL:UE1:PUCCh:F3Naport AP1
SOURce1:BB:EUTRa:UL:SUBF0:Alloc0:PUCCh:NAPused?
// Response: 2
SOURce1:BB:EUTRa:UL:SUBF0:Alloc0:FORMat F2B
SOURce1:BB:EUTRa:UL:SUBF0:Alloc0:PUCCh:NAPused?
// Response: 1
```

Usage: Query only

Options: R&S SMBV-K85

Manual operation: See "Number of Used Antenna Ports" on page 301

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR<ap>
<NPar>

Sets the resource index for the supported PUCCH formats.

Suffix:
<ap> 0..1
Antenna port index

Parameters:
<NPar> integer

n(x)_PUCCH_max depends on the PUCCH format; to query the value, use the corresponding command, for example `[:SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax?`.

Range: 0 to n(x)_PUCCH_max
*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:SUBF1:ALLoc2:PUCCh:NPAR0 10
```

Manual operation: See "n_PUCCH" on page 301

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS
<Bits>

(PUCCH format ≥3)

Sets the number of ACK/NACK+SR+CSI bits before channel coding.

Parameters:
<Bits> Max number of bits depend on the PUCCH format

Range: 1 to dynamic
*RST: 1

Manual operation: See "Number of A/N+SR+CSI Bits" on page 304

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?

(PUCCH format ≥3)

Queries the number of coded ACK/NACK+SR+CSI bits.

Return values:

<CBits> integer

Range: 0 to 48
*RST: 0

Usage: Query only

Manual operation: See "Number of Coded A/N+SR+CSI Bits" on page 304

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:
PATTern <Pattern>, <BitCount>

Sets the PUCCH ACK/NACK pattern or ACK/NACK + SR pattern per subframe.

Parameters:

<Pattern> 1024 bits

*RST: #H0

<BitCount> 1024 bits

Range: 1 to 32
*RST: 1

Example:

```
SOURce1:BB:EUTRa:SLENgth 4
SOURce1:BB:EUTRa:UL:UE1:CONSubframes:PUCCh 8
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc1:FORMat F1A
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUCCh:HARQ:PATTern #B01001,5
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc1:FORMat F1B
```

Manual operation: See "A/N Pattern / A/N+SR+CSI Pattern" on page 302

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs?

Queries the number of coded CQI bits.

Return values:

<CodedBits> integer

Range: 0 to max
*RST: 20

Example:

```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUCCh:CQI:
CBITs?
```

Queries sets the number of coded CQI bits

```
Response: 20
```

Usage: Query only

Manual operation: See "Number of Coded CQI Bits" on page 304

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS
<Bits>

Sets the number of CQI bits before channel coding.

Parameters:

<Bits> integer
Range: 1 to 13
*RST: 4

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern` on page 684

Manual operation: See "Number of CQI Bits" on page 303

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTern
<Pattern>, <BitCount>

Sets the CQI pattern for the PUCCH.

The length of the pattern is determined by the number of CQI bits (`[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS`).

Parameters:

<Pattern> numeric
*RST: #H1

<BitCount> integer
Range: 1 to 13
*RST: 4

Example:
```
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUCCh:CQI:BITS 6
SOURce1:BB:EUTRa:UL:SUBF4:ALLoc2:PUCCh:CQI:PATTern #B100100,6
```

Manual operation: See "CQI Pattern" on page 305

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:MRB
<PucchMRB>

Sets the number of resource blocks used by PUCCH format 5.

Parameters:

<PucchMRB> 1 | 2 | 3 | 4 | 5 | 6 | 8
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:FORMat F5
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:MRB 1
```

Options: R&S SMBV-K119

Manual operation: See "M_RB" on page 304

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NOC <NOC>

Sets the PUCCH format 4 index n_{oc}.

Parameters:

<NOC> integer

Range: 0 to 1
*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:FORMat F5
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:NOC 1
```

Options: R&S SMBV-K119

Manual operation: See "n_oc" on page 304

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CYCShift <CyclicShiftDmrs>

Sets the cyclic shift.

Parameters:

<CyclicShiftDmrs> integer

Range: 0 to 7
*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:FORMat F5
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:CYCShift 4
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:DMR1?
// 6
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:DMR1 2
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:CYCShift?
// 1
```

Options: R&S SMBV-K119

Manual operation: See "Cyclic Shift Field" on page 305

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR1 <PuccDmrs1>

Sets the index $n^{(2)}_{DMRS}$.

Parameters:

<PuccDmrs1> 0 | 2 | 3 | 4 | 6 | 8 | 9 | 10

*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CYCShift` on page 685.

Options: R&S SMBV-K119

Manual operation: See "n(1)_DMRS" on page 306

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:DMR2?

Queries the index $n^{(2)}_{DMRS}$.

Return values:

<PuccDmrs2> integer

Range: 0 to 6
*RST: 0

Example:

```
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:FORMat F5
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUCCh:DMR2?
// 0
```

Usage: Query only

Options: R&S SMBV-K119

Manual operation: See "n(2)_DMRS" on page 306

9.21 User Configuration

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STATe....687
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe....687
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM....687
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TXM....687
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC....688
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ULCA<st0>:STATe....688
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CELL....688
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBCI....689
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBUA....689
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex[<dir>]....689
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates....690
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE....690
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:REAL....690
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:IMAGinary....691
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe....691
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID....692
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA....692
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect....692
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern....692
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EIMTarnti....693
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA....693
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ASRS:STATe....693
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe....694
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:MCS....694
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TBAL....694
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:MCSTwo:STATe....695
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TALTindex:STATe....695
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:DMRS:STATe....695
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:SEOL:STATe....695

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STHP:STATe 696
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe 696
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:USE 696
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID1 697
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID2 697

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STATe <UserState>

Enables/disables a user.

Parameters:

<UserState> 0 | 1 | OFF | ON
*RST: 1

Example: `SOURce1:BB:EUTRa:DL:USER1:STATe OFF`

Manual operation: See "State" on page 197

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe <State>

Enables/disables carrier aggregation for the selected user.

Parameters:

<State> 0 | 1 | OFF | ON
*RST: 0

Options: R&S SMx/AMU-K85

Manual operation: See "Activate CA" on page 197

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM <TxMode>

Sets the transmission mode of the according user as defined in TS 36.213.

Parameters:

<TxMode> USER | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10
*RST: USER
Option:R&S SMBV-K115
<TxMode> = USER|M1|M2|M6|M9

Example: `SOURce1:BB:EUTRa:DL:USER1:TXM M6`

Manual operation: See "Tx Modes" on page 198

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TXM <TxMode>

Sets the transmission mode of the user.

Suffix:

<st0> 0 to 4
0 = PCell, 1 to 4 = SCell1 to SCell4

Parameters:

<TxMode> USER | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10

*RST: USER

Example:

```
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M9
SOURce1:BB:EUTRa:DL:USER1:CELL1:TXM M7
```

Manual operation: See "Tx Modes" on page 198

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC <UECategory>

Sets the UE Category.

Parameters:

<UECategory> USER | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | M1 | NB1

*RST: USER

Options: M1|NB1 require R&S SMBV-K115

Manual operation: See "UE Category" on page 198

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ULCA<st0>:STATe <CuUlCaState>

Sets the state of the associated UL carriers, if carrier aggregation is enabled.

Suffix:

<st0> 0 to 4
0 = PCell, 1 to 4 = SCell1 to SCell4
LAA SCells cannot be associated with UL carriers; the corresponding UL carrier state is always off.

Parameters:

<CuUlCaState> 0 | 1 | OFF | ON

*RST: 0

Example:

```
SOURce1:BB:EUTRa:DL:CA:STATe 1
SOURce1:BB:EUTRa:DL:USER1:ULCA0:STATe 1
SOURce1:BB:EUTRa:DL:USER1:ULCA1:STATe 1
```

Options: R&S SMBV-K85

Manual operation: See "UL Carriers Configuration" on page 198

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CELL <SelCompCar>

Sets the cell the antenna port mapping is related to, if a carrier aggregation is enabled.

Parameters:

<SelCompCar> PC0 | SC1 | SC2 | SC3 | SC4

*RST: PC0

Example:

```
:SOURce1:BB:EUTRa:DL:USER1:APM:CELL?
```

Manual operation: See "Cell" on page 166

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBCI <CbConstIdx>

Defines whether the codebook index is set globally or per subframe.

Parameters:
<CbConstIdx> 0 | 1 | OFF | ON

Manual operation: See "Constant Codebook Index" on page 164

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBUA <CbUseAlt>

Applies the enhanced 4 Tx codebook.

Parameters:
<CbUseAlt> 0 | 1 | OFF | ON

OFF
Tthe normal codebook is used.

ON
Applied is the enhanced 4Tx codebook.

*RST: 0

Example:

```
:SCONfiguration:APPLy
:SCONfiguration:FADing MIMO2X4X4
:SCONfiguration:BASeband:SOURce COUP
:SCONfiguration:APPLy

:ENTity1:SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX4
:ENTity1:SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M10
:ENTity1:SOURce1:BB:EUTRa:DL:USER1:APM:MODE CB
:ENTity1:SOURce1:BB:EUTRa:DL:USER1:APM:CBCI 0
:ENTity1:SOURce1:BB:EUTRa:DL:USER1:APM:CBUA 1

:ENTity1:SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:PRECoding:CBINdex2 1
:ENTity1:SOURce1:BB:EUTRa:DL:CELL0:SUBF0:ALLoc2:PUSCh:PRECoding:CBUA 1
```

Options: R&S SMBV-K113

Manual operation: See "Use Alternative Codebooks" on page 165

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex[<dir>]
<CodeBookIndex>

Sets the codebook index for mapping mode Codebook.

Parameters:
<CodeBookIndex> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Codebook Index/Codebook Index 2" on page 165

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates <MapCoord>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

Parameters:

<MapCoord> CARTesian | CYLindrical

*RST: CARTesian

Options: R&S SMBV-K84

Manual operation: See "Mapping Coordinates" on page 166

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE <AntPortMap>

Defines the antenna port mapping method.

Parameters:

<AntPortMap> CB | RCB | FW

CB
Codebook

RCB
Random codebook

FW
Fixed weight

*RST: FW

Manual operation: See "Antenna Port Mapping" on page 164

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:REAL <AntPortMapData>

Defines the mapping of the antenna ports to the physical antennas.

Suffix:

<dir0> 5 | 7 to 14
antenna port

<st0> 0 to 3
available basebands

Parameters:

<AntPortMapData> float

The REAL (Magnitude) and IMAGinary (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|REAL+j*IMAGinary| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: dynamic

Manual operation: See "Mapping table" on page 166

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP<dir0>:TX<st0>:IMAGinary <AntPortMapData>

Defines the mapping of the antenna ports to the physical antennas.

Suffix:

<dir0> 5 | 7 to 14
antenna port

<st0> 0 to 3
available basebands

Parameters:

<AntPortMapData> float

The REAL (Magnitude) and IMAGinary (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|REAL+j*IMAGinary| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: 0

Manual operation: See "Mapping table" on page 166

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe <State>

Sets the channel coding for all allocations belonging to the selected user.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example: BB:EUTR:DL:USER2:CCOD:STAT ON
Enables channel coding for the allocations belonging to user 2.

Manual operation: See "Channel Coding State" on page 199

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID <Ueid>

Sets the user equipment ID.

Parameters:

<Ueid> integer

Range: 0 to 65535
*RST: 0

Example: `BB:EUTR:DL:USER2:UEID 3308`
Sets the UE ID.

Manual operation: See "UE ID" on page 199

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA <Data>

Selects the data source for the selected user configuration.

Parameters:

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example:
```
SOURce1:BB:EUTRa:USER0:DATA PN23
// file lte_datalist.dm_iqd must exsist in the default directory
SOURce1:BB:EUTRa:USER2:DATA DLISt
SOURce1:BB:EUTRa:USER2:LIST "/var/user/lte_datalist.dm_iqd"
SOURce1:BB:EUTRa:USER4:DATA PATTern
SOURce1:BB:EUTRa:USER4:PATTern #H1C4A9,17
```

Manual operation: See "Data List Management" on page 62
See "Data Source, DList/Pattern" on page 199

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSELect <DSelect>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DSelect> string

File name incl. file extension or complete file path

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA` on page 692.

Manual operation: See "Data List Management" on page 62
See "Data Source, DList/Pattern" on page 199

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern <Pattern>, <BitCount>

Sets a bit pattern as data source.

Parameters:

<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA` on page 692.

Manual operation: See "Data Source, DList/Pattern" on page 199

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EIMTarnti <EIMTARnti>

Sets the dedicated eIMTA-RNTI.

Parameters:

<EIMTARnti> integer
Range: 1 to 65523
*RST: 1

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:DL:USER1:EIMTarnti 10
```

Options: R&S SMBV-K113

Manual operation: See "eIMTA-RNTI" on page 200

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA <Power>

Sets PDSCH power factor according to TS 36.213, chapter 5.2.

Parameters:

<Power> -6.02 | -4.77 | -3.01 | -1.77 | 0.97 | 2.04 | 3.01 | 0
*RST: 0

Example:
```
BB:EUTR:DL:USER2:PA 2.04
```
Selects the P_A

Manual operation: See "P_A" on page 200

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:ASRS:STATe <CuApSrsState>

Enables/disables an aperiodic transmission of SRS for the selected user.

Parameters:

<CuApSrsState> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER2:ASRS:STATe ON
```

Manual operation: See "Aperiodic SRS State" on page 200

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CAW:STATe <CuCsiAware>

Enables/disables the CSI awareness for the selected user.

Parameters:

<CuCsiAware> OFF | ON | 1 | 0
*RST: OFF

Example: See Example "Enabling a CSI-RS transmission" on page 588

Manual operation: See "CSI Awareness State" on page 201

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:MCS <McsTable>

Defines which of the tables defined in TS 36.213 is used to specify the used modulation and coding scheme.

Parameters:

<McsTable> 0 | OFF | T1 | 1 | ON | T2 | T3 | T4

0|OFF|T1
Table 7.1.7.1-1

1|ON|T2
Table 7.1.7.1-1A

T3
Table 7.1.7.1-1B

T4
Table 7.1.7.1-1C

*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:CELL0:MCS T1
```

Options: T1|T2 require R&S SMBV-K113
T3|T4 requireR&S SMBV-K119

Manual operation: See "MSC Table" on page 201

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TBAL <TBSAltIndex>

Sets the which of the transport block size (TBS) tables defined in TS 36.213 is used.

Parameters:

<TBSAltIndex> 0 | OFF | T1 | 1 | ON | T2 | T3 | T4

0|OFF|T1 ="TBS Alt. Index = 0"
1|ON|T2 = "TBS Alt. Index = 1"
T3 = "TBS Alt. Index = 2"
T3 = "TBS Alt. Index = 3"

*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:CELL0:TBAL T1
```

Options: T1|T2 require R&S SMBV-K113
T3|T4 requireR&S SMBV-K119

Manual operation: See "TBS Alt. Index" on page 201

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:MCSTwo:STATe <McsTable2Old>

This command is supported for backwards compatibility. Use `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:MCS` on page 694 instead.

Parameters:
<McsTable2Old> 0 | 1 | OFF | ON
*RST: 0

Options: R&S SMBV-K113

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TALTindex:STATe <TBSAltIndexOld>

This command is supported for backwards compatibility. Use `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:TBAL` on page 694 instead.

Parameters:
<TBSAltIndexOld> 0 | 1 | OFF | ON
*RST: 0

Options: R&S SMBV-K113

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:DMRS:STATe
<DmrsAltTable>

Sets the value of the higher-layer parameter `dmrs-tableAlt`.

Parameters:
<DmrsAltTable> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM TM10
SOURce1:BB:EUTRa:DL:USER1:CELL0:DMRS:STATe 1
```

Options: R&S SMBV-K119

Manual operation: See "DMRS Alt Table" on page 201

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CELL<st0>:SEOL:STATe
<SemiOpenLoop>

Sets the value of the higher-layer parameter `semiOpenLoop`.

Parameters:
<SemiOpenLoop> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM TM10
SOURce1:BB:EUTRa:DL:USER1:CELL0:SEOL:STATe 1
```

Options: R&S SMBV-K119

Manual operation: See "Semi Open Loop" on page 202

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:STHP:STATe <State>

Sets if NB-IoT UEs are capable of understanding the HARQ process bit.

Parameters:

<State> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER1:RELease NOIT
SOURce1:BB:EUTRa:DL:USER1:STHP:STATe 1
...
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:HPNMber 1
```

Example: See Example "DCI format N0 configuration" on page 760.

Options: R&S SMBV-K115
1|ON requires R&S SMBV-K143

Manual operation: See "Support two HARQ Processes" on page 202

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe <State>

Enables/disables scrambling for all allocations belonging to the selected user.

Parameters:

<State> 0 | 1 | OFF | ON
*RST: ON

Example:
```
SOUR:BB:EUTR:DL:USER3:SCR:STAT OFF
// Disables scrambling for allocations belonging to user 3

SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
// 0
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT?
// 0
```

Manual operation: See "Scrambling State" on page 136

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:USE <Use>

Defines how the DMRS scrambling sequence is initialized.

Parameters:

<Use> 0 | 1 | OFF | ON

OFF
DRMS sequence is generated with the variable $n_{ID} = N_{ID}^{cell}$.

ON
Used are two variable $n_{ID} = n_{ID}^{DMRS,i}$ set with the commands
`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID1|ID2`

Example:
```
SOURce1:BB:EUTRa:DL:MIMO:CONFIguration TX4
SOURce1:BB:EUTRa:DL:USER1:TXM M10
SOURce1:BB:EUTRa:DL:USER1:SCRambling:CELL0:DMRS:USE 1
SOURce1:BB:EUTRa:DL:USER1:SCRambling:CELL0:DMRS:ID1 100
SOURce1:BB:EUTRa:DL:USER1:SCRambling:CELL0:DMRS:ID1 220
SOURce1:BB:EUTRa:DL:USER1:SCRambling:CELL0:CSI:USE 1
SOURce1:BB:EUTRa:DL:USER1:SCRambling:CELL0:CSI:IDENt 100
```

Options: R&S SMBV-K112

Manual operation: See "Use DMRS Scrambling Identities" on page 136

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID1
<Ident>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:ID2
<Ident>

Sets the DMRS scrambling identity.

Parameters:

<Ident> integer

Range: 0 to 503
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:CELL<st>:DMRS:USE` on page 696.

Options: R&S SMBV-K112

Manual operation: See "DMRS Scrambling Identity 1/2" on page 136

9.22 EPDCCH

Option: R&S SMBV-K112

Example: Configuring EPDCCH transmission

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:DL:CONF:MODE AUTO
// EPDCCH cannot be activated in manual mode

SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:STATe 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:TTYP LOC
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:PRBS PRB2
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:RBA 1200
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:NID 100
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:PWR 0
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:STAT 1

SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:USER USER1
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PDCChtype EPD1
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:DCIFmt F1A
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:SESPace?
// UE
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:PFMT 2
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:NCCes?
// 2
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:CINDex 20
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:NDCCes?
// 4
SOURce1:BB:EUTRa:DL:SUBF0:ENCC:PDCCh:EXTC:ITEM0:CONFlict?
// 0

SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:DATA?
// USER1
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:RBCount?
// AUTO
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:RBOFfset?
// AUTO
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:CONType?
// EPD1
SOURce1:BB:EUTRa:DL:SUBF0:ALLoc2:CW1:STATe?
// 1
```

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:STATe 699
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STATe 699
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:TTYP 699
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:PRBS 700
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:RBA 700
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:NID 700
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:POWer 701

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:STATe <State>

Enables the EPDCCH transmission for the select user and component carrier.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Activate EPDCCH" on page 133

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STATe <State>

Enables the EPDCCH set.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Set 1/2 State" on page 134

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:TTYP <TransType>

Select the EPDCCH transmission type.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:
<TransType> LOCalized | DISTributed
*RST: LOCalized

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Transmission Type" on page 134

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:PRBS
<NumPRBs>

Sets the number of used physical resource block (PRB) pairs.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:
<NumPRBs> PRB2 | PRB4 | PRB8
*RST: PRB2

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Number of PRB Pairs" on page 134

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:RBA
<RBA>

Defines the resource blocks used for the EPDCCH transmission.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:
<RBA> integer
Range: 0 to 1000
*RST: 0

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Resource Block Assignment" on page 134

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:NID
<EpdcchId>

Sets the identifier $n^{EPDCCH}_{ID,m}$ used to calculate the UE-specific scrambling sequence.

Suffix:
<dir> 1|2
EPDCCH set

Parameters:

<EpdcchId> integer

Range: 0 to 503
*RST: 0

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "N^EPDCCH_ID" on page 134

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:POWer <RelPower>

Sets the power of the EPDCCH allocations relative to the power of the reference signals.

See `[:SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer` on page 541.

Suffix:

<dir> 1|2
EPDCCH set

Parameters:

<RelPower> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example "Configuring EPDCCH transmission" on page 698.

Example: Option:R&S SMBV-K115
See Example "Configuring the MPDCCH sets" on page 773.

Manual operation: See "Relative EPDCCH Power" on page 135

9.23 Dummy Data Configuration

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation 701
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer 702
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA 702
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect 702
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern 703
[:SOURce<hw>]:BB:EUTRa:DL:DUMD:OPSubframes 703

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation <Modulation>

Selects modulation for dummy data.

Parameters:
<Modulation> QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

Example: `BB:EUTR:DL:DUMD:MOD QAM16`
16QAM is selected as modulation for dummy data.

Options: QAM256 requires R&S SMBV-K113

Manual operation: See "Modulation" on page 123

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer <Power>

Sets the power for dummy data.

Parameters:
<Power> float
Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:DL:DUMD:POWer 10.00`
Sets the power for dummy data to 10 dB.

Manual operation: See "Power (Dummy Data)" on page 123

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA <Data>

Selects the data source for dummy data.

Parameters:
<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE
*RST: PN9

Example: `BB:EUTR:DL:DUMD:DATA PN9`
PN9 is selected as data source for dummy data.

Manual operation: See "Data Source" on page 123

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSELect <Filename>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:
<Filename> string
Filename incl. file extension or complete file path

Example:
```
SOURce1:BB:EUTRa:DL:DUMD:DATA DLIS
SOURce1:BB:EUTRa:DL:DUMD:DSELect "/var/user/temp/lte_dl.dm_iqd"
```

Manual operation: See "Data Source" on page 123

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:PATTern <Pattern>, <BitCount>

Sets the bit pattern.

Parameters:

<Pattern> <bit pattern>
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example:
```
SOURce1:BB:EUTRa:DL:DUMD:PATTern #H1E,8
```

Manual operation: See "Data Source" on page 123

[:SOURce<hw>]:BB:EUTRa:DL:DUMD:OPSubframes <OmitPrsSf>

If the OCNG is used, you can disable (omit) the OCNG transmission in the non-muted PRS subframes.

Parameters:

<OmitPrsSf> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:BUR DUData
SOURce1:BB:EUTRa:DL:PRSS:MIPattern #H2,2
SOURce1:BB:EUTRa:DL:DUMD:OPSubframes ON
```

Manual operation: See "Omit PRS Subframes" on page 123

9.24 SPS Configuration

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:STATe <UsrSpsState>

Enables SPS (semi-persistence scheduling).

Parameters:

<UsrSpsState> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:USER2:SPS:STATe ON
SOURce1:BB:EUTRa:DL:USER2:SPS:CRNTi 250
SOURce1:BB:EUTRa:DL:USER2:SPS:SINTerval S20
SOURce1:BB:EUTRa:DL:USER2:SPS:SACTivation 1
SOURce1:BB:EUTRa:DL:USER2:SPS:SRELease 3
```

Manual operation: See "Activate SPS" on page 206

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:CRNTi <UserSpsCRnti>

Sets the SPS C-RNTI parameter.

Parameters:

<UserSpsCRnti> integer

Range: 1 to 65523
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:STATe` on page 703

Manual operation: See "SPS C-RNTI" on page 207

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SINTerval <UserSpsInt>

Defines the SPS interval.

Parameters:

<UserSpsInt> S10 | S20 | S32 | S40 | S64 | S80 | S128 | S160 | S320 | S640

*RST: S10

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:STATe` on page 703

Manual operation: See "SPS Interval" on page 207

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SACTivation <UsrSpsActSubfr>
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:SRELease <UsrSpsRelSubfr>

Defines the start and end subframes of the semi-persistent scheduling.

Parameters:

<UsrSpsRelSubfr> integer

Range: 0 to 65535
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SPS:STATe` on page 703

Manual operation: See "Activation/Release Subframe No" on page 207

9.25 User Equipment

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease 706
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart 706
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID 707
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe 707
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE 707
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer 707
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:OCID:STATe 708

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CID 708
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:ALRB 708
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:MODulation? 709
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:N2DMrs 709
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:PASize? 709
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:STATe 710
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TNOBits? 710
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TYPE 710
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:VRBoffset 711
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRSTate 711
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRTT 712
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRFormat? 712
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:CFRames? 712
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RBOFfset 713
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:FRINdex 713
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:POWer 713
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:NCSConf 713
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RSEQuence 714
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:SINDex 714
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:DT 714
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:STATe 715
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DATA 715
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:PATTern 715
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DSELect 716
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:TXMode 716
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:NAPort 716
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:SCRambling:STATe 717
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:STATe 717
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:MODE 717
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:ICQioffset 718
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IHARqoffset 718
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IRIoffset 718
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:OCQimin 719
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:STATe 719
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:LDMRs 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:NSYM 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F4Naport? 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F5Naport? 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F1Naport 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F2Naport 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F3Naport 720
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:POWoffset 721
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:DWOCc 721
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:ENHanced 721
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:STATe 721
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:TT0 722
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:POWoffset 722
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NAPort 723
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:CYCShift 723
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NTRans 723

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:UPPTsadd....724
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:
SUBF<subfidx>....724
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:BHOP....725
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:BSRS....725
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:ISRS....725
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TSRS?....725
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TOFFset?....726
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TRComb....726
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NKTC....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NRRC....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP10Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP20Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP21Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP40Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP41Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP42Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP43Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1000Map:ROW<bbid>....727
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1010Map:ROW<bbid>....728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1020Map:ROW<bbid>....728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP100Map:ROW<bbid>....728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP200Map:ROW<bbid>....728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP201Map:ROW<bbid>....728
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CELL<dir0>:POFFset....728

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease <Release>

Sets which LTE release version the UE supports.

Parameters:

<Release> R89 | LADV | EMTC | NIOT

*RST: R89 (R&S SMBV-K55) | EMTC (R&S SMBV-K115)

Example: `SOURce1:BB:EUTRa:UL:UE1:RELease LADV`

Options: R89 requires R&S SMBV-K55
LADV requires R&S SMBV-K85
EMTC|NIOT require R&S SMBV-K115

Manual operation: See "3GPP Release" on page 239

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart <RestartState>

If activated, the indicated values are restarted at the specified intervals.

Parameters:

<RestartState> 0 | 1 | OFF | ON

*RST: 0

Example: `SOURce1:BB:EUTRa:UL:UE1:DACRestart 1`

Manual operation: See "Restart Data, A/N, CQI and RI Every Subframe and Codeword/Restart Data and A/N Every Subframe" on page 239

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID <Id>

Sets the radio network temporary identifier (RNTI) of the UE.

Parameters:

<Id> integer

Range: 0 to 65535
*RST: 0

Example: `BB:EUTR:UL:UE3:ID 303`
Sets the UE ID

Manual operation: See "UE ID/n_RNTI" on page 240

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe <State>

Selects the user equipment state.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 1 (UE1); 0 (UE2 to UE7)

Example: `BB:EUTR:UL:UE2:STAT ON`
Activates UE2.

Manual operation: See "State" on page 238

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE <Mode>

Selects whether the user equipment is in standard or in PRACH mode.

Parameters:

<Mode> STD | PRACh

*RST: STD

Example: `BB:EUTR:UL:UE:MODE STD`
Selects the standard mode for UE1.

Manual operation: See "Mode" on page 240

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer <Power>

Sets the power level of the selected UE.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:UL:UE2:POW -5.0`
Sets the power of UE2

Manual operation: See "UE Power" on page 240

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:OCID:STATe <OverrideCellID>

if enabled, you can set an user-defined cell ID for the selected user.

Parameters:
<OverrideCellID> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:CA:STATe 0
SOURce1:BB:EUTRa:UL:PLCI:CID 20

SOURce1:BB:EUTRa:UL:UE1:OCID:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CID 10
```

Manual operation: See "Override Cell ID" on page 239

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CID <ULUECELLID>

Sets the UE-specific cell ID.

Parameters:
<ULUECELLID> integer
Range: 0 to 503
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:OCID:STATe` on page 708.

Manual operation: See "Cell ID" on page 239

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:ALRB
<AllocResBlocks>

Queries the number of the allocated resource blocks for the selected FRC.

Parameters:
<AllocResBlocks> integer
Range: 0 to 110
*RST: 0

Example: `BB:EUTR:UL:UE2:FRC:TYPE A34`
Sets the FRC
`BB:EUTR:UL:UE2:FRC:ALRB?`
`Response: 25`

Manual operation: See "Allocated Resource Blocks" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:MODulation?

Queries the modulation for the selected FRC ([:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TYPE on page 710).

Return values:

<Modulation> QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

Example:
```
BB:EUTR:UL:UE2:FRC:TYPE A34
BB:EUTR:UL:UE2:FRC:MOD?
// QPSK
```

Usage: Query only

Manual operation: See "Modulation (FRC)" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:N2DMrs <N2Dmrs>

Sets the UE specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

Parameters:

<N2Dmrs> integer
Range: 0 to 10
*RST: 0

Example:
```
SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSC:NDMR 3
```
Sets the n(2)_DMRS
```
SOUR:BB:EUTR:UL:UE1:FRC:STAT ON
```
Enables FRC
```
SOUR:BB:EUTR:UL:UE1:FRC:N2DM 5
```
Sets the DMRS index for all PUSCH allocation of the selected UE in all subframes
```
SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSH:N2DM?
Response: 5
```

Manual operation: See "n(2)_DMRS (FRC)" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:PASize?

Queries the payload size for the selected FRC ([:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TYPE on page 710).

Return values:

<PayloadSize> integer
Range: 0 to 2E5
*RST: 0

Example: `BB:EUTR:UL:UE2:FRC:TYPE A34`
Sets the FRC
`BB:EUTR:UL:UE2:FRC:PAS?`
`Response: 2216`

Usage: Query only

Manual operation: See "Payload Size (FRC)" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:STATe <State>

Enables/disables FRC configuration.

Enabling FRC configuration sets some parameters to their predefined values, i.e. several parameters are displayed as read-only. Reconfiguration of the values of this parameters is possible only after disabling the FRC configuration.

The FRC State is disabled and cannot be enabled, if a user defined cyclic prefix (`BB:EUTR:UL:CPC USER`) is selected.

Parameters:
<State> 0 | 1 | OFF | ON
*RST: OFF

Example: `BB:EUTR:UL:UE2:FRC:STAT ON`
Enables FRC

Manual operation: See "FRC State" on page 242

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TNOBits?

Queries the total number of physical bits available for the PUSCH allocation per subframe in case the PUSCH is not shortened because of SRS or because it is transmitted in a cell-specific SRS subframe.

Return values:
<TotalBitCount> integer
Range: 0 to max
*RST: 0

Example: `BB:EUTR:UL:UE2:FRC:TYPE A34`
Sets the FRC
`BB:EUTR:UL:UE2:FRC:TNOB?`
`Response: 7200`

Usage: Query only

Manual operation: See "Physical Bits Per Subframe (Unshortened PUSCH)" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:TYPE <Type>

Selects a predefined fixed reference channel according to TS 36.141 and TS 36.521.

Parameters:

<Type> A11 | A12 | A13 | A14 | A15 | A21 | A22 | A23 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A41 | A42 | A43 | A44 | A45 | A46 | A47 | A48 | A51 | A52 | A53 | A54 | A55 | A56 | A57 | A71 | A72 | A73 | A74 | A75 | A76 | A81 | A82 | A83 | A84 | A85 | A86 | UE11 | UE12 | UE21 | UE22 | UE3 | A16 | A17 | A121 | A122 | A123 | A124 | A125 | A126 | A131 | A132 | A133 | A134 | A135 | A136 | A171 | A172 | A173 | A174 | A175 | A176 | A181 | A182 | A183 | A184 | A185 | A186 | A191 | A192 | A193 | A194 | A195 | A196

*RST: A11

Example:

```
BB:EUTR:UL:UE2:FRC:TYPE A34
```

Options: A171|A172|A173|A174|A175|A176|A181|A182|A183|A184|A185|A186|A191|A192|A193|A194|A195|A196 require R&S SMBV-K119

Manual operation: See "FRC" on page 243

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:FRC:VRBoffset <VrbOffset>

Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

Parameters:

<VrbOffset> integer

Range: 0 to dynamic
*RST: 2

Example:

```
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB 6
SOUR:BB:EUTR:UL:UE1:FRC:STAT ON
SOUR:BB:EUTR:UL:UE1:FRC:VRB 3
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB?
Response: 3
```

Manual operation: See "Offset VRB (FRC)" on page 244

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRSTate <State>

Activates Power Ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function (sin^2).

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example:

```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
```

Manual operation: See "State PRACH Power Ramping" on page 287

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRTT <TransitionTime>

Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

Parameters:

<TransitionTime> float

Range: 0 to 3E-5
Increment: 1E-7
*RST: 2E-5
Default unit: s

Example:
```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
BB:EUTR:UL:UE1:PRAC:PRTT 15us
```

Manual operation: See "Transition Time" on page 287

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:PRFormat?

Queries the preamble format.

Return values:

<PreaFormat> integer

Range: 0 to 3
*RST: 0

Example:
```
BB:EUTR:UL:UE1:PRAC:PRF?
```
Queries the preamble format.

Usage: Query only

Manual operation: See "Preamble Format (Burst Format)" on page 288

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:CFRames?

Queries the number of configurable frames.

Return values:

<ConfigFrameCoun> integer

Range: 1 to 10
*RST: 1

Example:
```
BB:EUTR:UL:UE1:PRAC:CRF?
```
Queries the number of frames

Usage: Query only

Manual operation: See "Number of Configurable Frames" on page 289

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RBOFfset <RbOffset>

Queries the starting RB, as set with the command `[:SOURce<hw>]:BB:EUTRa:UL:PRACh:FOFFset`.

Parameters:

<RbOffset> integer

Range: 0 to 109
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:RBOF?`
Queries the RB offset.

Manual operation: See "RB Offset" on page 289

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:FRINdex <FreqResIndex>

(enabled in TDD duplexing mode only)

Sets the frequency resource index f_{RA} for the selected subframe.

Parameters:

<FreqResIndex> integer

Range: 0 to dynamic
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:FRIN 2`
Sets the frequency resource index

Manual operation: See "Frequency Resource Index" on page 289

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:POWer <Power>

Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:POW -3`
Sets the power

Manual operation: See "Power" on page 290

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:NCSConf <NcsConfig>

Selects the Ncs configuration of the selected subframe.

Parameters:

<NcsConfig> integer

For details on the value range, see Table 4-21.

Range: 0 to 15
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:NCSC 2`
Sets the Ncs Configuration

Manual operation: See "Ncs Configuration" on page 289

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:RSEQuence <RootSequence>

Selects the logical root sequence index for the selected subframe.

Parameters:

<RootSequence> integer

Range: 0 to 838
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:RSEQ 200`
Sets the root sequence

Manual operation: See "Logical Root Sequence Index" on page 290

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:SINDex <SequenceIndex>

Selects the sequence index v.

Parameters:

<SequenceIndex> integer

Range: 0 to 63
*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:SIND 30`
Sets the sequence index

Manual operation: See "Sequence Index (v)" on page 290

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:DT <DeltaTime>

Sets the parameter delta_t in us.

Parameters:

<DeltaTime> float

Range: -500 to 500
Increment: 0.01
*RST: 0
Default unit: us

Example: `SOURce1:BB:EUTRa:UL:UE1:PRACh:SUBF2:DT 300`

Manual operation: See "Delta t/us" on page 290

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:SUBF<ch0>:STATe <State>

Enables/disables the PRACH for the selected subframe.

The subframes available for configuration depend on the selected PRACH configuration.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 0

Example: `BB:EUTR:UL:UE1:PRAC:SUBF2:STAT ON`
Activates PRACH in subframe 2 for UE1.

Manual operation: See "State" on page 290

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DATA <Data>

Selects the PUSCH data source of the selected UE. For the selected UE, this data source is used for the PUSCH channel in every subframe where this channel is configured.

Parameters:

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: `SOURce1:BB:EUTRa:UL:UE3:PUSCh:DATA PN11`

Manual operation: See "Data Source" on page 246

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:PATTern
<Pattern>, <BitCount>

Sets the bit pattern.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example: `BB:EUTR:UL:UE2:PUSC:DATA PATT`
`BB:EUTR:UL:UE2:PUSC:PATT #H3F,8`

Manual operation: See "Data Source" on page 246

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:DSELect
<Filename>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<Filename> string
Filename incl. file extension or complete file path

Example:
```
SOURce1:BB:EUTRa:UL:UE3:PUSCh:DATA DLISt
SOURce1:BB:EUTRa:UL:UE3:PUSCh:DSELect "/var/user/lte_data_list"
```

Manual operation: See "Data Source" on page 246

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:TXMode
<TxMode>

For LTE-A UEs, sets the PUSCH transmission mode according to TS 36.213.

eMTC UEs support PUSCH transmission mode M1 only.

Parameters:

<TxMode> M1 | M2

M1
Spatial multiplexing not possible

M2
Spatial multiplexing possible

*RST: M1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:PUSCh:TXMode M2
```

Options: R&S SMBV-K85

Manual operation: See "Transmission Mode" on page 246

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:NAPort
<NumAPs>

Sets the number of antenna ports for PUSCH transmission.

Use the command `[:SOURce<hw>]:BB:EUTRa:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:PUSCh:PRECoding:NAPused` on page 673 to query the number of used antenna ports.

Parameters:

<NumAPs> AP1 | AP2 | AP4

*RST: AP1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease R10
SOURce1:BB:EUTRa:UL:UE1:PUSCh:NAP AP2
SOURce1:BB:EUTRa:UL:SUBF0:ALLoc0:PUSCh:PRECoding:NAPused?
// Response: AP2
```

Options: R&S SMBV-K85

Manual operation: See "Max. Number of AP for PUSCH" on page 247

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:SCRambling:STATe <State>

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:EUTR:UL:UE2:PUSC:SCR:STAT ON`
Enables scrambling for UE2

Manual operation: See "State Scrambling (PUSCH)" on page 247

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:STATe <State>

Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:EUTR:UL:UE2:PUSC:CCOD:STAT ON`
Enables channel coding for UE2

Manual operation: See "State" on page 247

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:MODE <Mode>

Defines the information transmitted on the PUSCH.

Parameters:

<Mode> COMBined | ULSChonly | UCIonly

COMBined
Control information and data are multiplexed into the PUSCH.

ULSChonly
Only data is transmitted on PUSCH.

UCIonly
Only uplink control information is transmitted on PUSCH.

*RST: ULSChonly

Example: `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
Enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2

Manual operation: See "Mode" on page 248

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:ICQioffset <IcqiOffset>

Sets the CQI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

Parameters:

<IcqiOffset> integer

Range: 2 to 15
*RST: 2

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB
```
Enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2
```
BB:EUTR:UL:UE2:PUSC:CCOD:ICQ 5
```
Sets the CQI offset index

Manual operation: See "I_CQI_offset" on page 248

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IHARqoffset <IHarqOffset>

Sets the HARQ-ACK offset index for control information MCS offset determination according to TS 36.213.

Parameters:

<IHarqOffset> integer

Range: 0 to 14
*RST: 0

Example:
```
// enable multiplexing of the control information (UCI) and data (UL-SCH)
BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB
// set the HARQ-ACK offset index
BB:EUTR:UL:UE2:PUSC:CCOD:IHAR 5
```

Manual operation: See "I_HARQ_offset" on page 248

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:IRIoffset <IRIOffset>

Sets the RI offset index for control information MCS offset determination.

Parameters:

<IRIOffset> integer

Range: 0 to 12
*RST: 0

Example: `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`
Enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2
`BB:EUTR:UL:UE2:PUSC:CCOD:IRI 5`
Sets the RI offset index

Manual operation: See "I_RI_offset" on page 248

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:CCODing:OCQimin <ChanCodOCQIMin>

For PUSCH channel coding and multiplexing mode UCI only, sets the parameter O_CQI-Min.

Parameters:
<ChanCodOCQIMin> integer
Range: 1 to 472
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:MODE UCI
SOURce1:BB:EUTRa:UL:UE1:PUSCh:CCODing:OCQimin 7
```

Manual operation: See "O_CQI-Min" on page 248

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:STATe <UpPtsState>

Enables PUSCH transmission in the UpTPS part of the special subframe.

Parameters:
<UpPtsState> 0 | 1 | OFF | ON
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:TDD:UDConf 0
SOURce1:BB:EUTRa:TDD:SPSConf 10
SOURce1:BB:EUTRa:STATe 1

SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:UPTPs:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:UPTPs:LDMRs 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:UPTPs:NSYM 5
```

Options: R&S SMBV-K119

Manual operation: See "State" on page 249

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:LDMRs <UpPtsLessDMRS>

If enabled, the number of used demodulation reference signals (DMRS) is reduced.

Parameters:

<UpPtsLessDMRS> 0 | 1 | OFF | ON
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:STATe` on page 719.

Options: R&S SMBV-K119

Manual operation: See "Less DMRS" on page 249

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:NSYM <UpPtsNumSym>

Sets the number of symbols used for the PUSCH transmission.

Parameters:

<UpPtsNumSym> integer
Range: 1 to 472
*RST: 1

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:UPPTs:STATe` on page 719.

Options: R&S SMBV-K119

Manual operation: See "Number of Symbols" on page 249

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F4Naport?
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F5Naport?
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F1Naport <NumAPs>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F2Naport <NumAPs>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUCCh:F3Naport <NumAPs>

For LTE-A UEs, sets the number of antenna ports used for every PUCCH format transmission.

Parameters:

<NumAPs> AP1 | AP2
*RST: AP1

Example: See `[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NAPused?` on page 681

Options: F1Naport|F2Naport|F3Naport require R&S SMBV-K85
F4Naport|F5Naport require R&S SMBV-K119

Manual operation: See "Number of Antenna Ports for PUCCH per PUCCH Format" on page 241

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:POWoffset
<PowerOffset>

Sets the power offset of the demodulation reference signal (DRS) relative to the power level of the PUSCH/PUCCH allocation of the corresponding subframe.

Parameters:

<PowerOffset> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:UL:UE2:REFS:DRS:POW -2`

Manual operation: See "DRS Power Offset" on page 250

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:DWOCc
<DmrsWithOcc>

For Release 10 UEs, activate demodulation reference signal (DRS) with an orthogonal cover code (OCC) for one antenna port.

Parameters:

<DmrsWithOcc> 0 | 1 | OFF | ON

*RST: 0

Example:
```
SOURce1:BB:EUTRa:UL:UE1:RELease R10
SOURce1:BB:EUTRa:UL:UE1:REFSig:DRS:DWOCc ON
```

Options: R&S SMBV-K85

Manual operation: See "Activate DMRS with OCC for One Antenna Port" on page 250

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:DRS:ENHanced
<DmrsEnhanced>

Enables enhanced DMRS.

Parameters:

<DmrsEnhanced> 0 | 1 | OFF | ON

*RST: 0

Example:
```
// enabling mapping the DMRS sequence on each second subcarrier
SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:DRS:ENHanced 1
SOURce1:BB:EUTRa:UL:CELL0:SUBF0:ALLoc1:PUSCh:MAPPing 1
```

Manual operation: See "Enhanced DMRS" on page 250

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:STATe
<State>

Enables sending of SRS for the corresponding UE.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: OFF

Example: `BB:EUTR:UL:UE2:REFS:SRS:STAT ON`
Enables the SRS for UE2

Manual operation: See "SRS State" on page 252

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:TT0
<TType0>

Enables transmission of trigger type 0.

Parameters:

<TType0> 0 | 1 | OFF | ON

*RST: 1

Example:

```
:SOURce1:BB:EUTRa:LINK UP
:SOURce1:BB:EUTRa:UL:UE1:RELease LADV

:SOURce1:BB:EUTRa:UL:UE1:STATe 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:STATe 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:TT0 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:NAPort AP1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:CYCShift 3
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:ISRS 3
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:TRComb 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:BHOP 2

:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS2:NAPort AP2
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS2:NTRans 2
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS2:ISRS 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS2:SUBF1 1
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS2:SUBF2 3

:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS3:NAPort AP2
:SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS3:NTRans 1
```

Options: R&S SMBV-K85

Manual operation: See "Transmit Trigger Type 0" on page 252

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:POWoffset
<PowerOffset>

Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

Parameters:

<PowerOffset> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: `BB:EUTR:UL:UE2:REFS:SRS:POW -2`
Sets the sounding reference symbol power offset to -2 dB.

Manual operation: See "SRS Power Offset" on page 253

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NAPort <NumAPs>

Sets the number of antenna ports (N_{ap}) used for every SRS transmission.

Parameters:

<NumAPs> AP1 | AP2 | AP4

*RST: AP1

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:PUSCh:NAPort` on page 716

Options: R&S SMBV-K85

Manual operation: See "Number of Antenna Ports for SRS" on page 253

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:CYCShift <CyclicShift>

Sets the cyclic shift used for the generation of the sounding reference signal CAZAC sequence.

Parameters:

<CyclicShift> integer

Range: 0 to 11
*RST: 0
`<CyclicShift> = 7 to 11` if `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NKTC` 4

Example: `BB:EUTR:UL:UE2:REFS:SRS:CYCS 5`
Sets the SRS cyclic shift for UE2

Options: <CyclicShift> = 7 to 11 require R&S SMBV-K119

Manual operation: See "SRS Cyclic Shift n_CS (First AP)" on page 254

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NTRans <Transmissions>

Sets the number of SRS transmissions.

Parameters:

<Transmissions> integer

Range: 0 to (10*SeqLengthARB - 1)
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:TT0` on page 722

Options: R&S SMBV-K85

Manual operation: See "Number of Transmissions" on page 259

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:UPPTsadd <SrsUpPtsAdd>

In TDD mode, sets the parameter `srs-UpPtsAdd` and defines the number of additional SC-FDMA symbols in UpPTS.

Parameters:

<SrsUpPtsAdd> 0 | 2 | 4

*RST: 0

Example:

```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:UPPTsadd 2
```

Options: R&S SMBV-K119

Manual operation: See "SRS UpPTS Add" on page 254

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:SUBF<subfidx> <Subframe>

Sets the subframes in that SRS is transmitted.

Suffix:

<subfidx> 1 to 50
Transmission number, as set with `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NTRans`

Parameters:

<Subframe> integer

Range: 0 to (10*SeqLengthARB - 1)
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:TT0` on page 722

Options: R&S SMBV-K85

Manual operation: See "Subframes for Transmission" on page 259

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS:BHOP <BandwidthHopp>

Sets the UE-specific parameter frequency hopping bandwidth b_{hop}.

Parameters:

<BandwidthHopp> integer

Range: 0 to 3
*RST: 0

Example: `BB:EUTR:UL:UE2:REFS:SRS:BHOP 2`
Sets the SRS hopping bandwidth

Manual operation: See "Hopping Bandwidth b_hop" on page 259

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:BSRS <Bsrs>

Sets the UE-specific parameter SRS bandwidth B_{SRS}.

Parameters:

<Bsrs> integer

Range: 0 to 3
*RST: 0

Example: `BB:EUTR:UL:UE2:REFS:SRS:BSRS 2`
Sets the SRS bandwidth configuration

Manual operation: See "SRS Bandwidth B_SRS" on page 257

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:ISRS <Isrs>

Sets the UE-specific parameter SRS configuration index I_{SRS}.

Parameters:

<Isrs> integer

Range: 0 to 1023
*RST: 0

Example: `BB:EUTR:DUPL FDD`
Sets the duplexing mode
`BB:EUTR:UL:UE2:REFS:SRS:ISRS 22`
Sets the SRS configuration index

Manual operation: See "Configuration Index I_SRS" on page 254

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TSRS?

Queries the UE-specific parameter SRS periodicity T_{SRS}.

The value depends on the selected SRS configuration index I_{SRS} (`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:ISRS`) and duplexing mode (`[:SOURce<hw>]:BB:EUTRa:DUPLexing`) as defined in the TS 36.213.

Return values:
<PeriodTsrs> integer
Range: 0 to 65535
*RST: 0

Example:
```
BB:EUTR:DUPL FDD
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
BB:EUTR:UL:UE2:REFS:SRS:TSRS?
// 20
```

Usage: Query only

Manual operation: See "Periodicity T_SRS" on page 255

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TOFFset?

Queries the UE-specific parameter SRS subframe offset T_{offset}.

Return values:
<TOffset> integer
Range: 0 to 320
*RST: 0

Example:
```
BB:EUTR:DUPL FDD
```
Sets the duplexing mode
```
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
```
Sets the SRS configuration index
```
BB:EUTR:UL:UE2:REFS:SRS:TOFF?
```
Queries the SRS subframe offset
```
Response: 5
```

Usage: Query only

Manual operation: See "Subframe Offset T_offset" on page 256

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:TRComb <TransmComb>

Sets the UE-specific parameter transmission comb k_{TC}.

Parameters:
<TransmComb> integer
Range: 0 to 1
*RST: 0

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:TRC 1
```

Manual operation: See "Transmission Comb k TC" on page 259

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NKTC <TranCombNumKTC>

In TDD mode, sets the UE-specific parameter number of combs (`transmissionCombNum`).

Parameters:
<TranCombNumKTC>2 | 4

*RST: 2

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:SRS1:NKTC 2
```

Options: R&S SMBV-K119

Manual operation: See "Transmission Comb Num k TC" on page 258

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>[:CELL<ccidx>]:REFSig:SRS[<srsidx>]:NRRC <Nrrc>

Sets the UE-specific parameter `frqDomainPosition` n_{RRC}

Parameters:
<Nrrc> integer

Range: 0 to 23
*RST: 0

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:NRRC 10
```
Sets the SRS frequency domain position

Manual operation: See "Freq. Domain Position n_RRC" on page 259

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP10Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP20Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP21Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP40Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP41Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP42Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP43Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1000Map:ROW<bbid>
<AntPortMapping>

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1010Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP1020Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP100Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP200Map:ROW<bbid>
<AntPortMapping>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:APMap:AP201Map:ROW<bbid>
<AntPortMapping>

Sets which antenna port will be generated by which baseband.

Suffix:
<bbid> 0..7
Baseband

Parameters:
<AntPortMapping> 0 | 1 | OFF | ON
*RST: 0

Example: `SOURce1:BB:EUTRa:UL:UE1:APMap:AP10Map:ROW0 1`

Manual operation: See "Antenna port mapping table" on page 286

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CELL<dir0>:POFFset <UeCcPowerOffs>

Sets a power offset of the selected PCell or SCell.

Parameters:
<UeCcPowerOffs> float
Range: -80 to 10
Increment: 0.01
*RST: 0
Default unit: dB

Example: `SOURce1:BB:EUTRa:UL:UE1:CELL1:POFFset 3`

Manual operation: See "Power" on page 286

9.26 Sidelink Configuration

Option: R&S SMBV-K113

Example: Enabling sidelink transmission in communucation mode

```
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:SL:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:MODE COMM
SOURce1:BB:EUTRa:UL:UE1:SL:DATA PN9
SOURce1:BB:EUTRa:UL:UE1:SL:RESTart 1
```

```
// configure the control resource pool
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:CPERiod 40
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:OFFSetind 1
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:PRBStart 1
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:PRENd 45
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:PRBNumber 2
SOURce1:BB:EUTRa:UL:UE1:SL:RCTRl:SFBMp #HCF0AF0ACC3,40

// configure the data resource pool
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:OFFSetind 1
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:PRBStart 0
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:PRENd 49
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:PRBNumber 2
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:SFBMp #HFFFFFFFFFF,40
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:TRPTsubset #H5,3
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:HOPPingparam 1
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:NSUBbands 2
SOURce1:BB:EUTRa:UL:UE1:SL:RDATa:RBOFfset 1

// configure the synchronization signal
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:INCoverage 1
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:SLSSid 165
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:OFFSetind 1

// configure the SL control information
SOURce1:BB:EUTRa:UL:UE1:SL:NSCI 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:TXMode 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:PSCPeriod 10
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:NPSCch 10
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:SF?
// 1,2
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:FORMat?
// 0
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:FHFLag 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:RBAHoppalloc 10
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:TRP 101
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:MCS 28
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:TAINd 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:GRID 1
// configure the allocations
// PSBCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONTent?
// PSBCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONFlict?
// 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CYCShift 1
```

```
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CCODing:STATe 1

// PSCCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONTent?
// PSCCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:SF?
// 1,2
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:PHYSbits?
// 288
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONFlict?
// 0

// PSSCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:CONTent?
// PSSCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:PHYSbits?
// 288
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:CONFlict?
// 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CYCShift 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:TBSI?
// 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:TBSize?
// 32
```

Example: Enabling sidelink transmission in discovery mode

```
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:SL:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:MODE DISC

// configure the resource pool
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:CPERiod 64
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:OFFSetind 10
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:PRBStart 10
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:PRENd 45
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:PRBNumber 10
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:PRINdex 10
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:SFBMp #HEAAAA954AB,40
```

```
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:NRETrans 2
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:NREPetitions 2
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:N1PDsch 1
SOURce1:BB:EUTRa:UL:UE1:SL:RDISc:SFINdex 2

// configure the allocations
SOURce1:BB:EUTRa:UL:UE1:SL:NALLoc 2
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONT?
// PSBCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:DISCtype D1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:PSDPeriod 2
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:NPDSch 5
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SF?
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:PHYSbits?
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONFlict?
// 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CYCShift 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:PHYSbits?
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:TBSize?

SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONT?
// PSDCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:DISCtype D1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:PSDPeriod 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:NPDSch 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:SF?
// 10, 11,12
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:PHYSbits?
//576
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONFlict?
// 0
```

Example: Enabling sidelink transmission in V2X mode

Option: R&S SMBV-K119

```
SOURce1:BB:EUTRa:STDMode LTE
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:SL:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:MODE V2X
```

```
// configure the resource pool
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:OFFSet 1
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:BMPLength 20
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:BITLow #HFFF0F,20
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:ADJC 1
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:SUBChannels 3
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:SUBSize 5
SOURce1:BB:EUTRa:UL:UE1:SL:V2X:SRBSubchan 1

// configure the synchronization signal
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:INCoverage 1
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:SLSSid 165
SOURce1:BB:EUTRa:UL:UE1:SL:SYNC:OFFSetind 1

// configure the SL control information
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:TXMode 4
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:STARtsf 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:SUBChannel 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:SCI0:SF?
// 1,6
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:FORMat?
// 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:PRIRity 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:RREServation 2
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:FREQresloc 1
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:TIMGap 5
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:MCS 10
SOURce1:BB:EUTRa:UL:UE1:SL:SCI0:BITData?

// configure the allocations
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONTent?
// PSBCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SF?
// 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CYCShift 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:PHYSbits?
// 1008
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc0:CONFlict?
// 0

SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONTent?
// PSCCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:SF?
// 1,6
```

```
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CYCShift 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc01PHYSbits?
// 480
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc1:CONFlict?
// 0

SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:CONTent?
// PSSCH
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:SF?
// 1,6
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:MOD?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:CYCShift 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:PHYSbits?
// 720
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:TBSI?
// 10
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:TBSize?
// 680
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:POWer 0
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:ALLoc2:CONFlict?
// 0
```

Example: Configuring RMC

Option: R&S SMBV-K119

```
SOURce1:BB:EUTRa:STDMode LTE
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:UE1:RELease LADV
SOURce1:BB:EUTRa:UL:UE1:SL:STATe 1
SOURce1:BB:EUTRa:UL:UE1:SL:MODE v2x

SOURce1:BB:EUTRa:UL:UE1:SL:RMC:
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:RMC R821
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:ARBLocks?
// 48
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:MODulation?
// QPSK
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:PAYSize?
// 3496
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:PHYSbits?
```

```
// 11520
SOURce1:BB:EUTRa:UL:UE1:SL:RMC:STATe 1
```

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:STATe 735
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:MODE 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DATA 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DSELect 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:PATTern 736
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RESTart 737
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:CPERiod 737
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:CPERiod 737
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:OFFSetind 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:OFFSetind 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:OFFSet 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:OFFSetind 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBStart 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRENd 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBStart 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRENd 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PRBStart 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PRENd 738
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBNumber 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBNumber 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:PRBNumber 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:SFBMp 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFBMp 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRl:SFBMp 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NRETrans 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NREPetitions 739
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N1PDsch 740
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N2PDsch 740
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N3PDsch 740
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BMPLength 741
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITLow 741
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITHigh 741
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:ADJC 741
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBChannels 742
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SRBSubchan 742
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBSize 742
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFINdex 742
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRINdex 743
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:TRPTsubset 743
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:HOPPingparam 743
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:NSUBbands 743
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:RBOFfset 744
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:STATe 744
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:INCoverage 744
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:SLSSid 745
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:OFFSetind 745
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NSCI 745

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXMode 745
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PSCPeriod 746
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:NPSCch 746
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SF? 746
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FORMat 746
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:STARtsf 747
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SUBChannel 747
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:BITData? 747
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FHFLag 748
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RBAHoppalloc 748
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TRP 748
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:MCS 748
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TAINd 749
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:GRID 749
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FREQresloc 749
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PRIRity 750
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RREServation 750
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TIMGap 750
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXINdex? 751
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NALLoc 751
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONTent? 751
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:DISCtype 751
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PSDPeriod 752
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:NPDSch 752
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SF? 752
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:MODulation? 753
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PHYSbits? 753
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:POWer 753
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:STATe 753
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONFlict? 754
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CYCShift 754
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SCRambling:STATe 754
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:STATe 755
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSI? 755
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSize? 755
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:STATe 755
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:RMC 756
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:ARBLocks? 756
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:MODulation? 756
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PAYSize? 756
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PHYSbits? 757

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:STATe <State>

Enables sidelink transmission.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "State" on page 261

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:MODE <Mode>

Sets the mode of the sidelink communication.

Parameters:

<Mode> COMM | DISC | V2X

*RST: COMM

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Options: V2X requires R&S SMBV-K119

Manual operation: See "Mode" on page 261

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DATA <DataSource>

Sets the data source for the sidelink.

Parameters:

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Data Source" on page 262

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:DSELect <DataList>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DataList> string

Filename incl. file extension or complete file path

Example:

```
MMEM:CDIR "/var/user/"
SOURce1:BB:EUTRa:UL:UE1:SL:DATA DLISt
SOURce1:BB:EUTRa:UL:UE1:SL:DSELect "lte.dm_iqd"
```

Manual operation: See "Data Source" on page 262

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:PATTern <Pattern>, <BitCount>

Sets a bit pattern as data source.

Parameters:

<Pattern> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example:
```
SOURce1:BB:EUTRa:UL:UE1:SL:DATA PATT
SOURce1:BB:EUTRa:UL:UE1:SL:PATTern #H2B8,11
```

Manual operation: See "Data Source" on page 262

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RESTart <RestartEveryTra>

If enabled, the data source is restarted at each SL transmission.

Parameters:

<RestartEveryTra> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Restart Data every Transmission" on page 262

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:CPERiod <ControlPeriod>

Sets the period over which resources are allocated for sidelink control period (SC period).

Parameters:

<ControlPeriod> 32 | 64 | 128 | 256 | 512 | 1024
*RST: 32

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Control Period" on page 264

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:CPERiod <ControlPeriod>

Sets the period over which resources are allocated for sidelink control period (SC period).

Parameters:

<ControlPeriod> 40 | 60 | 70 | 80 | 120 | 140 | 160 | 240 | 280 | 320
*RST: 40

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Control Period" on page 264

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:OFFSetind <OffsetIndicator>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:OFFSetind <OffsetIndicator>

Sets the offset from the SFN=0 after that the SL control region starts.

Parameters:
<OffsetIndicator> integer
Range: 0 to 10239
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Offset Indicator" on page 264

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:OFFSet <OffsetIndicator>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:OFFSetind <OffsetIndicator>

Sets the offset from the SFN=0 after that the SL control region starts.

Parameters:
<OffsetIndicator> integer
Range: 0 to 319
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Offset Indicator" on page 264

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBStart <PrbStart>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRENd <PrbEnd>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBStart <PrbStart>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRENd <PrbEnd>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:PRBStart <PrbStart>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:PRENd <PrbEnd>

Sets the parameters `prb-Start` and `prb-End` and define allocation of the two SL bands.

Parameters:
<PrbEnd> integer
Range: 0 to 99
*RST: 99

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "PRB Start, PRB End" on page 265

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:PRBNumber <PrbNumber>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRBNumber <PrbNumber>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:PRBNumber <PrbNumber>

Sets the number of resource blocks each of the SL bands occupies.

Parameters:

<PrbNumber> integer

Range: 1 to 100
*RST: 1

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "PRB Number" on page 265

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:SFBMp <Pattern>, <BitCount>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFBMp <Pattern>, <BitCount>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RCTRI:SFBMp <Pattern>, <BitCount>

Sets the subframe bitmap.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 42
*RST: 1

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Control Subframe Bitmap/Subframe Bitmap" on page 265

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NRETrans <NumRetrans>

Sets the number of PSDCH retransmissions.

Parameters:

<NumRetrans> integer

Range: 0 to 3
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Number of Retransmission" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:NREPetitions <NumRepetitions>

Sets the number of PSDCH repetitions.

Parameters:
<NumRepetitions> integer
Range: 1 to 50
*RST: 1

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Number of Repetitions" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N1PDsch <N1PDsch>

Sets the PDSCH resource index.

Parameters:
<N1PDsch> integer
Range: 1 to 200
*RST: 1

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "N(1)PDSCH/N(2)PDSCH/N(3)PDSCH" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N2PDsch <N2PDsch>

Sets the PDSCH resource index.

Parameters:
<N2PDsch> integer
Range: 1 to 10
*RST: 1

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "N(1)PDSCH/N(2)PDSCH/N(3)PDSCH" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:N3PDsch <N3PDSCH>

Sets the PDSCH resource index.

Parameters:
<N3PDSCH> 1 | 5
*RST: 1

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "N(1)PDSCH/N(2)PDSCH/N(3)PDSCH" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BMPLength <BmpLength>

Sets the bitmap length.

To set the subframe bitmap, use the commands `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITLow` and `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITHigh`.

Parameters:

<BmpLength> 10 | 16 | 20 | 30 | 40 | 50 | 60 | 100

*RST: 16

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Subframe Bitmap Length" on page 267

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITLow <Pattern>, <BitCount>
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITHigh <Pattern>, <BitCount>

Sets the subframe bitmap.

`[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BITHigh` is enabled, if `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:BMPLength` on page 741`60|100`.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 0 to 50
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Subframe Bitmap (0 - 49)/Subframe Bitmap (50 - 100)" on page 267

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:ADJC <Adjacency>

If enabled, the PSCCH and PSSCH channels are allocated on contiguous resources.

Parameters:

<Adjacency> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Adjacent PSCCH/PSSCH" on page 268

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBChannels <NumSubchannels>

Sets the number of subchannels.

Parameters:
<NumSubchannels> 1 | 3 | 5 | 8 | 10 | 15 | 20
*RST: 1

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Number of Subchannels" on page 268

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SRBSubchan <StartRbSubchan>

Sets the first RB in the subchannel.

Parameters:
<StartRbSubchan> integer
Range: 0 to 99
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Start RB Subchannel" on page 268

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:V2X:SUBSize <SubchannelSize>

Sets the number of resource blocks the subchannel spans.

Parameters:
<SubchannelSize> 4 | 5 | 6 | 8 | 9 | 10 | 12 | 15 | 16 | 18 | 20 | 25 | 30 | 48 | 50 | 72 | 96 | 75 | 100 | 32
*RST: 5

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Subchannel Size" on page 268

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:SFINdex <SfIndex>

Sets the subframe index.

Parameters:
<SfIndex> integer
Range: 0 to 209
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Subframe Index" on page 266

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDISc:PRINdex <PrbIndex>

Sets the physical resource block index.

Parameters:
<PrbIndex> integer
Range: 0 to 49
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "PRB Index" on page 267

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:TRPTsubset <TrptSubset>

The TRTP subset is a time resources pattern that indicates the set of available subframes to be used for sidelink communication.

Parameters:
<TrptSubset> 5 bits

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "TRPT Subset" on page 271

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:HOPPingparam
<HoppingParam>

Sets the frequency hopping parameter.

Parameters:
<HoppingParam> integer
Range: 0 to 504
*RST: 0

Manual operation: See "Hopping Parameter" on page 271

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:NSUBbands <NumSubbands>

Sets the number of subbands.

Parameters:
<NumSubbands> 1 | 2 | 4
*RST: 1

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Number of Subbands" on page 271

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RDATa:RBOFfset <RbOffset>

Shifts the band in the frequency domain by the selected number of resource blocks (RB).

Parameters:
<RbOffset> integer
Range: 0 to 98
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "RB Offset" on page 271

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:STATe <SlSyncState>

Enables the synchronization signals.

Parameters:
<SlSyncState> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Synchronization State" on page 274

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:INCoverage <InCoverage>

Sets the in-coverage flag.

Parameters:
<InCoverage> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "In-coverage Flag" on page 275

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:SLSSid <SlssId>

Sets the sidelink synchronization signal ID.

Parameters:

<SlssId> integer

Range: 0 to 335
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SLSS ID" on page 275

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SYNC:OFFSetind <OffsetInd>

Sets the parameter `syncOffsetIndicator`.

Parameters:

<OffsetInd> integer

Range: 0 to 159
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Sync Offset Indicator" on page 275

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NSCI <SciNumConfigs>

Sets the number of SCI (SL control information) configurations.

Parameters:

<SciNumConfigs> integer

Range: 0 to 49
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Number of SCI Config" on page 276

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXMode <SciTxMode>

Sets the transmission mode of the SL transmission.

Parameters:

<SciTxMode> 1 | 2 | 3 | 4

*RST: 1

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Options: 3|4 require R&S SMBV-K119

Manual operation: See "SL Tx Mode" on page 276

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PSCPeriod
<SciPscchPeriod>

Sets the PSCCH period.

Parameters:
<SciPscchPeriod> integer
Range: 0 to 99
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "PSCCH Period" on page 276

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:NPSCch <SciNPscch>

Sets the parameter n_PSCCH and determines the resources in the time and the frequency domain that a transmitting UE uses for the PSCCH transmission.

Parameters:
<SciNPscch> integer
Range: 0 to 2100
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "n_PSCCH" on page 276

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SF?

Queries the subframe numbers of the subframes that can be used for SL transmission.

Return values:
<SciSF> string
List of SF numbers, separated by commas

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "SF" on page 277

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FORMat <SciFormat>

Queries the SCI (SL control information) format.

Parameters:
<SciFormat> 0
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format" on page 277

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:STARtsf <StartSf>

Sets the first subframe used for the SL transmission.

Parameters:
<StartSf> integer
Range: 0 to 655650
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Start SF" on page 277

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:SUBChannel <Subchannel>

Sets the used subchannel.

Parameters:
<Subchannel> integer
Range: 0 to 19
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "Subchannel" on page 277

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:BITData?

Queries the resulting bit data as configured with the `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>` commands.

Return values:
<BitData> bit pattern

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Bit Data" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FHFLag <SlFreqHopping>

Sets the DCI field frequency hopping flag. If enabled, frequency hopping is used for the PSSCH transmission.

Parameters:

<SlFreqHopping> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RBAHoppalloc <RbaAndHoppAlloc>

Sets the DCI field resource block (RBA) and hopping resource allocation.

This field identifies which resource blocks, within the subframes indicated by the time resource pattern ITRP, are used for PSSCH transmission.

Parameters:

<RbaAndHoppAlloc> integer

Range: 0 to 8191

*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TRP <TimeResPattern>

Sets the DCI field time resource pattern (ITPR).

Parameters:

<TimeResPattern> integer

Range: 0 to 127

*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:MCS <ModCodScheme>

Sets the 5-bits indicator of the modulation and coding scheme (MSC) used for the PSSCh transmission.

Parameters:
<ModCodScheme> integer
Range: 0 to 28
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278
See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TAINd <TimingAdvanceIn>

Sets the 11-bits timing advance indicator.

Parameters:
<TimingAdvanceIn> integer
Range: 0 to 2047
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:GRID <GroupDestID>

Sets the 8-bits group destination ID, indicating the group for which the sidelink communication is intended.

Parameters:
<GroupDestID> integer
Range: 0 to 255
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "SCI Format 0" on page 278

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:FREQresloc
<FreqResLocation>

Sets the frequency resource location of initial transmission and retransmission field.

Parameters:
<FreqResLocation> integer
Range: 0 to 255
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:PRIRity <Priority>

Sets the priority field.

Parameters:

<Priority> integer

Range: 0 to 7
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:RREServation <ResReservation>

Sets the resource reservation field.

Parameters:

<ResReservation> integer

Range: 0 to 12
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TIMGap <TimeGap>

Sets the field time gap between initial transmission and the retransmission.

Parameters:

<TimeGap> integer

Sets the time gap Sf_{gap}, where Sf_{gap} = 0 indicates single transmission.

Range: 0 to 15
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Options: R&S SMBV-K119

Manual operation: See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:SCI<ch0>:TXINdex?

Sets the retransmission index filed.

Return values:
<TxIndex> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabling sidelink transmission in V2X mode" on page 731.

Usage: Query only

Options: R&S SMBV-K119

Manual operation: See "SCI Format 1" on page 279

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:NALLoc <NumTransmission>

In discovery mode, sets the number of sidelink transmissions.

Parameters:
<NumTransmission> integer
Range: 0 to 100
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Number of Transmissions" on page 281

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONTent?

Queries the allocation content.

Return values:
<Content> PSCCh | PSSCh | PSDCh | PSBCh
*RST: PSCCh

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Content" on page 282

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:DISCtype
<DiscoveryType>

In discovers mode, sets one of the discovery types, type 1 or type 2B.

Parameters:
<DiscoveryType> D1 | D2B
*RST: D1

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "Discovery Type" on page 282

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PSDPeriod
<PsdchPeriod>

In discovery mode, sets the period of the PSDCH.

Parameters:
<PsdchPeriod> integer
Range: 0 to 100
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "PSDCH Period" on page 282

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:NPDSch <NPsdch>

In discovery mode and depending on the discovery type, sets one of the parameters:

- n_PSDCH applies for discovery type 1
- n' - for discovery type 2B.

Parameters:
<NPsdch> integer
Range: 0 to 2100
*RST: 0

Example: See Example "Enabling sidelink transmission in discovery mode" on page 730.

Manual operation: See "n_PSDCH/n'" on page 282

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SF?

Queries the subframe numbers of the allocated subframe.

Return values:
<SF> string

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "SF" on page 282

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:MODulation?

Queries the used modulation scheme.

Return values:
<Modulation> QPSK | QAM16
*RST: QPSK

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Modulation" on page 283

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:PHYSbits?

Queries the number of physical bits occupied by the channel.

Return values:
<PhysBits> integer
Range: 0 to 1E5
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Physical Bits" on page 283
See "Number of Physical Bits" on page 285

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:POWer <Power>

Sets the power of the selected channel.

Parameters:
<Power> float
Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "Power" on page 283

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:STATe <State>

Enables the transmission of the selected channel.

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "State" on page 283

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CONFlict?

Queries if there is a conflict.

Return values:

<Conflict> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Conflict" on page 283

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CYCShift <CyclicShift>

Sets the cyclic shift used by the generation of the DRS (discovery reference signal) sequence.

Parameters:

<CyclicShift> integer

Value range depens on the sidelink mode.
In communication mode, cyclic shift of 0 is used.
In V2X communication mode, the value for PSCCH is one of the following {0, 3, 6, 9}.

Range: 0 to 9
Increment: 3
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "DRS > Cyclic Shift" on page 284

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:SCRambling:STATe <ScramState>

Enables scrambling.

Parameters:

<ScramState> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "State" on page 284

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:STATe <ChanCodState>

Enables channel coding.

Parameters:
<ChanCodState> 0 | 1 | OFF | ON

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Manual operation: See "State" on page 284

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSI?

Queries the transport block index.

Return values:
<ChanCodTBIndex> integer
Range: 0 to 26
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Transport Block Index" on page 285

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:ALLoc<ch0>:CCODing:TBSize?

Queries the transport block size.

Return values:
<ChanCodTBSize> integer
Range: 0 to 75376
*RST: 0

Example: See Example "Enabling sidelink transmission in communucation mode" on page 728.

Usage: Query only

Manual operation: See "Transport Block Size" on page 285

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:STATe <RmcState>

Activates the selected RMC.

Parameters:
<RmcState> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Configuring RMC" on page 733.

Manual operation: See "State" on page 272

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:RMC <Rmc>

Selects the RMC.

Parameters:

<Rmc> R821 | R822 | R823

*RST: R821

Example: See Example "Configuring RMC" on page 733.

Manual operation: See "RMC" on page 273

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:ARBLocks?

Queries the allocated resource blocks.

Return values:

<AllocResBlocks> integer

Range: 0 to 48

*RST: 0

Example: See Example "Configuring RMC" on page 733.

Usage: Query only

Manual operation: See "Allocated Resource Blocks" on page 273

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:MODulation?

Queries the used modulation scheme.

Return values:

<RmcModulation> QPSK | QAM16 | QAM64 | QAM256 | QAM1024

*RST: QPSK

Example: See Example "Configuring RMC" on page 733.

Usage: Query only

Manual operation: See "Modulation" on page 273

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PAYSize?

Queries the payload size.

Return values:

<PayloadSize> integer

Range: 3496 to 31704

*RST: 3496

Example: See Example "Configuring RMC" on page 733.

Usage: Query only

Manual operation: See "Payload Size" on page 273

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:SL:RMC:PHYSbits?

Queries the number of physical bits per subframe.

Return values:

<RmcPhysBits> integer

Range: 11520 to 46080
*RST: 11520

Example: See Example "Configuring RMC" on page 733.

Usage: Query only

Manual operation: See "Pysical Bits per Subframe" on page 273

9.27 eMTC/NB-IoT Commands

Option: R&S SMBV-K115

Programming examples

Example: NB-IoT anchor carrier in standalone mode

```
*RST
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:SLENgth 40
SOURce1:BB:EUTRa:DL:BW BW0_20

// Antenna ports configuration
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:NIOT:CONFig TX2
SOURce1:BB:EUTRa:DL:MIMO:APM:MAPCoordinates CART
SOURce1:BB:EUTRa:DL:MIMO:APM:CS:AP2000:ROW0:REAL 1
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1

// PCI, NPSS and NSSS configuration
SOURce1:BB:EUTRa:DL:PLCI:CID 100
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:CELL 200
SOURce1:BB:EUTRa:DL:SYNC:TXANtenna ALL
SOURce1:BB:EUTRa:DL:SYNC:NIOT:TXANtenna TX2
SOURce1:BB:EUTRa:DL:SYNC:NIOT:TXANtenna ALL
SOURce1:BB:EUTRa:DL:SYNC:NIOT:NPPWr 0
SOURce1:BB:EUTRa:DL:SYNC:NIOT:NSPWr 0

// NB-IoT carrier configuration
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:MODE?
```

```
// ALON
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:STATe?
// 1
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:NVSF?
// N10
// enable all subframes
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SFALl
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SF0:VALSf?
// 0
// reserved for NPBCH
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SF1:VALSf?
// 1
// common serach space configration
SOURce1:BB:EUTRa:DL:NIOT:PAG:RMAX R4
SOURce1:BB:EUTRa:DL:NIOT:RAND:RMAX R4
SOURce1:BB:EUTRa:DL:NIOT:RAND:STSFrame S4
SOURce1:BB:EUTRa:DL:NIOT:RAND:SSOFfset O1_8

SOURce1:BB:EUTRa:STATe 1
```

Example: NB-IoT carriers in in-band mode

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:SLENgth 40
SOURce1:BB:EUTRa:DL:BW BW5_00

SOURce1:BB:EUTRa:DL:NIOT:LTECell:STATe 1

// SOURce1:BB:EUTRa:DL:NIOT:GAP:CONFig:STATe 1
// SOURce1:BB:EUTRa:DL:NIOT:GAP:PERiodicity 64
// SOURce1:BB:EUTRa:DL:NIOT:GAP:THReshold 32
// SOURce1:BB:EUTRa:DL:NIOT:GAP:DURation:COEFficent 1_8

// Enabling the anchor carrier and one dummy carrier
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:STATe 1
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:MODE INBD
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:MODE INBD
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:RBIDx 2
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:DFReq?
// -1807500
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:RBIDx 7
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:DFReq?
// -907500
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:CRSSeq?
// 5
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:CELL 200
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:CIDGroup?
// 66
SOURce1:BB:EUTRa:DL:NIOT:ID?
// 2
```

```
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:NVSF N40
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SFALl
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:STATe 1
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:NVSF N10
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:SFALl

SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SF0:VALSf?
// 0
// reserved for NPBCH
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:SF1:VALSf?
// 1
// common search space configration
SOURce1:BB:EUTRa:DL:NIOT:PAG:RMAX R4
SOURce1:BB:EUTRa:DL:NIOT:RAND:RMAX R4
SOURce1:BB:EUTRa:DL:NIOT:RAND:STSFrame S4
SOURce1:BB:EUTRa:DL:NIOT:RAND:SSOFfset O1_8

SOURce1:BB:EUTRa:STATe 1
SOURce1:BB:EUTRa:SETTing:STORe "/var/user/iot_inband"
```

Example: NB-IoT UE configuration

```
SOURce1:BB:EUTRa:DL:USER1:RELease NIOT
// UE-specific search space
SOURce1:BB:EUTRa:DL:USER1:NIOT:RMAX R4
SOURce1:BB:EUTRa:DL:USER1:NIOT:STSFrame S1_5
SOURce1:BB:EUTRa:DL:USER1:NIOT:SSOFfset O0
SOURce1:BB:EUTRa:DL:USER1:UEID 50
SOURce1:BB:EUTRa:DL:USER1:UEC?
// NB1
SOURce1:BB:EUTRa:DL:USER1:CCODing:STATe?
// 1
SOURce1:BB:EUTRa:DL:USER1:DATA PN9
// SOURce1:BB:EUTRa:DL:USER1:DATA DLIS
// SOURce1:BB:EUTRa:DL:USER1:DSELect "/var/user/UE1_NBIoT.dm_iqd"
```

Example: DCI format N0 configuration

DCI format N0 is used for scheduling of NPUSCH in one UL cell. If DCI format N0 is activated, one NPDCCH is configured and activated automatically.

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:NALLoc 1

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:UEID?
// 50
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:FMT N0
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SSP UE
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:STSF 0
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:STSF?
// 6
// first allowed subframe number is calculated automatically
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:FMT?
// 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:CCES?
// 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDCCe?
// 0

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SCINd 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IRU 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDELay 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:MCSCheme 6
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:RVERsion 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NDINd 0
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPUSch:IREP 3
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:HPNMber 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:REP?
// 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NRUNits?
// 3
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "000 0010 0101 0011 0101 1010"

// NPDCCH allocation is the third allocation
// NPBCH is always the first allocation
// NPDSCH carring SIB1-NB is the second one
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CONType?
// NPDC
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SFList?
// "6, 7, 8, 11"
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STSYmbol SYM1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PHYSbits?
// 232
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:DATA?
```

```
// USER1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:POWer 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STATe?
// 1

SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:SCHeme TXD
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:NOLayers?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:TBSize?
// 88
```

Example: NPDCCH and NPDSCH DCI-based configuration (DCI format N1)

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:NALLoc 1

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:UEID?
// 50
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:FMT N1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SSP UE
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:STSF 6
// first allowed subframe number is calculated automatically
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:FMT?
// 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:CCES?
// 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDCCe?
// 0

// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:OIND 1
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPRach:SNUMber 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPRach:SCINd 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "111 0000 0101 1111 1111 1111"

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:OIND 0
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDELay 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:ISF 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:MCSCheme 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:IREP 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NDINd 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:HACK 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NREP?
// 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NSF?
// 3
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:TBSZ?
```

```
// 208
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "100 1001 0010 0001 0100 0110"

SOURce1:BB:EUTRa:DL:NIOT:NALLoc?
// 4
// NPDCCH allocation is the third allocation
// NPBCH is always the first allocation
// NPDSCH carring SIB1-NB is the second one
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:RBIDx?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CONType?
// NPDC
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SFList?
// "6, 7, 8, 11"
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STSYmbol SYM1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PHYSbits?
// 256
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:DATA?
// USER1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:POWer 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CONFlict?
// 0

SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:SCHeme TXD
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:NOLayers?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:TBSize?
// 208

// NPDSCH allocation is the fourth allocation
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CONType?
// NPDS
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SFList?
// "26, 27, 28, 31..."
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:PHYSbits?
// 232
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:DATA?
// USER1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:STSYmbol SYM3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:POWer 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:PRECoding:SCHeme NONE
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SCRambling:STATe 1
```

```
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SCRambling:UEID?
// 50
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:ISF?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:NSF?
// 3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:TBSI?
// 4
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:TBSize?
// 208
```

Example: DCI format N2 configuration

DCI format N2 is paging and direct indication. If DCI format N2 is activated, one NPDCCH is configured and activated automatically.

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:NALLoc 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:UEID?
// 65534
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:FMT?
// N2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SSP?
// T1CM
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:STSF 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:FMT?
// 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:CCES?
// 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDCCe?
// 0

// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:PAG 0
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SIME 1
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SINF 1
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:PAG 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:ISF 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:MCSCheme 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:IREP 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:TBSZ?
// 208
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NSF?
// 3
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NREP?
// 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:REP?
// 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "101 0010 0001 0010"
```

Example: NPBCH and SIB1-NB configuration

```
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:SFList?
// "0, 10, 20, 30..."
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:STSYmbol?
// SYM3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:PHYSbits?
// 200
// NPBCH always uses 200 bits
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:DATA?
// MIB
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:POWer 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:STATe?
// 1

SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:PRECoding:SCHeme NONE
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:SCRambling:SROT 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:PHYSbits?
// 200
SOURce1:BB:EUTRa:DL:NIOT:CCODing:MIB 1
SOURce1:BB:EUTRa:DL:NIOT:CCODing:SOFFset 16
SOURce1:BB:EUTRa:DL:NIOT:CCODing:SIB 0
SOURce1:BB:EUTRa:DL:NIOT:CCODing:RSIB?
// 4
SOURce1:BB:EUTRa:DL:NIOT:CCODing:NCID?
// 200
// as set for the anchor carrier with the command
// SOURce1:BB:EUTRa:DL:CARRier1:NIOT:CELL
SOURce1:BB:EUTRa:DL:NIOT:CCODing:STFSib1?
// 0
SOURce1:BB:EUTRa:DL:NIOT:CCODing:MSPare #H000,11
SOURce1:BB:EUTRa:DL:NIOT:ALLoc0:CCODing:TBSize?
// 34

SOURce1:BB:EUTRa:DL:NIOT:ALLoc1:SFList?
// "4, 24, 44, 64..."
SOURce1:BB:EUTRa:DL:NIOT:ALLoc1:STSYmbol?
// SYM3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc1:PHYSbits?
// 208
// numer of bits used by NPDSCH carring SIB-NB
SOURce1:BB:EUTRa:DL:NIOT:ALLoc1:DATA?
// SIB1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc1:STATe?
// 1
```

Example: NPDCCH and NPDSCH DCI-based configuration (DCI format N1)

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:NALLoc 1

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:UEID?
// 50
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:FMT N1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SSP UE
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:STSF 6
// first allowed subframe number is calculated automatically
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:FMT?
// 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:CCES?
// 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDCCe?
// 0

// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:OIND 1
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPRach:SNUMber 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPRach:SCINd 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
// SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "111 0000 0101 1111 1111 1111"

SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDCch:OIND 0
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:IDELay 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:ISF 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:MCSCheme 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:IREP 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NDINd 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:HACK 1
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:SFRPt 2
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NREP?
// 4
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:NPDSch:NSF?
// 3
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:TBSZ?
// 208
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:BITS?
// "100 1001 0010 0001 0100 0110"

SOURce1:BB:EUTRa:DL:NIOT:NALLoc?
// 4
// NPDCCH allocation is the third allocation
// NPBCH is always the first allocation
// NPDSCH carring SIB1-NB is the second one
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:RBIDx?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CONType?
// NPDC
```

```
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SFList?
// "6, 7, 8, 11"
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STSYmbol SYM1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PHYSbits?
// 256
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:DATA?
// USER1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:POWer 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CONFlict?
// 0

SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:SCHeme TXD
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:PRECoding:NOLayers?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc2:CCODing:TBSize?
// 208

// NPDSCH allocation is the fourth allocation
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CONType?
// NPDS
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SFList?
// "26, 27, 28, 31..."
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:PHYSbits?
// 232
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:DATA?
// USER1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:STSYmbol SYM3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:POWer 0
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:PRECoding:SCHeme NONE
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SCRambling:STATe 1

SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:SCRambling:UEID?
// 50
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:STATe?
// 1
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:ISF?
// 2
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:NSF?
// 3
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:TBSI?
// 4
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:CCODing:TBSize?
// 208
```

Example: NPUSCH and NDRS configuration

```
SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:BW BW1_40

SOURce1:BB:EUTRa:UL:UE1:STATe 1
SOURce1:BB:EUTRa:UL:UE1:RELease NIOT
SOURce1:BB:EUTRa:UL:UE1:MODE STD
SOURce1:BB:EUTRa:UL:UE1:NIOT:SCSPacing S375
SOURce1:BB:EUTRa:UL:UE1:NIOT:MODE INBD
SOURce1:BB:EUTRa:UL:UE1:NIOT:RBINdex 5
SOURce1:BB:EUTRa:UL:UE1:NIOT:DFReq?
// 450000
SOURce1:BB:EUTRa:UL:UE1:NIOT:NTRansmiss 2
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:FORMat F1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:MODulation PI4Q
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:STSFrame 0
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:REPetitions R1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:NRUNits RU1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:SIRF 10
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:POW 0
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:NSCarriers?
// 1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:NSLTs?
// 16
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:STSCarrier?
// 10
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:STSLot?
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:FORMat F2
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:MODulation PI2B
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:STSFrame 32
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:REPetitions R2
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:SIRF 0
SOURce1:BB:EUTRa:UL:UE1:NIOT:ARB:SUGGested?
// 5
SOURce1:BB:EUTRa:SLENgth 5

SOURce1:BB:EUTRa:UL:UE2:STATe 1
SOURce1:BB:EUTRa:UL:UE2:MODE STD
SOURce1:BB:EUTRa:UL:UE2:RELease NIOT
SOURce1:BB:EUTRa:UL:UE2:NIOT:SCSPacing S15
SOURce1:BB:EUTRa:UL:UE2:NIOT:MODE INBD
SOURce1:BB:EUTRa:UL:UE2:NIOT:RBINdex 5
SOURce1:BB:EUTRa:UL:UE2:NIOT:NTRansmiss 2
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:FORMat F1
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs1:MODulation QPSK
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs1:REPetitions R2
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs1:NRUNits RU3
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs1:SIRF 17
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs2:FORMat F2
```

```
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs2:STSFrame 12
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs2:REPetitions R4
SOURce1:BB:EUTRa:UL:UE2:NIOT:TRANs2:SIRF 0

SOURce1:BB:EUTRa:UL:UE1:NIOT:NPSSim 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:DATA PN9
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:HARQ:PATTern #H1,1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:HARQ:BITS?
// 1
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs2:HARQ:CBITs?
// 16

SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:PUSCh:TBINdex 10
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:PUSCh:RVINdex 2
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:PUSCh:PHYSbits?
// 192
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:PUSCh:RUINdex?
// 0
SOURce1:BB:EUTRa:UL:UE1:NIOT:TRANs1:PUSCh:TBSize?
// 144

SOURce1:BB:EUTRa:UL:UE1:CELL0:REFSig:DRS:POWoffset 0
SOURce1:BB:EUTRa:UL:UE1:NIOT:GHDisable 0

SOURce1:BB:EUTRa:UL:REFSig:DRS:GHOPping 1
SOURce1:BB:EUTRa:UL:REFSig:DRS:DSEQshift 1
SOURce1:BB:EUTRa:UL:REFSig:DRS:TTCShift 2
SOURce1:BB:EUTRa:UL:REFSig:DRS:STCShift 3
SOURce1:BB:EUTRa:UL:REFSig:DRS:USEBase 1
SOURce1:BB:EUTRa:UL:REFSig:DRS:TTBSequence 10
SOURce1:BB:EUTRa:UL:REFSig:DRS:STBSequence 11
SOURce1:BB:EUTRa:UL:REFSig:DRS:TWBSequence 20
```

Example: NPRACH configuration

```
SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:BW BW5_00
SOURce1:BB:EUTRa:UL:PRACh:NIOT:PFMT F0
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG0:PERD 80
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG0:STTM 8
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG0:REP R2
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG0:SUBC 24
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG0:SCOF 2
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG1:REP R2
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG1:SUBC 24
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG1:SCOF 12
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG2:REP R16
SOURce1:BB:EUTRa:UL:PRACh:NIOT:CFG2:SUBC 48
SOURce1:BB:EUTRa:UL:UE1:RELease NIOT
SOURce1:BB:EUTRa:UL:UE1:MODE PRAC
SOURce1:BB:EUTRa:UL:UE1:PRACh:NIOT:MOD INBD
SOURce1:BB:EUTRa:UL:UE1:PRACh:NIOT:RBID 24
SOURce1:BB:EUTRa:UL:UE1:PRACh:NIOT:DFReq?
// 2.16  (value in MHz)
SOURce1:BB:EUTRa:UL:UE1:PRACh:NIOT:PRATtempts 1
SOURce1:BB:EUTRa:UL:UE1:PRACh:ATT0:NIOT:CONFig 0
SOURce1:BB:EUTRa:UL:UE1:PRACh:ATT0:NIOT:SFSTart 8
SOURce1:BB:EUTRa:UL:UE1:PRACh:ATT0:NIOT:POWer 0
SOURce1:BB:EUTRa:UL:UE1:PRACh:ATT0:NIOT:INIT 13
SOURce1:BB:EUTRa:UL:UE1:PRACh:ATT0:NIOT:STRT?
// 14
SOURce1:BB:EUTRa:UL:UE1:PRACh:NIOT:ARB:SUGGested?
// 2
SOURce1:BB:EUTRa:SLENgth 2
SOURce1:BB:EUTRa:STATe 1
```

Example: Using FRC

Activate a predefined fixed reference channel.

```
SOURce1:BB:EUTRa:UL:UE1:RELease NIOT
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:STATe 1
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:TYPE A141
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:SCSPacing?
// S15
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:NOSCarriers?
// 1
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:MODulation?
// PI2Bpsk
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:NNPRep?
// 1
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:TBSSindex?
// 0
```

```
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:PASize?
// 32
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:ALResunits?
// 2
SOURce1:BB:EUTRa:UL:UE1:NOIT:FRC:BPResunit?
// 96
```

Example: eMTC valid subframes and hopping configuration

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:SLENgth 40
SOURce1:BB:EUTRa:DL:BW BW5_00

// set cell-specific settings
SOURce1:BB:EUTRa:DL:PLCI:CID 110
SOURce1:BB:EUTRa:DL:PLCI:CIDGroup 36
SOURce1:BB:EUTRa:DL:PLCI:PLID 2
SOURce1:BB:EUTRa:DL:CPC NORM
SOURce1:BB:EUTRa:DL:PDSCh:PB 1
SOURce1:BB:EUTRa:DL:PBCH:RATBa 0
SOURce1:BB:EUTRa:DL:CSETtings:RARNti 25
SOURce1:BB:EUTRa:DL:REFSig:FPOWer 0

// PSS and SS settings
SOURce1:BB:EUTRa:DL:SYNC:TXANtenna ALL
SOURce1:BB:EUTRa:DL:SYNC:PPOWer 0
SOURce1:BB:EUTRa:DL:SYNC:SPOWer 0

// eMTC valid subframes
SOURce1:BB:EUTRa:DL:EMTC:BMP:SUBFrames 10
SOURce1:BB:EUTRa:DL:EMTC:BMP:STARt 2
SOURce1:BB:EUTRa:DL:EMTC:BMP:SUBFrame2 1
...

// PBCH scheduling and hopping
SOURce1:BB:EUTRa:DL:EMTC:BMP:SIBBr 1
SOURce1:BB:EUTRa:DL:EMTC:BMP:PBCHrep 1

// PDSCH and MPDCC hopping
SOURce1:BB:EUTRa:DL:EMTC:NNBands?
// 4
SOURce1:BB:EUTRa:DL:EMTC:NB:HOPPing 2
SOURce1:BB:EUTRa:DL:EMTC:NB:HOFFset 1
SOURce1:BB:EUTRa:DL:EMTC:NB:IVLA H1
SOURce1:BB:EUTRa:DL:EMTC:NB:IVLB H2
SOURce1:BB:EUTRa:DL:EMTC:NB:RHOPpping 1
SOURce1:BB:EUTRa:DL:EMTC:NB:PHOPping 1
SOURce1:BB:EUTRa:DL:EMTC:NB:RSTNb 2
SOURce1:BB:EUTRa:DL:EMTC:NB:PSTNb 2
```

```
// common search space configuration
SOURce1:BB:EUTRa:DL:EMTC:SSP:MPD1 8
SOURce1:BB:EUTRa:DL:EMTC:SSP:MPD2 16
SOURce1:BB:EUTRa:DL:EMTC:SSP:STSF S1
SOURce1:BB:EUTRa:DL:EMTC:SSP:PDSA 16
SOURce1:BB:EUTRa:DL:EMTC:SSP:PDSB NON

// Transmission antennas and antenna port mapping
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1

SOURce1:BB:EUTRa:STATe 1
SOURce1:BB:EUTRa:SETTing:STORe "/var/user/emtc_hopping"
```

Example: eMTC UE configuration

```
// Transmission antennas and antenna port mapping
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1

SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:DL:USER1:RELease EM_A
SOURce1:BB:EUTRa:DL:USER1:UEID 10
SOURce1:BB:EUTRa:DL:USER1:UEC?
// M1
SOURce1:BB:EUTRa:DL:USER1:CELL0:TXM M6
SOURce1:BB:EUTRa:DL:USER1:CCODing:STATe?
// 1
SOURce1:BB:EUTRa:DL:USER1:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:USER1:DATA PN11
// SOURce1:BB:EUTRa:DL:USER1:DATA DLIS
// SOURce1:BB:EUTRa:DL:USER1:DSELect "/var/user/UE1_eMTC.dm_iqd"
```

Example: Configuring the MPDCCH sets

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:STDMode IOT

// enable an eMTC UE, e.g. supporting eMTC CE Mode A
SOURce1:BB:EUTRa:DL:USER1:RELease EM_A

SOURce1:BB:EUTRa:DL:USER1:EPDCch1:STATe 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:STATe 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET2:STATe 1

SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:TTYP LOC
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:PRBS PRB2
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:RBA 2
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:NID 22
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:POWer 0
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:HOPPing 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STNB 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:REPMpdcch 16
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STSF S1

// MPDCCH allocations are configured automatically,
// depending on the eMTC DCI configuration
```

Example: MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)

The user UE1 is configured as described in Example "eMTC UE configuration" on page 772.

```
SOURce1:BB:EUTRa:DL:EMTC:DCI:NALLoc 1
// DCI configuration
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:UEID?
// 10
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:MPDCchset MPD1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F61A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:SSP UE
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:STSFrame 0
// first allowed subframe number is calculated automatically
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PDCCh 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:IDCCe 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:CCES?
// 4
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:NDCCes?
// 4

// UE-specific search space for MPDCCH
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:HOPPing 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STNB 1
```

```
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:REPMpdcch 16
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STSF S1

// PDSCH configuration via DCI format 6-1A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:UEMode STD
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PFRHopp 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:RBA 32
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:MCS 5
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:NREP 3
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:HARQ 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:NDINd 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:RVER 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:TPCPusch 1
// SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:DAINdex 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:TPCPusch 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PMIConfirm 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:TPMPrec 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:CSIRequest 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:SRSRequest 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:HRESoffset 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:SFRNumber 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:BITS?
// "011 0101 0101 0101 0110 1010 1000 0011"
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:TBS?
// 72
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:REPMpdcch?
// 4
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:REPPdsch?
// 16
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PDSHopping?
// 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:STRV?
// 3

SOURce1:BB:EUTRa:DL:EMTC:NALLoc?
// 4
// MPDCCH allocation is the third allocation
// PBCH is always the first allocation
// if activated, PDSCH carring SIB1-BR is the second one

// MPDCCH allocation
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:CONType?
// MPD
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:STSFrame?
// 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:ABSFrame?
// 4
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:STNB?
// 1
```

```
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:STSYmbol?
// 2
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:PHYSbits?
// 436
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:DATA?
// USER1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:POWer 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:STATe?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc2:CONFlict?
// 0

// PDSCH allocation not carrying SIB-BR is the fourth allocation
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CONType?
// PDSC
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PHYSbits?
// 264
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:DATA?
// USER1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:ABSFrame?
// 16
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:STSFrame?
// 5
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:NORB?
// 6
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:OVRB?
// 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:STSYmbol?
// 2
...
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:POWer 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:STATe?
// 1

SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:SCHeme?
// SPM
// because User 1 uses Tx mode TM6
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:NOLayers?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:CCD NOCD
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:CBINdex 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:SCRambling:STATe 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:SCRambling:UEID?
// 10
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CCODing:TBSI?
// 5
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CCODing:TBSize?
// 72
```

Example: PBCH and SIB1-BR configuration

```
// PBCH scheduling and hopping
SOURce1:BB:EUTRa:DL:EMTC:BMP:SIBBr 1
SOURce1:BB:EUTRa:DL:EMTC:BMP:PBCHrep 1

SOURce1:BB:EUTRa:DL:EMTC:DCI:NALLoc 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER USER1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:UEID?
// 10
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F61A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:SSP UE
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:STSFrame 0
// first allowed subframe number is calculated automatically
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PDCCh 2
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:IDCCe 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:CCES?
// 2

SOURce1:BB:EUTRa:DL:EMTC:NALLoc?
// 4
// PBCH is always the first allocation
// if enabled, PDSCH carring SIB1-BR is the second one

// PBCH allocation
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CONType?
// PBCH
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:STSFrame?
// 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:STSYmbol?
// 2
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:PHYSbits?
// 480
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:DATA?
// MIB
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:POWer 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:STATe?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CONFlict?
// 0

// Transmission antennas and antenna port mapping
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1


// Precoding for two Tx antennas
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:PRECoding:SCHeme TXD
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:PRECoding:NOLayers?
// 2
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:SCRambling:STATe 1
```

```
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:SCRambling:UEID?
// 10

SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:STATe 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:MIB 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:SOFFset 60

SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:SIB?
// 1
// resembles the value set with SOURce1:BB:EUTRa:DL:EMTC:BMP:SIBBr
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:RSIB?
// 4
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:MSPare #H00,5
SOURce1:BB:EUTRa:DL:EMTC:ALLoc0:CCODing:TBSize?

SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:CONType?
// PSIB
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:MODulation?
// QPSK
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:STSFrame?
// 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:ABSFrame?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:STNB?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:STSYmbol?
// 3
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:NORB?
// 6
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:PHYSbits?
// 1510
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:DATA?
// SIBB
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:STATe?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc1:CONFlict?
// 0
```

Example: DCI format 6-2 configuration

DCI format 6-2 carries paging and direct indication. If DCI format 6-2 is used, one MPDCCH is configured and activated automatically.

```
SOURce1:BB:EUTRa:DL:EMTC:DCI:NALLoc 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:UEID?
// 65534
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT?
// F62
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:SSP?
// T1CM
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:STSF 0
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PDCCh?
// 5
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:CCES?
// 10
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:IDCCe?
// 0

// SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PAGNg 0
// SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:DIINfo 100

SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PAGNg 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:RBA 3
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:MCSCheme 3
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:NREP 3
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:BITS?
// "000 1100 0111"
```

Example: eMTC PUSCH configuration

```
SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:LINK UP
SOURce1:BB:EUTRa:UL:EMTC:VALid:SUBFrame1 1
SOURce1:BB:EUTRa:UL:BW BW5_00
SOURce1:BB:EUTRa:UL:EMTC:NNBands?
// 4
SOURce1:BB:EUTRa:UL:UE1:RELease EMTC
SOURce1:BB:EUTRa:UL:UE1:STATe 1

SOURce1:BB:EUTRa:UL:UE1:MODE STD
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:REPetitions R4
SOURce1:BB:EUTRa:UL:PUSCh:NHOPping 1
SOURce1:BB:EUTRa:UL:PUSCh:NHOFfset 2

SOURce1:BB:EUTRa:UL:UE1:EMTC:HOPP H4
SOURce1:BB:EUTRa:UL:UE1:EMTC:CELevel CE01
SOURce1:BB:EUTRa:UL:UE1:EMTC:NTRansmiss 1
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:CONTent PUSC
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:MODulation QPSK
```

```
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:STSFrame 61
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:REPetitions R16
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:STNBand 1
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:NRBLocks 5
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:RBOFfset 1
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:POW 0
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:ASFRrame?
// 16

SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:DATA PN9
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:SCRambling:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:STATe 1
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:MODE COMB
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:IHARqoffset 0
SOURce1:BB:EUTRa:UL:UE1:CELL0:PUSCh:CCODing:ICQioffset 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:DRS:CYCShift?
// 0
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:NDMRs?
// 0
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:HARQ:MODE MUX
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:HARQ:BITS 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:HARQ:PATTern #H2,2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:HARQ:CBITs?
// 144
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:PUSCh:CQI:BITs 12
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:PUSCh:CQI:PATTern #HC,4
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:PUSCh:CQI:CBITs?
// 810
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:CCODing:TBSize 16
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:CCODing:RVINdex 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:PHYSbits?
// 1440
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs1:ULSCh:BITS?
// 584

SOURce1:BB:EUTRa:UL:UE1:EMTC:ARB:SUGGested?
SOURce1:BB:EUTRa:SLENgth 10
SOURce1:BB:EUTRa:STATe 1
```

Example: eMTC PUCCH configuration

```
SOURce1:BB:EUTRa:UL:PUCCh:NORB 4
SOURce1:BB:EUTRa:UL:PUCCh:N1CS 1
SOURce1:BB:EUTRa:UL:PUCCh:DESHift 1
SOURce1:BB:EUTRa:UL:PUCCh:N2RB 0

SOURce1:BB:EUTRa:UL:UE1:MODE STD
SOURce1:BB:EUTRa:UL:UE1:EMTC:NTRansmiss 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:CONTent PUCC
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:FORMat F2B
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:STSFrame 77
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:REPetitions R8
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:ASFRrame?
// 8
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:POWer 0
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:NAPused?
// 1
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:NPUCch 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:PUCCh:HARQ:PATTern #H3,2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:PUCCh:CQI:BITS 2
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:PUCCh:CQI:PATTern #H1,1
SOURce1:BB:EUTRa:UL:UE1:EMTC:TRANs2:PUCCh:CQI:CBITs?
// 20
SOURce1:BB:EUTRa:SLENgth 10
```

Example: eMTC PRACH configuration

```
SOURce1:BB:EUTRa:UL:PRACh:EMTC:HOFF 6
SOURce1:BB:EUTRa:UL:PRACh:EMTC:RSET OFF
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV0:FOFFset 2
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV0:SSFPeriod 2
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV1:CONFig 48
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV1:FOFFset 16
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV1:HOPPing 1
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV1:REPetit R2
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV1:SSFPeriod NONE
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV2:CONFig 9
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV2:FOFFset 10
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV2:REPetit R8
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV2:SSFPeriod NONE
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV3:CONFig 22
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV3:FOFFset 6
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV3:HOPPing 1
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV3:REPetit R4
SOURce1:BB:EUTRa:UL:PRACh:EMTC:CELV3:SSFPeriod NONE

SOURce1:BB:EUTRa:UL:UE2:STATe 1
SOURce1:BB:EUTRa:UL:UE2:RELease EMTC
SOURce1:BB:EUTRa:UL:UE2:MODE PRAC
SOURce1:BB:EUTRa:UL:UE2:PRACh:EMTC:PRATtempts 4
```

```
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:SFSTart 21
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:NCSConf 0
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:RSEQuence 10
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:SINDex 12
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:DT 0
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:POWer 0
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT1:EMTC:CELV 1
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT1:EMTC:SFSTart 41
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT2:EMTC:CELV 2
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT2:EMTC:SFSTart 81
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT3:EMTC:CELV 3
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT3:EMTC:SFSTart 121

SOURce1:BB:EUTRa:UL:UE2:PRACh:EMTC:ARB:SUGGested?
SOURce1:BB:EUTRa:SLENgth 14
```

9.27.1 General IoT Downlink

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- NB-IoT Carrier Allocation....782
- eMTC Bitmap, Valid Subframes, Hopping and Common Search Space....789

9.27.1.1 Physical Settings

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NNBands?

Return values:

<NumNarrowbands> integer

Range: 0 to 18
*RST: 1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Usage: Query only

Manual operation: See "Number of eMTC Narrorbands" on page 93

9.27.1.2 DL Reference and Sychronization Signals

[:SOURce<hw>]:BB:EUTRa:DL:REFSig:NIOT:POWer....781
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:TXANtenna....782
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NPPWr....782
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NSPWr....782

[:SOURce<hw>]:BB:EUTRa:DL:REFSig:NIOT:POWer <NbRefSigSymPowe>

Sets the power of the narrowband reference signal (NRS).

Parameters:
<NbRefSigSymPowe>float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Narrowband Reference Signal Power" on page 101

[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:TXANtenna <NpNsSyncTxAnt>

Defines on which antenna the NPSS/NSSS are transmitted.

Parameters:
<NpNsSyncTxAnt> NONE | ANT1 | ANT2 | ALL

*RST: ALL

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "NP-/NS-Sync Tx Antenna" on page 101

[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NPPWr <NPSyncPower>
[:SOURce<hw>]:BB:EUTRa:DL:SYNC:NIOT:NSPWr <NsSyncPower>

Sets the power of the NPSS/NSSS allocations.

Parameters:
<NsSyncPower> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "NP-SYNC Power/NS-SYNC Power" on page 101

9.27.1.3 NB-IoT Carrier Allocation

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:NIOT:CONFig ... 783
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PUNCture ... 783
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:LTECell:STATe ... 783
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:CONFig:STATe ... 784
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:THReshold ... 784
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:PERiodicity ... 784
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:DURation:COEFficent ... 784
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:MODE ... 785
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:RBIDx ... 785
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:DFReq ... 785

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CRSSeq 785
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CELL 786
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CIDGroup 786
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ID? 786
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSF 786
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:GBRBidx 787
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFALl 787
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFNN 787
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SF<st0>:VALSf 787
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PAG:RMAX 788
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:RMAX 788
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:SSOFfset 789
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:STSFrame 789
[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:STATe 789

[:SOURce<hw>]:BB:EUTRa:DL:MIMO:NIOT:CONFig <NbiotMimoConf>

Set the number of transmit antennas used for the simulated NB-IoT system.

Parameters:

<NbiotMimoConf> TX2 | TX1

*RST: TX1

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "NB-IoT MIMO Configuration" on page 120

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PUNCture <PunctureInband>

Punctures the LTE signal at the NB-IoT in-band or guard band carriers.

Parameters:

<PunctureInband> 0 | 1 | OFF | ON

*RST: 0

Example:

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:STDMode LIOT
SOURce1:BB:EUTRa:DL:BW BW5_00
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:STATe 1
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:MODE INBD
SOURce1:BB:EUTRa:DL:NIOT:PUNCture 1
```

Manual operation: See "Puncture LTE at Inband Carriers" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:LTECell:STATe <LTECell>

In in-band mode, defines how the LTE channels are handled.

If enabled, all LTE channels are deactivated. However, LTE reference signals are still transmitted.

Parameters:
<LTECell> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "LTE Cell" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:CONFig:STATe <GapConfig>

If activated, a gap between the NPDCCH and NPDSCH with the specified duration is applied.

Parameters:
<GapConfig> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "Gap Configuration" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:THReshold <GapThreshold>

Sets the gap threshold.

Parameters:
<GapThreshold> 32 | 64 | 128 | 256
*RST: 32

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "Gap Threshold" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:PERiodicity <GapPeriodicity>

Sets the number of subframes after that the configured gap is repeated.

Parameters:
<GapPeriodicity> 64 | 128 | 256 | 512
*RST: 64

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "Gap Periodicity" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:GAP:DURation:COEFficent <GapDurCoeff>

Sets the gap duration coefficient.

Parameters:
<GapDurCoeff> 1_8 | 1_4 | 3_8 | 1_2
*RST: 1_8

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "Gap Duration Coefficient" on page 342

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:MODE <Mode>

Sets the operating mode.

Parameters:

<Mode> INBD | ALON | GBD

*RST: INBD

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Mode" on page 343

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:RBIDx <RbIndex>

Sets the resource block number in that the NB-IoT transmissions are allocated.

Parameters:

<RbIndex> 2 | 4 | 7 | 9 | 12 | 14 | 17 | 19 | 22 | 27 | 24 | 29 | 30 | 32 | 34 | 35 | 39 | 42 | 44 | 40 | 45 | 47 | 52 | 55 | 57 | 60 | 62 | 65 | 67 | 70 | 72 | 75 | 80 | 85 | 90 | 95 | USER

*RST: 40

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "RB Index" on page 344

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:DFReq <DeltaFreq>

Sets the frequency offset between the NB-IoT carrier and the LTE center frequency.

Parameters:

<DeltaFreq> float

Range: -10000000 to 10000000
*RST: 0
Default unit: MHz

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "Delta Frequency to DC, MHz" on page 344

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CRSSeq <CrsSeqInfo>

Sets the CRS sequence info.

Parameters:

<CrsSeqInfo> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "CRS Sequence Info" on page 343

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CELL <CellID>

Sets the narrowband physical cell identifier.

Parameters:

<CellID> integer

Range: 0 to 503
*RST: 0

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "NCell ID" on page 345

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:CIDGroup <CellIdGr>

Queries the physical cell identity group.

Parameters:

<CellIdGr> integer

Range: 0 to 111
*RST: 0

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Manual operation: See "NCell ID Group" on page 345

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ID?

Queries the physical layer identity.

Return values:

<Identity> integer

Range: 0 to 111
*RST: 0

Example: See Example "NB-IoT carriers in in-band mode" on page 758.

Usage: Query only

Manual operation: See "Identity" on page 345

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSF <NoValidSubframe>

Sets the subframes bitmap.

Parameters:

<NoValidSubframe> N10 | N40

*RST: N10

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Valid Subframes" on page 345
See "Bitmap Subframes" on page 346

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:GBRBidx <RbIndexGB>

In guardband opration, sets the resource block number in that the NB-IoT transmissions are allocated.

Parameters:
<RbIndexGB> integer

Example:
```
SOURce1:BB:EUTRa:DL:BW BW5_00
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:MODE GBD
SOURce1:BB:EUTRa:DL:CARRier1:NIOT:GBRBidx 26
```

Manual operation: See "RB Index" on page 344

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFALl

Sets all SFs to valid.

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Usage: Event

Manual operation: See "Select All/Deselect All" on page 346

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SFNN

Sets all SFs to invalid.

Example:
```
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:SFNN
SOURce1:BB:EUTRa:DL:CARRier2:NIOT:SF1:VALSf?
// 0
```

Usage: Event

Manual operation: See "Select All/Deselect All" on page 346

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:SF<st0>:VALSf <Valid>

Sets the valid subframes.

Suffix:

<st0> 0 to 9/ 0 to 39
Subframe number, where the max number of subframes depends on the selected bitmap
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSFN10`: 0 to 9
`[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:NVSFN40`: 0 to 39

Parameters:

<Valid> 0 | 1 | OFF | ON

1
Valid subframe

0
Not valid subframe

*RST: 1

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Valid Subframes" on page 345

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:PAG:RMAX <PagingRmax>

Sets the maximum number NPDCCH is repeated R_{Max} (paging).

Parameters:

<PagingRmax> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128 | R256 | R512 | R1024 | R2048

*RST: R1

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Max. Repetitions of NPDCCH (Rmax) for Type 1 common search space" on page 350

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:RMAX <RandomRmax>

Sets the maximum number NPDCCH is repeated R_{Max} (random access).

Parameters:

<RandomRmax> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128 | R256 | R512 | R1024 | R2048

*RST: R1

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Max. Repetitions of NPDCCH (Rmax) for Type 2 common search space" on page 350

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:SSOFfset <RandomOffset>

Sets the serach space offset (α_{offset}).

Parameters:
<RandomOffset> O0 | O1_8 | O1_4 | O3_8
*RST: O0

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Search Space Offset (α_{offset})" on page 350

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:RAND:STSFrame <StartSf>

Sets the start SF for the random access common search space.

Parameters:
<StartSf> S1_5 | S2 | S4 | S8 | S16 | S32 | S48 | S64
*RST: S4

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Search Space Start Subframe (G)" on page 350

[:SOURce<hw>]:BB:EUTRa:DL:CARRier<ch>:NIOT:STATe <State>

Enables the selected NB-IoT carrier.

To enable the NB-IoT configuration, enable the anchor carrier (`SOURce1:BB:EUTRa:DL:CARRier0:NIOT:STATe 1`)

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NB-IoT anchor carrier in standalone mode" on page 757.

Manual operation: See "Activate NB-IoT" on page 342
See "State" on page 347

9.27.1.4 eMTC Bitmap, Valid Subframes, Hopping and Common Search Space

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrames....790
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrame<ch0>....790
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:STARt....790
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SIBBr....791
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:PBCHrep....791
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOPPing....791
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOFFset....791

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLA....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLB....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PHOPping....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RHOPpping....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PSTNb....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RSTNb....792
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD1....793
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD2....793
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:STSF....793
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSA....793
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSB....793

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrames <BitmapSubframes>

Sets the valid subframes configuration over 10ms or 40ms.

Parameters:

<BitmapSubframes> 10 | 40

*RST: 10

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Bitmap Subframes" on page 395

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SUBFrame<ch0> <ValidSubFrames>

Sets a SF as valid or invalid.

Suffix:

<dir> 0 to 9
Subframe number

Parameters:

<ValidSubFrames> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "SF State" on page 396

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:STARt <StartingSymbol>

Defines the first symbol within a frame that can be used for eMTC.

Parameters:

<StartingSymbol> 1 | 2 | 3 | 4

*RST: 2

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Starting Symbol" on page 395

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:SIBBr <SchedInfoSIB1BR>

Sets the number of times the PDSCH allocation carrying the SIB1-BR is repeated.

Parameters:

<SchedInfoSIB1BR> integer

Range: 0 to 18
*RST: 0

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Scheduling Info SIB1-BR" on page 396

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:BMP:PBCHrep <PbchRepetitions>

Configures the cell for PBCH repetition.

Parameters:

<PbchRepetitions> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "PBCH Repetition" on page 396

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOPPing <NumNBHopping>

Sets the number of narrowbands over which MPDCCH or PDSCH hops.

Parameters:

<NumNBHopping> 2 | 4

*RST: 2

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Number of Narrowbands for Hopping" on page 397

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:HOFFset <HoppingOffset>

Sets the number of narrowbands between two consecutive MPDCCH or PDSCH hops.

Parameters:

<HoppingOffset> integer

Range: 1 to 16
*RST: 8

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Hopping Offset" on page 397

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLA <HoppingIvlA>
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:IVLB <HoppingIvlB>

Sets the number of consecutive subframes during which MPDCCH or PDSCH stays at the same narrowband before hopping to another narrowband.

Parameters:
<HoppingIvlB> H1 | H2 | H4 | H5 | H8 | H10 | H16 | H20 | H40
*RST: H2

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Hopping Interval for CE Mode A/B" on page 397

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PHOPping <PagingHopping>
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RHOPpping <RaHopping>

Enables hopping for the random access.

Parameters:
<RaHopping> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "RA Hopping" on page 397

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:PSTNb <PagingStartingN>
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NB:RSTNb <RaStartingNB>

Sets the first used narrowband, if hoping is enabeld.

Parameters:
<RaStartingNB> integer
Range: 0 to 15
*RST: 8

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "RA Starting NB" on page 397

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD1 <MaxRepMPDCCH1>
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:MPD2 <MaxRepMPDCCH2>

Sets the maximum number of MPDCCH repetitons for type 1 and type 2 common seach spaces.

Parameters:
<MaxRepMPDCCH2> 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256
*RST: 1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Max. Repetitions of MPDCCH (Rmax) for Type 2 common search space" on page 399

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:STSF <SpStartSf>

Sets the start SF for the random access common search space.

Parameters:
<SpStartSf> S1 | S1_5 | S2 | S2_5 | S5 | S8 | S10 | S20 | S4
*RST: S1

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Search Space Start Subframe" on page 399

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSA <MaxRepPDSCHA>

Sets the parameter `pdsch-maxNumRepetitionCEmode`**`A`** that defines the PDSCH subframe assigment.

Parameters:
<MaxRepPDSCHA> 16 | 32 | 64 | NON | 192 | 256 | 384 | 512 | 786 | 1024 | 1536 | 2048
*RST: NON

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Max. Repetitions of PDSCH for CE Mode A/B" on page 399

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:SSP:PDSB <MaxRepPDSCHB>

Sets the parameter `pdsch-maxNumRepetitionCEmode`**`B`** that defines the PDSCH subframe assigment.

Parameters:

<MaxRepPDSCHB> 16 | 32 | 64 | NON | 192 | 256 | 384 | 512 | 786 | 1024 | 1536 | 2048

*RST: NON

Example: See Example "eMTC valid subframes and hopping configuration" on page 771.

Manual operation: See "Max. Repetitions of PDSCH for CE Mode A/B" on page 399

9.27.2 DL IoT Frame Configuration

9.27.2.1 NB-IoT DCI Configuration

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:NALLoc....795
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:AWARound....795
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:USER....795
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:UEID?....795
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:FMT....796
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SSP....796
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:STSFrame....796
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:FMT....796
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CCES?....797
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDCCe....797
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CONFlict?....797
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:BITS?....798
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IRU....798
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:HACK....798
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDELay....798
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:MCSCheme....799
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd....799
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:OIND....799
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:REP?....799
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:IREP....800
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:ISF....800
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NREP?....800
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NSF?....801
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SCINd....801
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SNUMber....801
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPUSch:IREP....801
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NRUNits?....802
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd....802
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:PAG....802
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:RVERsion....803
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SCINd....803
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SFRPt....803
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SIME....803

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SINF 804
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:TBSZ? 804
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:DIST 804

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:NALLoc <NoAlloc>

Sets the number of configurable DCIs.

Parameters:

<NoAlloc> integer

Range: 0 to 100
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Number of DCI Allocations" on page 352

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:AWARound <AllocWrapAround>

If enabled, the NPDSCH allocations are relocated at the beginning of the ARB sequence to ensure a consistent signal.

Parameters:

<AllocWrapAround> 0 | 1 | OFF | ON

*RST: 0

Example:

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:AWARound 1
```

Manual operation: See "Allocation Wrap-around" on page 353

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:USER <User>

Selects the user the DCI is dedicated to.

Parameters:

<User> USER1 | USER2 | USER3 | USER4 | PRNTi | RARNti

*RST: USER1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "User" on page 353

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:UEID?

Queries the UE_ID or the n_RNTI for the selected DCI.

Return values:

<UeID> integer

Range: 0 to 65535
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "UE_ID/n_RNTI" on page 353

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:FMT <Format>

Sets the DCI format for the selected allocation.

Parameters:

<Format> N0 | N1 | N2

*RST: N0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format" on page 353

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SSP <SearchSpace>

Sets the search space for the selected DCI.

Parameters:

<SearchSpace> UE | T1CM | T2CM

*RST: UE

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Search Space" on page 354

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:STSFrame <StartSf>

Sets the next valid starting subframe for the selected allocation.

Parameters:

<StartSf> integer

Range: 1 to 20

*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Start Sufbrame" on page 363

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:FMT <NPdcchFmt>

Sets the NPDCCH format.

Parameters:
<NPdcchFmt> integer
Range: 0 to 1
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "NPDCCH Format" on page 363

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CCES?

queries the number NCCEs.

Return values:
<NoCCEs> integer
Range: 1 to 2
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Number NCCEs" on page 364

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDCCe <NcceIndex>

Sets the NCCE start index.

Parameters:
<NcceIndex> integer
Range: 0 to 1
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "NCCE Index" on page 364

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:CONFlict?

Queries if there is a conflict between two DCI formats.

Return values:
<Conflict> 0 | 1 | OFF | ON
*RST: 0

Example: `SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc1:CONFlict?`

Usage: Query only

Manual operation: See "Conflict" on page 364

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:BITS?

Queries the resulting bit data as selected with the DCI format parameters.

Return values:
<BitData> string

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Bit Data" on page 354

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IRU <DciIRU>

Sets the DCI field resource assignment field of NPUSCH (I_{RU}).

Parameters:
<DciIRU> integer
Range: 0 to 7
*RST: 0

Example: See Example "DCI format N0 configuration" on page 760.

Manual operation: See "DCI Format N0" on page 355

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:HACK <HackResource>

Sets the DCI field HARQ-ACK resource field.

Parameters:
<HackResource> integer
Range: 0 to 15
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:IDELay <SchedDelay>

Sets the DCI field scheduling delay field (I_{Delay}).

Parameters:
<SchedDelay> integer
Range: 0 to 7
*RST: 0

Example: See Example "DCI format N0 configuration" on page 760.

Manual operation: See "DCI Format N0" on page 355
See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:MCSCheme <Scheme>

Sets the DCI field modulation and coding scheme (I_{MSC}).

Parameters:
<Scheme> integer
Range: 0 to 13
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N0" on page 355
See "DCI Format N1" on page 357
See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd <NewDataInd>

Sets the DCI field new data indicator.

Parameters:
<NewDataInd> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N0" on page 355
See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:OIND <OrderInd>

Sets the DCI field NPDCCH order indicator.

Parameters:
<OrderInd> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDCch:REP?

Queries the number of repetitions of NPDCCH (R).

Return values:
<NPdcchRpt> integer
Range: 1 to 2048
*RST: 1

Example: See Example "DCI format N2 configuration" on page 764.

Usage: Query only

Manual operation: See "Repetitions of NPDCCH (R)" on page 363

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:IREP
<DciINPDSCH>

Sets the DCI field number of NPDSCH repetition fields (I_{Rep}).

Parameters:
<DciINPDSCH> integer
Range: 0 to 15
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357
See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:ISF <DciISF>

Sets the DCI feild resource assignment field (I_{SF}).

Parameters:
<DciISF> integer
Range: 0 to 7
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357
See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NREP?

Queries the number of repetitions of NPDSCH (N_{Rep}.)

Return values:
<NPdschRpt> integer
Range: 1 to 2048
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Repetitions of NPDSCH (N_{Rep})" on page 363

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPDSch:NSF?

queries the number of NPDSCH subframes (N_{SF}).

Return values:
<NoSubframes> integer
Range: 1 to 10
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Number of NPDSCH Subframes (N_{SF})" on page 363

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SCINd
<SubcarrierInd>

Sets the DCI field subcarrier indication field of NPRACH (I_{SC}).

Parameters:
<SubcarrierInd> integer
Range: 0 to 47
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPRach:SNUMber
<StartingNumber>

Sets the DCI field starting number of NPRACH repetitions (I_{Rep}).

Parameters:
<StartingNumber> integer
Range: 0 to 2
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NPUSch:IREP
<DciINPUSCH>

Sets the DCI field number of NPUSCH repetition fields (I_{Rep}).

Parameters:
<DciINPUSCH> integer
Range: 0 to 7
*RST: 0

Example: See Example "DCI format N0 configuration" on page 760.

Manual operation: See "DCI Format N0" on page 355

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NRUNits?

Queries the number of resource units (N_{RU}).

Return values:
<NoResUnits> integer
Range: 1 to 10
*RST: 1

Example: See Example "DCI format N0 configuration" on page 760.

Usage: Query only

Manual operation: See "Number of Resource Units (N_{RU})" on page 362

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:NDINd <NewDataInd>

Sets the DCI field new data indicator.

Parameters:
<NewDataInd> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N0" on page 355
See "DCI Format N1" on page 357

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:PAG <Paging>

Sets the DCI field flag for paging/direct indication.

Parameters:
<Paging> 0 | 1 | OFF | ON
1
Paging
0
Direct indication
*RST: 0

Example: See Example "DCI format N2 configuration" on page 764.

Manual operation: See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:RVERsion
<RedundancyVers>

Sets the DCI field redundancy version.

Parameters:
<RedundancyVers> integer
Range: 0 to 1
*RST: 0

Example: See Example "DCI format N0 configuration" on page 760.

Manual operation: See "DCI Format N0" on page 355

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SCINd <SubcarrierInd>

Sets teh DCI field subcarrier identification field of NPUSCH (I_{SC}).

Parameters:
<SubcarrierInd> integer
Range: 0 to 47
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N0" on page 355

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SFRPt <SfRepetition>

Sets the DCI field repetitions of DCI subframes.

Parameters:
<SfRepetition> integer
Range: 0 to 7
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "DCI Format N0" on page 355
See "DCI Format N1" on page 357
See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SIME <SysInfModExt>

Sets the DCI field system info modification - extended discontinuous reception.

Parameters:
<SysInfModExt> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "DCI format N2 configuration" on page 764.

Manual operation: See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:SINF <SysInfMod>

Sets the DCI field system info modification.

Parameters:

<SysInfMod> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "DCI format N2 configuration" on page 764.

Manual operation: See "DCI Format N2" on page 360

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:TBSZ?

Queries the transport block size.

Return values:

<TransportBlockS> integer

Max transport block size depends on the installed options
Option:R&S SMBV-K115: Max = 680

Range: 16 to max
*RST: 16

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "DCI Format N1" on page 357
See "Transport Block Size" on page 362

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:DCI:ALLoc<ch0>:DIST <DistNpdcchNpdsc>

Sets how the distance between the NPDCCH to NPDSCH is determined.

Parameters:

<DistNpdcchNpdsc> STD | MIN | ZERO

`ZERO` disables the NPDSCH SIB1-NR and NPUCCH transmissions. The NPDSCH is transmitted immediately after the NPDCCH.
Use this value to increase the number of NPDSCH allocations.

*RST: STD

Example:

```
SOURce1:BB:EUTRa:DL:NOIT:DCI:ALLoc0:FMT N1
SOURce1:BB:EUTRa:DL:NOIT:DCI:ALLoc0:DIST STD
```

Manual operation: See "Distance from NPDCCH to NPDSCH" on page 362

9.27.2.2 NB-IoT Allocation

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:NALLoc?....805
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONType?....805
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:MODulation?....805
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SFList?....806
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STSYmbol....806
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PHYSbits?....806
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:POWer....807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DATA....807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DSELect....807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PATTern....807
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STATe?....808
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONFlict?....808

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:NALLoc?

Queries the number of NB-IoT allocations.

Return values:
<NbIoTNAlloc> integer
Range: 0 to 42
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Allocation number" on page 365

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONType?

Queries the channel type.

Return values:
<ContentType> NPBCh | NSIB | NPDCch | NPDSch
*RST: NPBCh

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Content Type" on page 365

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:MODulation?

Queries the used modulation scheme.

Return values:
<Modulation> QPSK
*RST: QPSK

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Modulation" on page 366

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SFList?

Queries the subframes in that the channel is allocated.

Return values:

<SubframeList> "<SF#>, <SF#>, <SF#>, <SF#>..."

String of four comma-separated integer values, indicating subframe numbers

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Suframe List" on page 366

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STSYmbol <StartSymbol>

Sets the first symbol in a subframe where NB-IoT channels can be allocated.

Parameters:

<StartSymbol> SYM0 | SYM1 | SYM2 | SYM3

*RST: SYM0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Start Symbol" on page 366

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PHYSbits?

Queries the used number of physical bits.

Return values:

<PhysicalBits> integer

Range: 0 to 320
*RST: 200

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Phys. Bits" on page 367
See "Number of Physical Bits" on page 370
See "Number of Physical Bits" on page 373

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:POWer <Power>

Sets the power of the selected allocation.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "ρ A" on page 368

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DATA <DataSource>

Queries the data source or sets the data source for NPDSCH allocations configured for P-RNTI or RA-RNTI.

Parameters:

<DataSource> USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE | MIB | SIB1nb | PRNTi | RARNti

*RST: MIB

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Data Source" on page 368

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:DSELect <DataList>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DataList> string

Filename incl. file extension or complete file path

Example:

```
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:DATA DLIS
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:DSELect "/var/user/IoT.dm_iqd"
```

Manual operation: See "Data Source" on page 368

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PATTern <Pattern>, <BitCount>

Sets a bit pattern as data source.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example:
```
SOURce1:BB:EUTRa:DL:NIOT:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:DATA PATT
SOURce1:BB:EUTRa:DL:NIOT:ALLoc3:PATTern #H735,12
```

Manual operation: See "Data Source" on page 368

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:STATe?

Queries the allocation state.

Return values:
<State> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "State" on page 368

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CONFlict?

Queries if there is a conflict between allocations.

Return values:
<Conflict> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Conflict" on page 368

9.27.2.3 NPBCH, NPDCCH, NPDSCH Enhanced Settings

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:SCHeme....809
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:NOLayers?....809
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:STATe....809
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:SROT....810
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:UEID?....810
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:STATe....810
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:ISF?....810
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:NSF?....811
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSI....811
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSize?....811
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MIB....812

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MSPare 812
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:NCID? 812
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:RSIB? 812
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SIB 813
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SOFFset 813
[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:STFSib1? 813

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:SCHeme
<PrecAntScheme>

Sets the precoding scheme.

Parameters:

<PrecAntScheme> NONE | TXD
*RST: NONE

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Precoding Scheme" on page 369
See "Precoding Scheme" on page 372

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:PRECoding:NOLayers?

Queries the number of layers for the selected allocation.

Return values:

<NoLayers> integer
Range: 1 to 2
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Number of Layers" on page 370
See "Number of Layers" on page 373

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:STATe
<ScramblingState>

Enables scrambling.

Parameters:

<ScramblingState> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Scrambling State" on page 373

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:SROT
<SymbolRotation>

Enables NPBCH scrambling with symbol rotation.

Parameters:
<SymbolRotation> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Manual operation: See "NPBCH Symbol Rotation" on page 370

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:SCRambling:UEID?

Queries the user equipment identifier (n_RNTI) or UE ID of the user to which the NPDSCH transmission is intended.

Return values:
<UEIDnRNTI> integer
Range: 0 to 65535
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "UE ID/n_RNTI" on page 373

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:STATe
<ChanCodState>

Enables channel coding.

Parameters:
<ChanCodState> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Channel Coding State" on page 370
See "Channel Coding State" on page 373

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:ISF?

Queries the resource assignment field (I_{SF}).

Return values:
<RAssinField> integer
Range: 0 to 100
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Resource Assignment Field (I_{SF})" on page 374

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:NSF?

Queries the number of NPDSCH subframes (N_{SF}).

Return values:
<NumSF> integer
Range: 1 to 100
*RST: 1

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Usage: Query only

Manual operation: See "Number of NPDSCH Subframes (N_{SF})" on page 374

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSI <TBSindex>

Sets the transport block size index.

Parameters:
<TBSindex> integer
Range: 0 to 15
*RST: 0

Example: See Example "NPDCCH and NPDSCH DCI-based configuration (DCI format N1)" on page 761.

Manual operation: See "Transport Block Size Index (I_{TBS})" on page 374

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:ALLoc<ch0>:CCODing:TBSize?

Queries the size of the transport block/payload in bits.

Return values:
<TranBlckSize> integer
Range: 16 to 1500
*RST: 16

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Usage: Query only

Manual operation: See "Transport Block Size/Payload (DL)" on page 372
See "Transport Block Size/Payload (DL)" on page 374

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MIB <MibState>

Enables transmission of MIB data.

Parameters:
<MibState> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Manual operation: See "MIB (including SFN)" on page 370

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:MSPare <MibSpareBits>

Sets the 11 spare bits in the NPBCH transmission.

Parameters:
<MibSpareBits> 11-bits

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Manual operation: See "MIB Spare Bits" on page 372

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:NCID?

Queries the NCell ID.

Return values:
<NCellId> integer
Range: 0 to 503

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Usage: Query only

Manual operation: See "NCell ID" on page 371

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:RSIB?

Queries the number of repetitions of the NDPSCH that carries SIB1-NB.

Return values:
<RepetitionSIB1> integer
Range: 0 to 11
*RST: 0

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Usage: Query only

Manual operation: See "NPDSCH repetition carrying SIB1" on page 371

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SIB <SchedulingSIB1>

Sets the parameter scheduling info SIB1.

Parameters:

<SchedulingSIB1> integer

Range: 0 to 11
*RST: 0

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Manual operation: See "Scheduling SIB1" on page 371

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:SOFFset <SfnOffset>

Sets the start SFN value.

Parameters:

<SfnOffset> float

Range: 0 to 1020
Increment: 4
*RST: 0

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Manual operation: See "SFN Offset" on page 370

[:SOURce<hw>]:BB:EUTRa:DL:NIOT:CCODing:STFSib1?

Queries the first frame in that the NPDSCH transmission carrying SIB1-NB is allocated.

Return values:

<SIB1StartFrame> integer

Range: 0 to 11
*RST: 0

Example: See Example "NPBCH and SIB1-NB configuration" on page 765.

Usage: Query only

Manual operation: See "Starting Frame carrying SIB1" on page 371

9.27.2.4 NB-IoT User Configuration

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:RELease....814
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:RMAX....814
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:STSFrame....814
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:SSOFfset....814

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:RELease <Release>

Sets the 3GPP release version the UE supports.

Parameters:

<Release> R89 | LADV | EM_A | NIOT | EM_B

*RST: R89 (in LTE/eMTC/NB-IoT mode)/ EM_A (in eMTC/NB-IoT mode)

`EM_A` = eMTC CE: A and `EM_B` = eMTC CE: B

Options: R89 requires R&S SMBV-K55
LADV requires R&S SMBV-K85
EM_A|NIOT|EM_B require R&S SMBV-K115

Manual operation: See "3GPP Release" on page 197

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:RMAX <MaxRepNPDCCH>

Sets the maximum number NPDCCH is repeated R_{Max}.

Parameters:

<MaxRepNPDCCH> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128 | R256 | R512 | R1024 | R2048

*RST: R1

Example: See Example "NB-IoT UE configuration" on page 759.

Manual operation: See "Max. Repetitions of NPDCCH (Rmax) (UE-specific search space)" on page 351

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:STSFrame <SearchSpStartSF>

Sets the serach space start subframe (G).

Parameters:

<SearchSpStartSF> S1_5 | S2 | S4 | S8 | S16 | S32 | S48 | S64

*RST: S4

Example: See Example "NB-IoT UE configuration" on page 759.

Manual operation: See "Search Space Start Subframe (G)" on page 351

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:NIOT:SSOFfset <SearchSpaceOffs>

Shifts the search space start.

Parameters:

<SearchSpaceOffs> O0 | O1_8 | O1_4 | O3_8

*RST: O0

Example: See Example "NB-IoT UE configuration" on page 759.

Manual operation: See "Search Space Offset (α_{offset})" on page 351

9.27.2.5 eMTC DCI Configuration

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:NALLoc ... 816
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:AWARound ... 816
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:USER ... 816
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEID? ... 816
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MPDCchset ... 817
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:FMT ... 817
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SSP ... 817
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STSFrame ... 818
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDCCh ... 818
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CCES? ... 818
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:IDCCe ... 818
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:BITS? ... 819
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDCCes? ... 819
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CONFlict? ... 819
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TBS? ... 819
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPMpdcch? ... 820
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPPdsch? ... 820
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDSHopping? ... 820
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STRV? ... 821
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TCMD ... 821
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PFRHopp ... 821
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA ... 821
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MCS ... 822
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NREP ... 822
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HARQ ... 822
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDINd ... 823
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RVER ... 823
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPCPusch ... 823
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:ULINdex ... 824
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DAINdex ... 824
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CSIRequest ... 824
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SRSRequest ... 825
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SFRNumber ... 825
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEMode ... 825
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HRESoffset ... 826
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:APSI ... 826
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PMIConfirm ... 826
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPMPrec ... 826
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAPreamble ... 827
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAMask ... 827

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAStart 827
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PAGNg 828
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DIINfo 828

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:NALLoc <DciNumberAlloc>

Sets the number of configurable DCIs.

Parameters:

<DciNumberAlloc> integer

Range: 0 to 400
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Number of DCI Allocations" on page 400

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:AWARound <AllocWrapAround>

If enabled, the PDSCH allocations are relocated at the beginning of the ARB sequence to ensure a consistent signal.

Parameters:

<AllocWrapAround> 0 | 1 | OFF | ON

*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:EMTC:DCI:AWARound 1
```

Manual operation: See "Allocation Wrap-around" on page 401

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:USER <DciUser>

Selects the user the DCI is dedicated to.

Parameters:

<DciUser> USER1 | USER2 | USER3 | USER4 | PRNTi | RARNti

USER1|USER2|USER3|USER4
Available are only eMTC users (`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:RELease EM_A|EM_B`).

PRNTi|RARNti
Selects a group of users.

*RST: USER1

Example: See Example "DCI format 6-2 configuration" on page 778.

Manual operation: See "User" on page 401

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEID?

Queries the UE_ID of the selected user or the n_RNTI for the selected DCI.

Return values:
<DciUeID> integer
Range: 0 to 65535
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "UE_ID/n_RNTI" on page 401

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MPDCchset
<DciMpdcchSet>

Selects the MPDCCH set by which the DCI is carried.

Parameters:
<DciMpdcchSet> MPD1 | MPD2
*RST: MPD1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "MPDCCH Set" on page 401

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:FMT <DciFormat>

Sets the DCI format for the selected allocation.

Parameters:
<DciFormat> F3 | F3A | F60A | F60B | F61A | F61B | F62
*RST: F60A

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format" on page 401

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SSP <DciSearchSpace>

Sets the search space for the selected DCI.

Parameters:
<DciSearchSpace> UE | T1CM | T2CM | T0CM
*RST: UE

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Search Space" on page 402

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STSFrame <DciStartSf>

Sets the next valid starting subframe for the particular MPDCCH.

Parameters:

<DciStartSf> integer

Range: 1 to 1E6
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Start Sufbrame" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDCCh <DciPdcchFmt>

Selects one of the five MPDCCH formats

Parameters:

<DciPdcchFmt> 0 | 1 | 2 | 3 | 4 | 5

The available values depend on the search space.

*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "MPDCCH Format" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CCES?

Queries the number of consecutive control channel elements (ECCE) on that MPDCCH is transmitted.

Return values:

<DciNumCCEs> integer

Range: 1 to 24
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Number ECCEs" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:IDCCe <DciCCEIndex>

For UE-specific search space, sets the ECCE start index.

Parameters:

<DciCCEIndex> integer

Range: 0 to 24
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "ECCE Index" on page 410

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:BITS?

Queries the resulting bit data as selected with the DCI format parameters.

Return values:
<DciBitData> string

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Bit Data" on page 402

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDCCes?

Queries the number of dummy ECCEs that are appended to the corresponding MPDCCH.

Return values:
<NoDummyCCEs> integer

Range: 0 to 1E5
*RST: 25

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "No. Dummy ECCEs" on page 410

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CONFlict?

Queries whether a conflict between allocations occurs.

Return values:
<Conflict> 0 | 1 | OFF | ON

*RST: 0

Example:
```
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc2:CONFlict?
// 0
```

Usage: Query only

Manual operation: See "Conflict" on page 410

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TBS?

Queries the resulting transport block size.

Return values:
<DciTranBlkSize> integer
Range: 0 to 2000
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Transport Block Size" on page 408

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPMpdcch?

Queries the resulting number of MPDCCH repetitions.

Return values:
<DciRepMPDCCH> integer
Range: 1 to 256
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Repetitions of MPDCCH" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:REPPdsch?

Queries the resulting number of PDSCH repetitions.

Return values:
<DciRepPDSCH> integer
Range: 1 to 2048
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Repetitions of PDSCH" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PDSHopping?

Queries if PDSCH hopping is enabled or not.

Return values:
<DciPDSCHHopping> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "PDSCH Hopping" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:STRV?

Queries the starting redundancy version (RV).

Return values:
<DciStartingRV> integer
Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Starting Redundancy Version" on page 409

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TCMD <TpcCmd3>

Sets the TCP command field of the DCI format 3/3A.

Parameters:
<TpcCmd3> 64 bits

Example:
```
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F3
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:TCMD #H0,64
```

Manual operation: See "DCI Format 3/3A" on page 402

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PFRHopp
<DciPuschFreqHop>

Sets the DCI format 6-0A and 6-1A filed frequency hopping flag that applies to PUSCH and PDSCH respectively.

Parameters:
<DciPuschFreqHop> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RBA <DciRBA>

Sets the DCI filed resource block assignment.

Parameters:

<DciRBA> integer

Range: 0 to depends on the installed options*
*RST: 0
max = 2047 (R&S SMBV-K115)

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404
See "DCI Format 6-2" on page 407

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:MCS <DciMCS>

Sets the DCI field modulation and coding scheme.

Parameters:

<DciMCS> integer

Range: 0 to 15
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404
See "DCI Format 6-2" on page 407

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NREP <DciRepNum>

Sets the DCI field repetition number.

Parameters:

<DciRepNum> integer

Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404
See "DCI Format 6-2" on page 407

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HARQ
<DciHarqProcNum>

Sets the DCI field HARQ process number.

Parameters:
<DciHarqProcNum> integer
In FDD mode: 0 to 7
In TDD mode: 0 to 15
Range: 0 to 15
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:NDINd <DciNewDataInd>

Sets the DCI field new data indicator.

Parameters:
<DciNewDataInd> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:RVER <DciRedVersion>

Sets the DCI field redundancy version.

Parameters:
<DciRedVersion> integer
Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPCPusch
<DciTpcCmdPusch>

Sets the DCI field TPC command for scheduled PUSCH.

Parameters:
<DciTpcCmdPusch> integer
Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:ULINdex <DciUlIndex>

In TDD mode and if UL/DL Configuration 0 is used, sets the DCI field UL index.

Parameters:
<DciUlIndex> integer
Range: 0 to 3
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:TDD:UDConf 0
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F60A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:ULINdex 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:DAINdex 1
```

Manual operation: See "DCI Format 6-0A/6-0B" on page 403

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DAINdex
<DLAssignIndex>

In TDD mode and if UL/DL Configuration 0 is used, sets the DCI field downlink assignment index (DAI).

Parameters:
<DLAssignIndex> integer
Range: 0 to 3
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:ULINdex` on page 824.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:CSIRequest
<DciCSIRequest>

Sets the DCI field CSI request.

Parameters:
<DciCSIRequest> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SRSRequest
<DciSRSRequest>

Sets the DCI field SRS request.

Parameters:
<DciSRSRequest> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:SFRNumber
<DciSfRepNumber>

If `[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:REPMpdcch` ≥2, sets the DCI field DCI subframe repetition number.

Parameters:
<DciSfRepNumber> integer
Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-0A/6-0B" on page 403
See "DCI Format 6-1A/6-1B" on page 404
See "DCI Format 6-2" on page 407

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:UEMode <UEMode>

Sets the DCI field mode and defines if the DCI format 6-1A/B is used for PDSCH or PRACH.

Parameters:
<UEMode> STD | PRACh
*RST: STD

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:HRESoffset
<DciHarqResOffs>

Sets the DCI field HARQ-ACK ressource offset.

Parameters:

<DciHarqResOffs> integer

Range: 0 to 3
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:APSI <DciAPsSI>

For users working in transmission mode TM9 and if UE-specific search space is used, sets the DCI format 6-1A field antenna ports and scrambling identity.

Parameters:

<DciAPsSI> integer

Range: 0 to 3
*RST: 0

Example:

```
SOURce1:BB:EUTRa:DL:USER1:TXM TM9
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F61A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:APSI 1
```

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PMIConfirm
<DciPmiConfirm>

Sets the DCI field PMI confirmation for precoding.

Parameters:

<DciPmiConfirm> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:TPMPrec <DciTpmiPrec>

Sets the DCI field TPMI information for precoding.

Parameters:

<DciTpmiPrec> integer

Range: 0 to 15
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAPreamble
<DciPrachPreambl>

Sets the DCI field preamble index.

Parameters:

<DciPrachPreambl> integer

Range: 0 to 63
*RST: 0

Example:

```
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F61A
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:UEMode PRACh
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:RBA 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PRAPreamble 8
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PRAMask 5
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:PRAStart 1
```

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAMask
<DciPrachMaskIdx>

Sets the DCI field PRACH mask index.

Parameters:

<DciPrachMaskIdx> integer

Range: 0 to 15
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAPreamble` on page 827.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAStart
<DciPrachStartCe>

Sets the DCI field starting CE level.

Parameters:
<DciPrachStartCe> integer
Range: 0 to 3
*RST: 0

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PRAPreamble` on page 827.

Manual operation: See "DCI Format 6-1A/6-1B" on page 404

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:PAGNg <DciPaging>

Sets the DCI bit that defines if the DCI format 6-2 is used for paging or for direct indication.

Parameters:
<DciPaging> 0 | 1 | OFF | ON
*RST: 0

Firmware/Software: See Example "DCI format 6-2 configuration" on page 778.

Manual operation: See "DCI Format 6-2" on page 407

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:DCI:ALLoc<ch0>:DIINfo <DciDiInfo>

Sets the DCI field direct indication information.

Parameters:
<DciDiInfo> integer
Range: 0 to 255
*RST: 0

Example: SeeExample "DCI format 6-2 configuration" on page 778 .

Manual operation: See "DCI Format 6-2" on page 407

9.27.2.6 eMTC Allocations

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NALLoc?....829
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONType?....829
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:MODulation?....829
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSFrame?....829
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:ABSFrames?....830
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STNB?....830
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSYmbol?....830
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:NORB?....831
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:OVRB?....831
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PHYSbits?....831
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DATA....832
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DSELect....832
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PATTern....832

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:POWer 833
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STATe? 833
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONFlict? 833

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:NALLoc?

Queries the number of automatically configured allocations.

Return values:
<NoAlloc> integer
Range: 0 to 100
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONType?

Queries the channel type.

Return values:
<ContentType> MPD1 | MPD2 | PSIB | PDSCh | PBCH
*RST: PDSCh

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Content Type" on page 411

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:MODulation?

Queries the used modulation scheme.

Return values:
<Modulation> QAM16 | QPSK
*RST: QPSK

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Modulation" on page 412

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSFrame?

Queries the first subframe where the channel can be allocated.

Return values:
<StartSf> integer
Range: 0 to 39
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Start SF" on page 412

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:ABSFrames?

Queries the number of absolute subframes.

Return values:
<NumAbsSf> integer
Range: 0 to 39
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Num. Abs. SF" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STNB?

Queries the first narrowband where the channel can be allocated.

Return values:
<StartNarrowBand> integer
Range: 0 to 15
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Start NB" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STSYmbol?

Queries the first symbol where the channel can be allocated.

Return values:
<StartSymbol> 1 | 2 | 3 | 4
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Start Symbol" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:NORB?

Queries the number of resource blocks the allocation spans.

Return values:
<NumberResBlk> integer

Range: 1 to 6
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "No. RB" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:OVRB?

Queries the start resource block of the selected allocation.

Return values:
<OffsetVRB> integer

Range: 0 to 5
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Offset VRB" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PHYSbits?

Queries the allocation size in bits.

Return values:
<PhysBits> integer

Range: 0 to 4032
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Phys. Bits" on page 413
See "Number of Physical Bits" on page 417
See "Number of Physical Bits" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DATA <DataSource>

Queries the data source or sets the data source for the following allocations:

- PBCH if MIB is disabled
- PDSCH SIB1-BR allocation
- PDSCH allocations configured for P-RNTI or RA-RNTI.

Parameters:

<DataSource> USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE | MIB | PRNTi | RARNti | SIBBr

*RST: MIB

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Data Source" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:DSELect <DataList>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DataList> string

Filename incl. file extension or complete file path

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

```
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:DATA DLIS
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:DSELect "/var/user/IoT.dm_iqd"
```

Manual operation: See "Data Source" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PATTern <Pattern>, <BitCount>

Sets a bit pattern as data source.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example:

```
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER PRNT
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:DATA PATT
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PATTern #H735,12
```

Manual operation: See "Data Source" on page 413

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:POWer <Power>

Sets the power of the selected allocation.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "ρ A" on page 414

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:STATe?

Queries whether the allocation is activated.

Return values:

<State> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "State" on page 414

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CONFlict?

Queries if there is a conflict between the allocations.

Return values:

<Conflict> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Conflict" on page 414

9.27.2.7 PBCH and PDSCH Enhanced Settings

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCHeme 834
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CODWords? 834
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:NOLayers? 835
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CCD 835
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CBINdex 835
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme? 835

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP? 836
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCID? 837
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:APM? 837
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:DAFormat 837
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:REAL? 837
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:IMAGinary? 838
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:STATe 838
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:UEID? 839
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:STATe 839
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSize? 839
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSI 840
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MIB 840
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SIB 840
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:RSIB? 841
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MSPare 841
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SOFFset 841
[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SRPeriod 841

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCHeme <PrecMultAntSche>

Selects the precoding scheme.

Parameters:

<PrecMultAntSche> NONE | SPM | TXD | BF
*RST: NONE

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Precoding Scheme" on page 416
See "Precoding Scheme" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CODWords?

Queries the number of the codewords.

Return values:

<CodeWord> CW11 | CW12
*RST: CW11

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme?` on page 835.

Usage: Query only

Manual operation: See "Codeword" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:NOLayers?

Queries the number of layers for the selected allocation.

Return values:
<PrecLayCnt> integer
Range: 1 to 2
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Number of Layers" on page 416
See "Number of Layers" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CCD
<CycDelDiv>

Sets the cyclic delay diversity for the selected allocation.

Parameters:
<CycDelDiv> NOCDd | LADelay
*RST: NOCDd

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Cyclic Delay Diversity" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:CBINdex
<PrecCodeBookIdx>

Sets the codebook index.

Parameters:
<PrecCodeBookIdx> integer
Range: 0 to 15
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Codebook Index" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme?

Queries the transmsission scheme.

Return values:
<TranScheme> TM9
*RST: TM9

Example:

```
// Transmission antennas and antenna port mapping
SOURce1:BB:EUTRa:DL:MIMO:CONFiguration TX2
SOURce1:BB:EUTRa:DL:MIMO:ANTenna ANT1

SOURce1:BB:EUTRa:STDMode IOT
SOURce1:BB:EUTRa:DL:USER4:RELease EM_A
SOURce1:BB:EUTRa:DL:USER4:UEC?
// M1
SOURce1:BB:EUTRa:DL:USER4:CELL0:TXM M9

SOURce1:BB:EUTRa:DL:EMTC:DCI:NALLoc 1
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:USER USER4
SOURce1:BB:EUTRa:DL:EMTC:DCI:ALLoc0:FMT F61A

SOURce1:BB:EUTRa:DL:EMTC:NALLoc?
// 4
// PDSCH allocation not carrying SIB-BR is the fourth allocation
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CONType?
// PDSC

SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:SCHeme?
// BF
// because User 1 uses Tx mode TM9
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:TRSCheme?
// TM9
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:CODWords?
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:NOLayers?
// 1
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:AP?
// AP7
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:SCID?
// 0
SOURce1:BB:EUTRa:DL:EMTC:ALLoc3:PRECoding:APM?
// FW
```

Usage: Query only

Manual operation: See "Transmission Scheme" on page 420

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP?

Queries the used antenna ports.

Return values:

<AntPorts> AP7 | AP5 | AP8 | AP78 | AP79 | AP710 | AP711 | AP712 | AP713 | AP714 | AP107 | AP108 | AP109 | AP110 | AP107108 | AP107109

*RST: AP7

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme?` on page 835.

Usage: Query only

Manual operation: See "Antenna Ports" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:SCID?

Queries the scrambling identity.

Return values:

<ScramIdent> integer

Range: 0 to 1
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Scrambling Identity n_SCID" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:APM?

Queries the antenna port mapping method.

Return values:

<AntPortMap> CB | RCB | FW

`CB` = codebook
`RCB` = random codebook
`FW` = fixed weights

*RST: CB

Example: See `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:TRSCheme?` on page 835.

Usage: Query only

Manual operation: See "Antenna Port Mapping" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:DAFormat <CoordMapMode>

Switches between the cartesian and cylindrical coordinates representation.

Parameters:

<CoordMapMode> CARTesian | CYLindrical

*RST: CARTesian

Manual operation: See "Mapping Coordinates" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:REAL?

Defines the mapping of the antenna ports to the physical antennas.

Suffix:
<dir0> 5 | 7 to 14
antenna port

Return values:
<DataReal> float

The REAL (Magnitude) and IMAGinary (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|REAL+j*IMAGinary| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.

Range: -1 to 1
Increment: 0.001
*RST: 0

Usage: Query only

Manual operation: See "Mapping Table" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:PRECoding:AP<dir0>:BB<st0>:IMAGinary?

Defines the mapping of the antenna ports to the physical antennas.

Suffix:
<dir0> 5 | 7 to 14
antenna port

Return values:
<DataImag> float

The REAL (Magnitude) and IMAGinary (Phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|REAL+j*IMAGinary| ≤ 1
Otherwise, the values are normalized to Magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: 0

Usage: Query only

Manual operation: See "Mapping Table" on page 421

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:STATe <ScramState>

Enables scrambling.

Parameters:
<ScramState> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Scrambling State" on page 416
See "Scrambling State" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:SCRambling:UEID?

Queries the user equipment identifier (n_RNTI) or UE ID of the user to which the PDSCH transmission is intended.

Return values:
<UEID> integer

Range: 0 to 65535
*RST: 0

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "UE ID/n_RNTI" on page 416
See "UE ID/n_RNTI" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:STATe
<ChanCodState>

Enables channel coding.

Parameters:
<ChanCodState> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Channel Coding State" on page 416
See "Channel Coding State" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSize?

Queries the size of the transport block/payload in bits.

Return values:
<ChanCodTranBlck> integer

Range: 34 to 1E4
*RST: 16

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Usage: Query only

Manual operation: See "Transport Block Size/Payload (DL)" on page 418
See "Transport Block Size/Payload (DL)" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:TBSI
<ChanCodTBSIndex>

Queries the resulting transport block size index.

Parameters:
<ChanCodTBSIndex> integer
Range: 34 to 34
*RST: 34

Example: See Example "MPDCCH and PDSCH DCI-based configuration (DCI format 6-1A)" on page 773.

Manual operation: See "Transport Block Size I_{TBS}" on page 422

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MIB
<ChanCodMibState>

Enables transmission of real MIB (master information block) data.

Parameters:
<ChanCodMibState> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Manual operation: See "MIB (including SFN)" on page 417

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SIB
<SchedulingSIB1>

Sets the parameter `schedulingInfoSIB1-RB` and defines the PDSCH number of repetitions.

Query the resulting number of repetitions with the command `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:RSIB?`.

Parameters:
<SchedulingSIB1> integer
Range: 0 to 18
*RST: 0

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Manual operation: See "Scheduling Info SIB1-RB" on page 417

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:RSIB?

Queries the number of PDSCH repetitions N_{Rep}^{PDSCH}, as defined with the command `[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SIB`.

Return values:
<PDSCHRepSIB1> integer
Range: 0 to 11
*RST: 0

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Usage: Query only

Manual operation: See "PDSCH Repetitions SIB1-RB" on page 417

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:MSPare
<MibSpareBits>

Sets the spare bits in the PBCH transmission.

Parameters:
<MibSpareBits> 5 bits

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Manual operation: See "MIB Spare Bits" on page 418

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SOFFset
<ChanCodSfnOffse>

Sets the start SFN value.

Parameters:
<ChanCodSfnOffse> float
Range: 0 to 1020
Increment: 4
*RST: 0

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Manual operation: See "SFN Offset" on page 417

[:SOURce<hw>]:BB:EUTRa:DL:EMTC:ALLoc<ch0>:CCODing:SRPeriod
<SfnRestPeriod>

Determines the time span after which the SFN (System Frame Number) restarts.

Parameters:
<SfnRestPeriod> PERSlength
`PER3gpp` = "3GPP (1024 Frames)"
`PERSlength` = SFN restart period to the ARB sequence length
*RST: PERSlength

Example: See Example "PBCH and SIB1-BR configuration" on page 776.

Manual operation: See "SFN Restart Period" on page 417

9.27.2.8 MPDCCH Configuration

This section lists the MPDCCH-specific commands; for description of the commands common to EPDDCH and MPDCCH, see Chapter 9.22, "EPDCCH", on page 697.

Example: Configuring the MPDCCH sets

```
SOURce1:BB:EUTRa:DUPLexing FDD
SOURce1:BB:EUTRa:LINK DOWN
SOURce1:BB:EUTRa:STDMode IOT

// enable an eMTC UE, e.g. supporting eMTC CE Mode A
SOURce1:BB:EUTRa:DL:USER1:RELease EM_A

SOURce1:BB:EUTRa:DL:USER1:EPDCch1:STATe 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET1:STATe 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch1:SET2:STATe 1

SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:TTYP LOC
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:PRBS PRB2
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:RBA 2
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:NID 22
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:POWer 0
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:HOPPing 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STNB 1
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:REPMpdcch 16
SOURce1:BB:EUTRa:DL:USER1:EPDCch:CELL0:SET1:STSF S1

// MPDCCH allocations are configured automatically,
// depending on the eMTC DCI configuration
```

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:HOPPing.....842
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:REPMpdcch..... 843
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STNB..... 843
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STSF.....843

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:
HOPPing <Hopping>

Enables MPDCCH hopping.

Parameters:

<Hopping> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Configuring the MPDCCH sets" on page 773.

Options: R&S SMBV-K115

Manual operation: See "Hopping" on page 135

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:REPMpdcch <MaxRepMPDCCH>

Sets the maximum number the MPDCCH is repeated.

Parameters:
<MaxRepMPDCCH> 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256
*RST: 1

Example: See Example "Configuring the MPDCCH sets" on page 773.

Options: R&S SMBV-K115

Manual operation: See "Max. Repetitions MPDCCH (Rmax)" on page 135

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STNB <StartingNB>

Sets the first narrowbands in which MPDCCH is allocated.

Parameters:
<StartingNB> integer
Range: 0 to 15
*RST: 0

Example: See Example "Configuring the MPDCCH sets" on page 773.

Options: R&S SMBV-K115

Manual operation: See "Starting NB" on page 135

[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:EPDCch:CELL<st0>:SET<dir>:STSF <SearchSpStartSf>

Sets the first subframe of the search space.

Parameters:
<SearchSpStartSf> S1 | S1_5 | S2 | S2_5 | S5 | S8 | S10 | S20 | S4
*RST: S1

Example: See Example "Configuring the MPDCCH sets" on page 773.

Options: R&S SMBV-K115

Manual operation: See "Search Space Start Subframe" on page 135

9.27.3 General IoT Uplink

[:SOURce<hw>]:BB:EUTRa:UL:EMTC:NNBands? 844
[:SOURce<hw>]:BB:EUTRa:UL:EMTC:VALid:SUBFrame<dir> 844
[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOPping 845

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOFfset....845
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:GHOPping....845
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:DSEQshift....845
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTCShift....846
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STCShift....846
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:USEBase....846
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTBSequence....846
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STBSequence....847
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TWBSequence....847
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:PFMT....847
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:PERD....847
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:STTM....848
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:REP....848
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SUBC....848
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SCOF....848
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:RSET....848
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:HOFF....849
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:CONFig....849
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:HOPPing....849
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:REPetit....850
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:FOFFset....850
[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:SSFPeriod....850

[:SOURce<hw>]:BB:EUTRa:UL:EMTC:NNBands?

Queries the number of eMTC narrowbands N_{RB}^{UL} available within the selected channel bandwidth.

Return values:

<NumNarrowbands> integer

Range: 0 to 18
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Number of eMTC Narrowbands" on page 215

[:SOURce<hw>]:BB:EUTRa:UL:EMTC:VALid:SUBFrame<dir> <ValidSubFrames>

Sets a subframe as valid and used for eMTC transmission.

Suffix:

<dir> 0 to 9
Subframe number

Parameters:

<ValidSubFrames> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Valid Subframes" on page 219

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOPping <NBHopping>

Enables narrowband hopping.

Parameters:
<NBHopping> 0 | 1 | OFF | ON
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Narrowband Hopping" on page 426

[:SOURce<hw>]:BB:EUTRa:UL:PUSCh:NHOFfset <NBHoppingOffset>

Sets the narrowband hopping offset.

Parameters:
<NBHoppingOffset> integer
Range: 1 to 16
*RST: 3

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Hopping Offset" on page 426

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:GHOPping <GroupHopping>

Enables NDRS group hopping.

Parameters:
<GroupHopping> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Group Hopping" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:DSEQshift <DeltaSeqShift>

Sets the delta sequence shift for NPUSCH required for the calculation of the NDRS group hopping pattern.

Parameters:
<DeltaSeqShift> integer
Range: 0 to 29
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Delta Sequence Shift for NPUSCH" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTCShift <ThreeToneCycShi>

Sets the three tone cyclic shift.

Parameters:
<ThreeToneCycShi> integer
Range: 0 to 2
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Three/Six-Tone Cyclic Shift" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STCShift <SixToneCycShift>

Sets the six tone cyclic shift.

Parameters:
<SixToneCycShift> integer
Range: 0 to 3
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Three/Six-Tone Cyclic Shift" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:USEBase <UseBaseSequence>

Enables using base sequences for the generation of the NB-IoT DRS sequence hopping pattern.

Parameters:
<UseBaseSequence> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Use Base Sequences" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TTBSequence <ThreeToneBaseSq>

Sets the three tone base sequence.

Parameters:
<ThreeToneBaseSq> integer
Range: 0 to 12
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Three/Six/Twelve-Tone Base Sequence" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:STBSequence <SixToneBaseSeq>

Sets the six tone base sequence.

Parameters:

<SixToneBaseSeq> integer
Range: 0 to 14
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Three/Six/Twelve-Tone Base Sequence" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DRS:TWBSequence <TwelfeToneBaseS>

Sets the 12 tone base sequence.

Parameters:

<TwelfeToneBaseS> integer
Range: 0 to 30
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Three/Six/Twelve-Tone Base Sequence" on page 378

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:PFMT <PreambleFormat>

Select the preamble format.

Parameters:

<PreambleFormat> F0 | F1 | 0 | 1
`0|1` backward compatibility; use `F0|F1` instead.
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Preamble Format" on page 390

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:PERD <Periodicity>

Sets NPRACH periodicity.

Parameters:

<Periodicity> 40 | 80 | 160 | 240 | 320 | 640 | 1280 | 2560
*RST: 40

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Periodicity, ms" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:STTM <StartTime>

Sets the start time of the specific NPRACH configuration.

Parameters:
<StartTime> 8 | 16 | 64 | 128 | 32 | 256 | 512 | 1024
*RST: 8

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Starting Time, ms" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:REP <Repetitions>

Queries the number of NPRACH repetitions per preamble attempt.

Parameters:
<Repetitions> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128
*RST: R1

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Number of Repetitions" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SUBC <Subcarriers>

Sets the number of NPRACH subcarriers.

Parameters:
<Subcarriers> 12 | 24 | 36 | 48
*RST: 12

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Number of Subcarriers" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:NIOT:CFG<ch0>:SCOF <SubcarrierOffse>

Sets the NPRACH subcarrier offset.

Parameters:
<SubcarrierOffse> 0 | 2 | 12 | 18 | 24 | 34 | 36
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Subcarrier Offset" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:RSET <RestrictedSet>

Enables using the restricted set.

Parameters:
<RestrictedSet> URES | ARES | BRES | OFF | ON

URES|OFF
Unrestricted preamble set.

ARES|ON
Restricted set type A.

BRES
Restricted set type B.

*RST: URES

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Restricted Set" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:HOFF <HoppingOffset>

Sets a PRACH hopping offset as number of resource blocks (RB).

Parameters:
<HoppingOffset> integer

Range: 1 to 110
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Hopping Offset" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:CONFig <Config>

Selects the PRACH configuration index.

Parameters:
<Config> integer

Range: 0 to 63
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "PRACH Configuration" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:HOPPing <Hopping>

Enables frequency hopping.

Parameters:
<Hopping> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Hopping" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:REPetit <Repetitions>

Sets the PRACH number of repetitions.

Parameters:

<Repetitions> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128
*RST: R1

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Number of Repetitions" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:FOFFset
<FrequencyOffset>

Sets a frequency offset in terms of resource blocks.

Parameters:

<FrequencyOffset> integer
Range: 0 to 94
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Freq. Offsets" on page 444

[:SOURce<hw>]:BB:EUTRa:UL:PRACh:EMTC:CELV<ch0>:SSFPeriod
<StartSfPeriod>

Sets the starting subframe periodicity.

Parameters:

<StartSfPeriod> NONE | 4 | 2 | 8 | 16 | 32 | 64 | 128 | 256
*RST: NONE

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Starting SF Periodicity" on page 444

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[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:SCSPacing....853
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[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:EMTC:ARB:SUGGested?....880

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:GHDisable <NbiotDisGH>

Disables NDRS group hopping for the selected UE.

Parameters:

<NbiotDisGH> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Disable Group Hopping" on page 379

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:SCSPacing <SubcarrSpacing>

Sets the subcarrier spacing.

Parameters:

<SubcarrSpacing> S15 | S375

*RST: S15

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Subcarrier Spacing" on page 382

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:RBINdex <ResBlkIndex>

Sets the resource block number in that the NB-IoT transmissions are allocated.

Parameters:

<ResBlkIndex> integer

Range: Depends on other values
*RST: 20

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Resource Block Index" on page 382

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:DFReq <DeltaFreq>

Sets the frequency offset between the NB-IoT carrier and the LTE center frequency.

Parameters:

<DeltaFreq> float

Range: -1E7 to 1E7
Increment: 1000
Default unit: MHz

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Delta Frequency to DC, MHz" on page 382

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:MODE <Mode>

Selects the operating mode.

Parameters:

<Mode> INBD | ALON | GBD

*RST: INBD

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Mode" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:NTRansmiss <NumTransmission>

Sets the number of NPUSCH transmissions.

Parameters:
<NumTransmission> integer
Range: 1 to 20
*RST: 1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Number of Transmissions" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:FORMat <Format>

Sets the NPUSCH transmission format.

Parameters:
<Format> F1 | F2
*RST: F1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "NPUSCH Format" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:MODulation
<Modulation>

Sets the modulation scheme for the NPUSCH transmission.

Parameters:
<Modulation> QPSK | PI2Bpsk | PI4Qpsk
*RST: PI2Bpsk

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Modulation" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSFrame
<StartSubframe>

Sets the NPUSCH starting subframe.

Parameters:
<StartSubframe> integer
Range: 0 to 10000
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Starting Subframe (SF)" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:REPetitions
<Repetitions>

Sets the number of repetitions.

Parameters:
<Repetitions> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128
*RST: R1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Repetitions" on page 384

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NRUNits
<ResourceUnits>

Sets the number of allocated resource units.

Parameters:
<ResourceUnits> RU1 | RU2 | RU3 | RU4 | RU5 | RU6 | RU8 | RU10
*RST: RU1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Number of Resource Units N_{RU}" on page 384

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:SIRF
<SCarrIndAckNack>

Sets the subcarrier indication field.

Parameters:
<SCarrIndAckNack> integer
Range: 0 to 47
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Subcarrier Indication or ACK/NACK Resource Field" on page 384

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NSCarriers?

Queries the allocated number of subcarriers.

Return values:
<NumSubcarriers> integer
Range: 0 to 63
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Number of Subcarriers" on page 384

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:NSLTs?

Queries the allocated number of slots per RU.

Return values:
<NumSlots> integer
Range: 1 to 16
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Slots" on page 385

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSCarrier?

Queries the starting subcarrier.

Return values:
<NbiotStartSc> integer
Range: 0 to 1000
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Starting Subcarrier" on page 385

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:STSLot?

Queries the starting slot.

Return values:
<StartSlot> integer
Range: 0 to 2E5
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Starting Slot" on page 383

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:POWer <Power>

Sets the power of the NPUSCH transmission.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Power, dB" on page 385

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:ARB:SUGGested?

Queries the ARB sequence length that is required for the selected NPUSCH transmissions.

Return values:

<NbiotSuggSeqLen> integer

Range: 0 to 1E4
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Suggested" on page 385

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:NPSSim <NPuschAllSymb>

Enables simultaneous transmission of NPUSCH and SRS.

Parameters:

<NPuschAllSymb> 0 | 1 | OFF | ON

*RST: 1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "NPUSCH + SRS simultaneous Tx" on page 246

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:BITS?

Queries the number of used ACK/NACK bits.

NPUSCH format F2 uses 1 ACK/NACK bit.

Return values:

<NbiotAnBits> integer

Range: 1 to 1
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Number of A/N Bits" on page 388

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:CBITs?

Queries the number of coded bits.

NPUSCH format F2 uses 16 coded bits.

Return values:

<NbiotCodANBits> integer

Range: 16 to 16
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Number of Coded A/N Bits" on page 388

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:HARQ:PATTern
<NbiotANPat>, <BitCount>

Set the ACK/ANCK pattern.

Parameters:

<NbiotANPat> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 1
*RST: 1

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "ACK/NACK Pattern" on page 388

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:PHYSbits?

Queries the number of physical bits of the selected NPUSCH transmission.

Return values:

<NBiotPhysBits> integer

Range: 1 to 1E5
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Total Number of Physical Bits" on page 387

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:RUINdex?

Queries the resource unit (RU) field index.

Return values:
<NbiotRuFInd> integer
Range: 1 to 16
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Resource Unit Field Index I_{RU}" on page 387

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:RVINdex
<NbiotRVIdx>

Sets the starting redundancy version index.

Parameters:
<NbiotRVIdx> integer
Range: 0 to 2
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Starting Redundancy Version Idex (rv_ix)" on page 388

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:TBINdex
<NbiotTBSizeIdx>

Sets the transport block size index.

Parameters:
<NbiotTBSizeIdx> integer
Range: 0 to 12
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Manual operation: See "Transport Block Size Index I_{TBS}" on page 387

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:TRANs<ch>:PUSCh:TBSize?

Queries the transport block size.

Return values:
<NbiotTBSize> integer
Max transport block size depends on the installed options
Option:R&S SMBV-K115: Max = 1000
Range: 16 to max
*RST: 0

Example: See Example "NPUSCH and NDRS configuration" on page 768.

Usage: Query only

Manual operation: See "Transport Block Size/Payload" on page 388

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TYPE <FrcID>

Selects the FRC.

Parameters:

<FrcID> A141 | A142 | A143 | A151 | A144 | A152 | A161 | A162 | A163 | A164 | A165 | A241 | A242 | A243 | A244 | A245 | A246 | A247

*RST: A141

Example: See Example "Using FRC" on page 770.

Manual operation: See "FRC" on page 375

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:STATe <State>

Enables the FRC.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 0

Example: See Example "Using FRC" on page 770.

Manual operation: See "FRC State" on page 375

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:ALResunits?

Queries the number of allocated resource units.

Return values:

<AllocResUnits> integer

Range: 1 to 2
*RST: 2

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Allocated Resource Units" on page 377

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:BPResunit?

Queries the number of bits per resource unit.

Return values:

<BitsPerResUnit> integer

Range: 96 to 288
*RST: 96

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Total Number of Bits per Resource Unit" on page 377

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:MODulation?

Queries the modulation scheme.

Return values:
<Modulation> QPSK | PI2Bpsk | PI4Qpsk
*RST: PI2Bpsk

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Modulation" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NNPRep <NoNPUSCHRep>

Queries the number of NPUSCH repetitions.

Parameters:
<NoNPUSCHRep> 1 | 2 | 16 | 64
*RST: 1

Example: See Example "Using FRC" on page 770.

Manual operation: See "Number of NPUSCH Repetitions" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NOSCarriers?

Queries the number of allocated subcarriers.

Return values:
<NoSubCarriers> integer
Range: 1 to 12
*RST: 1

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Number of Allocated Subcarriers" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:PASize?

Queries the payload size.

Return values:
<PayloadSize> integer
Range: 32 to 136
*RST: 32

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Payload Size" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:SCSPacing?

Queries the subcarrier spacing.

Return values:
<SubCarrSpacing> S15 | S375
*RST: S15

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Subcarriers Spacing" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TBSSindex?

Queries the transport block size index.

Return values:
<TBSSizeIndex> integer
Range: 0 to 9
*RST: 0

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Transport Block Size Index I_{TBS}" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:MOD <Mode>

Selects the operating mode.

Parameters:
<Mode> INBD | ALON | GBD
*RST: INBD

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Mode" on page 391

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:PRATtempts
<PreambleAttempt>

Sets the number of preamble attempts.

Parameters:
<PreambleAttempt> integer
Range: 0 to 30
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Number of Preamble Attempts" on page 392

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:RBID <RbIndex>

Sets the resource block in that the NPRACH is allocated.

Parameters:
<RbIndex> integer
Range: 0 to 100
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Resource Block Index" on page 392

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:DFReq <DeltaFreq>

Sets the frequency offset between the NB-IoT carrier and the LTE center frequency.

Parameters:
<DeltaFreq> float
Range: -1E7 to 1E7
Increment: 1000
Default unit: MHz

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Delta Frequency to DC, MHz" on page 392

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:CONFig
<Configuration>

Selects the NPRACH configuration.

Parameters:
<Configuration> integer
Range: 0 to 2
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "NPRACH Configuration" on page 393

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:SFSTart <StartingSf>

Sets the starting subframe.

Parameters:

<StartingSf> integer

Range: 0 to 1E4
*RST: 8

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Starting Subframe" on page 393

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:INIT <Ninit>

Sets the subcarrier index.

Parameters:

<Ninit> integer

Range: 0 to 47
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "n_{int}" on page 393

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:STRT?

Queries the value n_{start}.

Return values:

<Nstart> integer

Range: 0 to 47
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Usage: Query only

Manual operation: See "n_{start}" on page 393

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:NIOT:POWer <Power>

Sets the preamble attempt power relative to the UE power.

Parameters:

<Power> float

Range: -80.000 to 10.000
Increment: 0.001
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Manual operation: See "Power" on page 393

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:NIOT:ARB:SUGGested?

Queries the ARB sequence length that is required for the selected NPRACH transmissions.

Return values:
<PracNbiotSugg> integer
Range: 0 to 1E4
*RST: 0

Example: See Example "NPRACH configuration" on page 770.

Usage: Query only

Manual operation: See "ARB Sequece Length > Sugested" on page 394

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TYPE <FrcID>

Selects the FRC.

Parameters:
<FrcID> A141 | A142 | A143 | A151 | A144 | A152 | A161 | A162 | A163 | A164 | A165 | A241 | A242 | A243 | A244 | A245 | A246 | A247
*RST: A141

Example: See Example "Using FRC" on page 770.

Manual operation: See "FRC" on page 375

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:STATe <State>

Enables the FRC.

Parameters:
<State> 0 | 1 | OFF | ON
*RST: 0

Example: See Example "Using FRC" on page 770.

Manual operation: See "FRC State" on page 375

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:ALResunits?

Queries the number of allocated resource units.

Return values:
<AllocResUnits> integer
Range: 1 to 2
*RST: 2

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Allocated Resource Units" on page 377

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:MODulation?

Queries the modulation scheme.

Return values:
<Modulation> QPSK | PI2Bpsk | PI4Qpsk
*RST: PI2Bpsk

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Modulation" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:PASize?

Queries the payload size.

Return values:
<PayloadSize> integer
Range: 32 to 136
*RST: 32

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Payload Size" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:TBSSindex?

Queries the transport block size index.

Return values:
<TBSSizeIndex> integer
Range: 0 to 9
*RST: 0

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Transport Block Size Index I_{TBS}" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:SCSPacing?

Queries the subcarrier spacing.

Return values:
<SubCarrSpacing> S15 | S375
*RST: S15

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Subcarriers Spacing" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:PASize?

Queries the payload size.

Return values:
<PayloadSize> integer
Range: 32 to 136
*RST: 32

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Payload Size" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NOSCarriers?

Queries the number of allocated subcarriers.

Return values:
<NoSubCarriers> integer
Range: 1 to 12
*RST: 1

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Number of Allocated Subcarriers" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:NNPRep <NoNPUSCHRep>

Queries the number of NPUSCH repetitions.

Parameters:
<NoNPUSCHRep> 1 | 2 | 16 | 64
*RST: 1

Example: See Example "Using FRC" on page 770.

Manual operation: See "Number of NPUSCH Repetitions" on page 376

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:NIOT:FRC:BPResunit?

Queries the number of bits per resource unit.

Return values:
<BitsPerResUnit> integer
Range: 96 to 288
*RST: 96

Example: See Example "Using FRC" on page 770.

Usage: Query only

Manual operation: See "Total Number of Bits per Resource Unit" on page 377

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:CELevel <CeLevel>

Set the coverage extension level (CE).

Parameters:
<CeLevel> CE01 | CE23
*RST: CE01

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "CE Level" on page 427

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:HOPP <HoppingInterval>

Sets the narrowband hopping interval.

Parameters:
<HoppingInterval> H1 | H2 | H4 | H5 | H8 | H10 | H16 | H20 | H40
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Narrowband Hopping Interval" on page 427

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:NTRansmiss <NumTransmission>

Sets the number of PUSCH and PUCCH eMTC transmission for the selected UE.

Parameters:
<NumTransmission> integer
Range: 1 to 20
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Number of Transmissions" on page 428

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CONTent
<ContentType>

Sets the channel type.

Parameters:
<ContentType> PUSCh | PUCCh
*RST: PUSCh

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Content" on page 428

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:MODulation
<Modulation>

Sets the modulation scheme of the PUSCH transmission.

Parameters:
<Modulation> QPSK | QAM16 | QAM64
*RST: QPSK

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Modulation/Format" on page 428

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:FORMat <Format>

Sets the PUCCH format.

Parameters:
<Format> F1 | F1A | F1B | F2 | F2A | F2B
*RST: F1

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "Modulation/Format" on page 428
See "Format" on page 440

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:STSFrame
<StartSubframe>

Sets the subframe number in that the PUSCH/PUCCH allocation is scheduled for the first time.

Parameters:
<StartSubframe> integer
Range: 0 to 10000
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Start Subframe" on page 428

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:ASFRrame?

Queries the number of absolute subframes.

Return values:
<NumAbsSubframe> integer
Range: 1 to 10000
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "No. Absolute Subframes" on page 429

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:REPetitions
<Repetitions>

Sets the number of repetitions.

Parameters:
<Repetitions> R1 | R2 | R4 | R8 | R16 | R32 | R64 | R128 | R192 | R256 | R384 | R512 | R768 | R1024 | R1536 | R2048 | R12 | R24
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Repetitions" on page 429

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:STNBand
<StartNarrowBand>

Sets the start NB of the PSUCH/PUCCH transmission.

Parameters:
<StartNarrowBand> integer
Range: 0 to number of available narrowbands
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Start Narrowband" on page 429

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NRBLocks
<NumberResBlocks>

Sets the number of used resource blocks (RB) within one narrowband.

Parameters:
<NumberResBlocks> integer
Range: 1 to 6
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "No. RB" on page 429

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:RBOFfset
<ResBlockOffset>

For allocations that span less than 6 RB, this parameter shifts the allocated RBs within the NB.

Parameters:

<ResBlockOffset> integer

Range: 0 to 5
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Offset VRB" on page 430

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:POWer <Power>

Sets the power of the eMTC PUSCH and PUCCH transmission

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Power, dB" on page 430

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:ARB:SUGGested?

Queries the ARB sequence length that is required for the selected PUSCH transmissions.

Return values:

<Suggested> integer

Range: 0 to 10000
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Suggested" on page 385

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:DRS:CYCShift?

Sets the cyclic shift field.

Return values:
<Cyclicshift> integer
Range: 0 to 7
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Cyclic Shift Filed" on page 433

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NDMRs?

Queries the parameter n(2)_DMRS,λ (Layer λ).

Return values:
<Ndmrs> integer
Range: 0 to 10
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "n(2)_DMRS,0 (Layer 0)" on page 433

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:BITS
<NumCQIBits>

Sets the number of CQI bits before channel coding.

Parameters:
<NumCQIBits> integer
Range: 0 to 1024
*RST: 10

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "Number of CQI Bits" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:PATTern
<EmtcCqiPat>, <BitCount>

Sets the CQI pattern for the PUSCH.

The length of the pattern is determined by the number of CQI bits as set with the command `[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:BITS`.

Parameters:
<EmtcCqiPat> numeric
*RST: #H0

<BitCount> integer
Range: 1 to 1024
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "CQI Pattern" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUSCh:CQI:CBITs?

Queries the number of coded CQI bits.

Return values:
<NumCodedCQIBits> integer
Range: 0 to 1E5
*RST: 20

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Number of Coded CQI Bits" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:MODE <Mode>

Sets the ACK/NACK mode.

Parameters:
<Mode> MUX
*RST: MUX

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "ACK/NACK Mode" on page 433

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:ULSCh:BITS?

Queries the number of physical bits used for UL-SCH transmission.

Return values:
<PhysBitULSCH> integer
Range: 0 to 1E5
*RST: 1500

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Number of Coded UL-SCH Bits" on page 435

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CCODing:TBSize <TranspBlockSize>

Sets the size of the transport block.

Parameters:

<TranspBlockSize> integer

Range: 1 to 1E5
*RST: 16

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Transport Block Size/Payload" on page 435

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NAPused?

Queries the number of antenna ports used for transmissions of the selected PUCCH format.

Return values:

<NumAntennaPorts> integer

Range: 1 to 1
*RST: 1

Example: See Example "eMTC PUCCH configuration" on page 780.

Usage: Query only

Manual operation: See "Number of Used Antenna Port" on page 440

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:NPUCch <NPucchAP100>

Sets the PUCCH resource index.

Parameters:

<NPucchAP100> integer

Range: 0 to 65535
*RST: 0

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "n_PUCCH Antenna Port 100" on page 441

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:BITS <Bits>

Sets the number of ACK/NACK bits.

Parameters:

<Bits> integer

Range: 0 to 20
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Number of A/N Bits" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:CBITs?

Queries the number of coded ACK/NACK bits.

Return values:

<Codedbits> integer

Range: 0 to 1E5
*RST: 20

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See "Number of Coded A/N Bits" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:HARQ:PATTern
<EmtcAckNackPat>, <BitCount>

Sets the ACK/NACK pattern for the PUSCH.

Parameters:

<EmtcAckNackPat> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "ACK/NACK Pattern" on page 434

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PHYSbits?

Queries the number of physical bits of the selected PUSCH transmission.

Return values:

<PuscPhysBits> integer

Range: 1 to 1E5
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Usage: Query only

Manual operation: See " Total Number of Physical Bits " on page 435

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:CCODing:RVINdex <RedundVersIndex>

Sets the redundancy version index.

Parameters:

<RedundVersIndex> integer

Range: 0 to 3
*RST: 0

Example: See Example "eMTC PUSCH configuration" on page 778.

Manual operation: See "Starting Redundancy Version Index (rv_idx)" on page 435

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:HARQ:PATTern <EmtcAckNackPat>, <BitCount>

Sets the PUCCH ACK/NACK pattern.

Parameters:

<EmtcAckNackPat> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "A/N Pattern" on page 441

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:BITS <NumCQIBits>

Sets the number of CQI bits before channel coding.

Parameters:

<NumCQIBits> integer

Range: 0 to 1024
*RST: 10

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "Number of CQI Bits" on page 441

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:PATTern <Pattern>, <BitCount>

Sets the CQI pattern for the PUCCH.

Parameters:

<Pattern> numeric

*RST: #H0

<BitCount> integer

Range: 1 to 13
*RST: 1

Example: See Example "eMTC PUCCH configuration" on page 780.

Manual operation: See "CQI Pattern" on page 441

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:EMTC:TRANs<ch>:PUCCh:CQI:CBITs?

Queries the number of coded CQI bits.

Return values:
<NumCodedCQIBits> integer

Range: 0 to 1E5
*RST: 20

Example: See Example "eMTC PUCCH configuration" on page 780.

Usage: Query only

Manual operation: See "Number of Coded CQI Bits" on page 441

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:EMTC:PRATtempts
<PreambleAttempt>

Sets the number of preamble attempts.

Parameters:
<PreambleAttempt> integer

Range: 0 to 40
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Number of Preamble Attempts" on page 445

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:CELV <CeLevel>

Sets the CE level.

Parameters:
<CeLevel> integer

Range: 0 to 3
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "CE Level" on page 445

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:SFSTart
<StartingSf>

Sets the starting subframe.

Parameters:
<StartingSf> integer
Range: 0 to 1E5
*RST: 1

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Starting Subframe" on page 445

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:FRINdex
<FreqResIndex>

For "Duplexing > TDD", sets the frequency resource index.

Parameters:
<FreqResIndex> integer
Range: 0 to 1E5
*RST: 0

Example:
```
SOURce1:BB:EUTRa:DUPLexing TDD
SOURce1:BB:EUTRa:UL:UE2:PRACh:ATT0:EMTC:FRINdex 10
```

Manual operation: See "Frequency Resource Index" on page 445

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:NCSConf
<NcsConfig>

Selects the Ncs configuration.

Parameters:
<NcsConfig> integer
For detail on the value range, see Table 5-49.
Range: 0 to 15
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Ncs Configuration" on page 446

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:RSEQuence
<RootSequence>

Sets the logical root sequence index.

Parameters:

<RootSequence> integer

Range: 0 to 838
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Logical Root Sequence Index" on page 446

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:SINDex <SequenceIndex>

Sets the sequence index **v**.

Parameters:

<SequenceIndex> integer

Range: 0 to 63
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Sequence Index (v)" on page 446

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:DT <DeltaTime>

Sets the parameter Delta_t in us.

Parameters:

<DeltaTime> float

Range: -500 to 500
Increment: 0.01
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Delta t /us" on page 446

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:ATT<ch0>:EMTC:POWer <Power>

Sets the preamble attempt power relative to the UE power.

Parameters:

<Power> float

Range: -80.000 to 10.000
Increment: 0.001
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Manual operation: See "Power, dB" on page 446

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACh:EMTC:ARB:SUGGested?

Queries the ARB sequence length that is required for the PRACH configuration.

Return values:

<Suggested> integer
Range: 0 to 10000
*RST: 0

Example: See Example "eMTC PRACH configuration" on page 780.

Usage: Query only

Manual operation: See "ARB Sequece Length > Sugested" on page 447

9.28 Test Case Wizard Remote-Control Commands

The signal generator gives you the opportunity to generate predefined settings which enable tests on base stations in conformance with the 3G standard EUTRA/LTE. It offers a selection of predefined settings according to Test Cases in TS 36.141. The settings take effect only after execution of command `[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings`.

[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings....881
[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLEVel?....881
[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation....881
[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation....881
[:SOURce<hw>]:BB:EUTRa:TCW:GS:SPEC....882
[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease....882
[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals....882
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig....882
[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass....882
[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout....883
[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig....883
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:CHBW?....883
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?....883
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:DUPLex....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBLock?....884
[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEDge....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLEVel?....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLEVel?....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLEVel?....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency....885
[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig....886

[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel? 886
[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID 886
[:SOURce<hw>]:BB:EUTRa:TCW:TC 886
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW 887
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID 887
[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix 887
[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex 887
[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC 888
[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset 888
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel 888
[:SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB 888
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB 888
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB 888
[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLEVel? 889
[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency 889
[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig 889
[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID 889
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID 889
[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID 889

[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings

Activates the current settings of the test case wizard.

Note: The settings of the selected test case become active only after executing this command.

Usage: Event

Manual operation: See "Apply Settings" on page 471

[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLEVel?

Queries the AWGN power level.

Return values:
<PowerLevel> string

Usage: Query only

Manual operation: See "Power Level" on page 488

[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation <FrequencyAlloc>
[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation <ResBlockAlloc>

Determines the frequency position of the wanted and interfering signal.

Parameters:
<ResBlockAlloc> HIGHer | LOWer
*RST: HIGHer

Manual operation: See "Frequency Allocation of the Interfering signal" on page 469

[:SOURce<hw>]:BB:EUTRa:TCW:GS:SPEC <GsSpec>

Selects the 3GPP test specification used as a guideline for the test cases.

Parameters:

<GsSpec> TS36141

*RST: TS36141

Example: `SOURce1:BB:EUTRa:TCW:GS:SPEC TS36141`

Manual operation: See "Test Specification" on page 467

[:SOURce<hw>]:BB:EUTRa:TCW:GS:RELease <Release>

Sets the 3GPP test specification used as a guideline for the test cases.

Parameters:

<Release> REL8 | REL9 | REL10 | REL11

*RST: REL8

Manual operation: See "Release" on page 468

[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals <GeneratedSignal>

Determines the signal is generated by the instrument.

Parameters:

<GeneratedSignal> IF23 | WSIF1AWGN

*RST: WSIF1AWGN

[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig <MarkerConfig>

Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

Parameters:

<MarkerConfig> UNCHanged | FRAMe

FRAMe
The marker settings are customized for the selected test case. "Radio Frame Start" markers are output; the marker delays are set equal to zero.

UNCHanged
The current marker settings of the signal generator are retained unchanged.

*RST: FRAMe

Manual operation: See "Marker Configuration" on page 468

[:SOURce<hw>]:BB:EUTRa:TCW:GS:BSCLass <BsClass>

Sets the base station class.

Parameters:

<BsClass> WIDE | LOCal | HOME | MEDium

*RST: WIDE

Example:

```
SOURce1:BB:EUTRa:TCW:GS:RELease REL10
SOURce1:BB:EUTRa:TCW:TC TS36141_TC72
SOURce1:BB:EUTRa:TCW:GS:BSCLass LOCal
SOURce1:BB:EUTRa:TCW:WS:PLevel?
```

Response: `"-98.10 dBm"`

Manual operation: See "Base Station Class" on page 468

[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout <SignalRouting>

Selects the signal routing for baseband A signal which usually represents the wanted signal.

Parameters:

<SignalRouting> PORTA

*RST: PORTA

Example:

```
SOURce1:BB:EUTRa:TCW:GS:SIGRout PORTA
```

Manual operation: See "Signal Routing" on page 469

[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig <TriggerConfig>

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

Parameters:

<TriggerConfig> UNCHanged | AAUTo

UNCHanged
The current trigger settings of the signal generator are retained unchanged.

AAUTo
The trigger settings are customized for the selected test case. The trigger setting "Armed Auto" with external trigger source is used; the trigger delay is set to zero.
Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.

*RST: AAUTo

Manual operation: See "Trigger Configuration" on page 468

[:SOURce<hw>]:BB:EUTRa:TCW:IS2:CHBW?
[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?

Queries the channel bandwidth of the interfering signal.

Return values:
<ChanBandwidth> BW20_00 | BW10_00 | BW5_00 | BW3_00 | BW1_40 | BW15_00

Usage: Query only

Manual operation: See "Channel Bandwidth" on page 477
See "Channel Bandwidth" on page 484

[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID <CellID>

Sets the Cell ID for the interfering signal.

Parameters:
<CellID> integer
Range: 0 to 503
*RST: 1

Manual operation: See "Cell ID" on page 485

[:SOURce<hw>]:BB:EUTRa:TCW:IS2:DUPLex <Duplexing>
[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex <Duplex>

Selects whether TDD or FDD duplexing mode is used.

Parameters:
<Duplex> TDD | FDD
*RST: FDD

Manual operation: See "Duplexing" on page 477
See "Duplexing" on page 484

[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?
[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe <InterfererType>

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal (`EUTra`) or out-of-band CW signal (`CW`).
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal (`EUTra`) or narrowband EUTRA signal (`NEUTra`).
  The second interfering signal is always a CW signal (`CW`).

Parameters:
<InterfererType> NEUTra | EUTra | CW | UTRA
*RST: EUTra

Manual operation: See "Interferer Type" on page 483

[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBLock?

Queries the number of RBs used by the LTE interfering signal.

Return values:
<NumResBlock> integer
Range: 3 to 25
*RST: 3

Usage: Query only

Manual operation: See "Number of Resource Blocks" on page 485

[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset <SigAdvNTAoffset>

Sets the parameter $N_{TAoffset}$.

Parameters:
<SigAdvNTAoffset> NTA624 | NTA0
*RST: NTA624

Manual operation: See "Signal Advance N_TA_offset" on page 484

[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEDge <OffsChannelEdge>

Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth.

Parameters:
<OffsChannelEdge> OCE12_5 | OCE7_5 | OCE2_5
*RST: OCE2_5

Manual operation: See "Offset to Channel Edge" on page 476

[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLEVel?
[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLEVel?
[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLEVel?

Queries the power level of the interfering signal.

Return values:
<PowerLevel> string

Usage: Query only

Manual operation: See "Power Level/Power Level P-CPICH" on page 477
See "Power Level" on page 485

[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency <RfFrequency>
[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency <RfFrequency>

Queries the center frequency of the interfering signal.

Parameters:

<RfFrequency> integer

Range: 100E3 to 6E9
*RST: 1.95E9

Manual operation: See "RF Frequency" on page 476
See "RF Frequency" on page 483

[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig <TddConfig>

For TDD mode, selects the UL/DL Configuration number.

Parameters:

<TddConfig> integer

Range: 0 to 6
*RST: 0

Manual operation: See "TDD UL/DL Configuration" on page 484

[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODel?

Queries the test model. The interfering signal is generated according to E-TM1.1 test model.

Return values:

<TestModel> TM1_1

Usage: Query only

Manual operation: See "Test Model" on page 477

[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID <UE_ID_nRNTI>

Sets the UE ID/n_RNTI for the interfering signal.

Parameters:

<UE_ID_nRNTI> integer

Range: 0 to 65535
*RST: 1

Manual operation: See "UE ID/n_RNTI" on page 485

[:SOURce<hw>]:BB:EUTRa:TCW:TC <TestCase>

Selects the test case.

Parameters:

<TestCase> TS36141_TC839 | TS36141_TC834 | TS36141_TC835 | TS36141_TC836 | TS36141_TC67 | TS36141_TC72 | TS36141_TC73 | TS36141_TC74 | TS36141_TC75A | TS36141_TC75B | TS36141_TC76 | TS36141_TC78 | TS36141_TC821 | TS36141_TC822 | TS36141_TC823 | TS36141_TC824 | TS36141_TC831 | TS36141_TC832 | TS36141_TC833 | TS36141_TC841 | TS36141_TC838 | TS36141_TC837

*RST: TS36141_TC72

Manual operation: See "Test Case" on page 468

[:SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW <ChanBandwidth>

Selects the channel bandwidth.

Parameters:

<ChanBandwidth> BW20_00 | BW10_00 | BW5_00 | BW3_00 | BW1_40 | BW15_00

*RST: BW1_40

Manual operation: See "Channel Bandwidth" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID <CellId>

Sets the Cell ID.

Parameters:

<CellId> integer

Range: 0 to 503
*RST: 150

Manual operation: See "Cell ID" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix <CyclicPrefix>

Selects normal or extended cyclic prefix.

Parameters:

<CyclicPrefix> EXTended | NORMal

*RST: NORMal

Manual operation: See "Cyclic Prefix" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex <Duplex>

Selects whether TDD or FDD duplexing mode is used.

Parameters:
<Duplex> TDD | FDD
*RST: FDD

Manual operation: See "Duplexing" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC <FRC>

Queries the fixed reference channel used.

Parameters:
<FRC> A11 | A12 | A13 | A14 | A15 | A21 | A22 | A23 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A41 | A42 | A43 | A44 | A45 | A46 | A47 | A48 | A51 | A52 | A53 | A54 | A55 | A56 | A57 | A71 | A72 | A73 | A74 | A75 | A76 | A81 | A82 | A83 | A84 | A85 | A86 | UE11 | UE12 | UE21 | UE22 | UE3
*RST: A11

Example:
```
SOURce1:BB:EUTRa:TCW:WS:FRC?
```

Manual operation: See "FRC" on page 471

[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset <SigAdvNTAoffset>

Sets the parameter $N_{TAoffset}$.

Parameters:
<SigAdvNTAoffset> NTA624 | NTA0
*RST: NTA624

Manual operation: See "Signal Advance N_TA_offset" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel <OutPowerLevel>

The settings of the selected test case become active only after selecting "Apply Settings".

Parameters:
<OutPowerLevel> float
Range: -115 to 0
Increment: 0.01
*RST: -30

Manual operation: See "Output Power Level" on page 480

[:SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB <OffsetVRB>
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB <OffsetVRB>
[:SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB <OffsetVRB>

Sets the number of RB the allocated RB(s) are shifted with.

Parameters:
<OffsetVRB> integer
Range: 0 to 75
*RST: 0

Manual operation: See "Offset VRB" on page 471

[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLEVel?

Queries the Power Level.

Return values:
<PowerLevel> string

Usage: Query only

Manual operation: See "Power Level" on page 471

[:SOURce<hw>]:BB:EUTRa:TCW:WS:RFFRequency <RfFrequency>

Sets the RF frequency of the wanted signal.

Parameters:
<RfFrequency> integer
Range: 100E3 to 6E9
*RST: 1.95E9

Manual operation: See "RF Frequency" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:WS:TDDConfig <TddConfig>

For TDD mode, selects the UL/DL Configuration number.

Parameters:
<TddConfig> integer
Range: 0 to 6
*RST: 0

Manual operation: See "TDD UL/DL Configuration" on page 470

[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID <UE_ID_nRNTI>
[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID <UE_ID_nRNTI>
[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID <UE_ID_nRNTI>

Sets the UE ID/n_RNTI.

Parameters:
<UE_ID_nRNTI> integer
Range: 0 to 65535
*RST: 1

Manual operation: See "UE ID/n_RNTI" on page 471

Annex

A Conflict Handling

In TS 36.211, physical signals and physical channels are defined for the EUTRA/LTE system. Therefore the available resources in the time-frequency domain are shared by the different signals and different kinds of allocations (comparable to the different channel types in the 3GPP FDD mode).

A.1 Downlink

R&S SMBV supports the following types of downlink signals and channels:

- Reference signals
- Primary synchronization signal (PSS)
- Secondary synchronization signal (SSS)
- Physical broadcast channel (PBCH)
- Physical Downlink Control Channel (PDCCH), including PCFICH and PHICH
- Physical Downlink Shared Channel (PDSCH)

Due to the concept of the R&S SMBV, different situations can appear that need clarification. If several signals and/or channels (of the same or different type) partly share resources, a decision has to be made what bits are mapped to the affected subcarriers. The general rule here is that the signal or channel with higher priority is transmitted completely while the affected subcarriers are stamped out of the lower priority signal or channel. Note that this reduces the number of available physical bits of a signal/channel.

The actual size of a certain allocation is displayed in the column physical bits of the resource allocation table.

The following picture shows the priorities of the different signal and channel types.

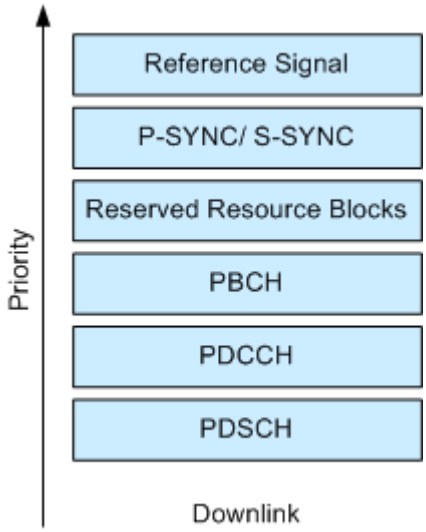

Figure A-1: Priority of different allocations, channels and signals in the downlink

- Overlapping of signals and/or channels with different priorities
  In case signals or channels of different priorities overlap, no conflict is indicated in the resource allocation table, as the signal with the higher priority is transmitted completely.
- Overlapping of allocations with the same priority
  If different allocations of the same priority are overlapping, the one with the lower allocation index (i.e. which comes first) in the resource allocation table is treated with higher priority. In this case, the reduced allocation is marked in the conflict column of the resource allocation table.

There is no way to configure a signal with overlapping reference signal and P-SYNC/S-SYNC.

If PRS and MBSFN are configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks is skipped then (see Example "Overlapping PDSCH, PRS and MBSFN" on page 103).

A.2 Uplink

In the uplink implementation of the R&S SMBV, you can configure different user equipment (UEs) to use the same physical resources. The signals of the different UEs are added, nevertheless a conflict is indicated in the resource allocation table.

Although a conflict is also displayed if the PUSCH and PUCCH allocations of one UE are overlapping, the signals of both allocations are added. However, a conflict can

occur between the sounding reference signal of a certain UE and the PUSCH of another UE.

A.3 DCI Conflict Handling

The R&S SMBV allows you to configure multiple scheduling messages with their corresponding PDCCHs per subframe. Using the DCI table in the Enhanced PCFICH, PHICH and PDCCH Channel Configuration dialog, the position of the DCI/PDCCH inside the multiplexed bitstream can be freely configured by setting the appropriate CCE index.

Because the number of CCEs for each PDCCH vary, the 3GPP specification TS 36.211, chapter 6.8.1 defines some restriction on the aggregation of CCEs. An aggregation of eight CCEs for instance can only start on CCE numbers evenly dividable by eight. The same principle applies to the other aggregation levels. In this implementation, if the restriction is not fulfilled or two CCEs are overlapping, a conflict is displayed for the DCI/PDCCH with the greater number. This DCI/PDCCH is not considered by the multiplexing, i.e. it is not transmitted.

The R&S SMBV provides the operations "Append", "Insert", "Delete", "Up", "Down" and "Resolve Conf." for flexibly configuration of valid DCIs and for resolving of conflicts.

Example:

This example is based on a DCI table of a control channel with a total "Number of CCEs = 26".

The "DCI Table" indicates a conflict in the second DCI/PDCCH. The reason for this conflict is that the CCEs allocated for the second DCI/PDCCH are overlapping with the CCEs used by the first one. The second DCI/PDCCH is ignored by the multiplexing.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	0	4	
User1	0	0	1A	UE-Spec	Config...	0	1	1	-	●
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

One of the ways to overcome this problem and to resolve the DCI conflict is to use the Resolve Conflicts function of the software. The built-in algorithm reassigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values are not maintained. The calculated signal is suitable for receiver tests that demand conflict free CCEs but have no requirements on explicit CCE values. If the conflict cannot be resolved automatically, the values remain unchanged.

If however there is a requirement for CCE indexes with explicit values, you can perform the corrections manually. In this particular example, you can set the CCE index of the third DCI/PDCCH to 4.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	4	0	
User1	0	0	1A	UE-Spec	Config...	0	1	1	2	
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

The CCEs used by the two subsequent DCIs/PDCCHs are not overlapping and the two DCIs/PDCCHS are configured to be transmitted consecutive, i.e. there is no gap between them ("No. Dummy CCEs" = 0).

The Figure A-2 shows the resulting PDCCH after multiplexing.

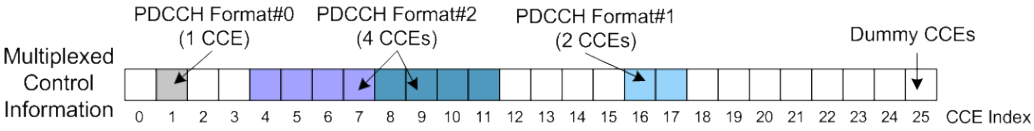

Figure A-2: PDCCH multiplexing (example)

If "Activate Carrier Aggregation > On", the parameter DCI Table determines the component carrier the corresponding User is mapped to. For this reason, there is no DCI conflict, if in the example above the second DCI belongs to a User enabled on an SCell.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	0	4	
User1	0	1	1A	UE-Spec	Config...	0	1	1	24	
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

B Subframes Handling

The following sections explain the subframes handling concept and implementation in the R&S SMBV.

B.1 Copy/Paste Subframe

The required EUTRA/LTE test signal consists of several subframes, possibly with the same or similar settings.

In these cases, you can:

- Copy and paste settings from one subframe to another.
- Configure a subset of subframes manually and use them periodically
  See Chapter B.2, "Number of Configurable Subframes", on page 895

Consider, however, that with both methods only subset of settings are inherited.

Both methods maintain the following settings:

- Cyclic prefix length
- Structure of PDCCH and PDSCH allocations
- Structure of PUSCH and PUCCH allocations

The following settings are not considered:

- P-SYNC/S-SYNC
  The P-SYNC/S-SYNC are global setting ("General DL Settings" dialog) and therefore cannot be overwritten by the configuration of one particular frame
- PBCH
  The PBCH is transmitted in subframe#0 only
- PRACH and sounding reference signals
  The SRS and the PRACH are settings dedicated to the individual user equipment (User Equipment Configuration dialog)

Copying allocations from a subframe without P-SYNC/S-SYNC/PBCH to one with P-SYNC/S-SYNC/PBCH and vice versa can lead to conflict situations. In this case, the internal algorithm applies the rules discussed in Chapter A, "Conflict Handling", on page 890.

However, it can happen that allocations which are identical in terms of scheduled resource blocks have a different number of physical bits available in the different subframes. This situation occurs due to the out stamping of overlapping subcarriers.

B.2 Number of Configurable Subframes

As described in Chapter B.1, "Copy/Paste Subframe", on page 895, you can simplify the configuration of the EUTRA/LTE test signal if you define a small number of subframes manually ("Number of Configurable Subframes") and use them periodically.

Internally, the R&S SMBV applies the Copy/Paste Subframe functionality and the same subset of settings are inherited.

B.3 Four Configurable Frames in Uplink and Downlink Direction

The R&S SMBV supports the configuration of up to four frames in uplink and downlink direction. However, there is a limitation for the maximum number of the real configurable subframes in these four frames depending on the transmission direction and several other parameters.

B.3.1 Uplink Direction

The maximum number of configurable subframes changes as function of the parameters in the following way:

- For **disabled** Realtime Feedback
  - In FDD duplexing mode, the maximum number of configurable subframes is 40 subframes, where the maximum number of 40 subframes is available for sequence lengths of at least four frames
  - In a TDD frame, only the uplink subframes are enabled for configuration. The maximum number of the configurable subframes is determined by the selected "UL/DL Configuration" and the possible values are listed in the corresponding column in the cross-reference table below.

The current subframe to be configured is selected by means of the parameter Subframe.

The configurable range ("Number of configurable uplink subframes") can be selected independently for the individual user equipment (UE). Furthermore, for LTE-A UEs, the range can be selected independently for the PUCCH and the PUSCH channel.

Subframes behind the configurable range of the corresponding UE or channel are indicated as read-only.

Table B-1: Value range for the parameter Number of Configurable UL Subframes

"Duplexing mode"	"UL/DL Configuration"	UL subframes in the first four frames (see Figure 3-5)	Number of UL subframes per frame	Number of HARQ processes	Value range for the parameter "Number of Configurable UL Subframes"	
					Disabled realtime feedback	Enabled realtime feedback
TDD	0	2, 3, 4, 7, 8, 9, 12, 13, 14, 17, 18, 19, 22, 23, 24, 27, 28, 29, 32, 33, 34, 37, 38, 39	6	7	1 to 24	1, 7
	1	2, 3, 7, 8, 12, 13, 17, 18, 22, 23, 27, 28, 32, 33, 37, 38	4	4	1 to 16	1, 2, 4
	2	2, 7, 12, 17, 22, 27, 32, 37	2	2	1 to 8	1, 2
	3	2, 3, 4, 12, 13, 14, 22, 23, 24, 32, 33, 34	3	3	1 to 12	1, 3
	4	2, 3, 12, 13, 22, 23, 32, 33	2	2	1 to 8	1, 2
	5	2, 12, 22, 32	1	1	1 to 4	1
	6	2, 3, 4, 7, 8, 12, 13, 14, 17, 18, 22, 23, 24, 27, 28, 32, 33, 34, 37, 38	5	6	1 to 20	1, 2, 3, 6
FDD	-	0 .. 39	10	8	1 to 40	1, 2, 4 ,8

Example:

If not stated otherwise, the following examples assume disabled realtime feedback.

- For selected FDD duplexing mode and **"Number of Configurable Uplink Subframes = 13"**, "Subframes = 0 to 12" are configurable.
  Subframes from 13 on are read-only.
- For selected TDD duplexing mode and "UL/DL Configuration = 6", the "Number of Configurable Uplink Subframes = 1 to 20".
  (See Table B-1).
  If for instance the "Number of Configurable Uplink Subframes = 10", the following ten subframes are configurable: 2, 3, 4, 7, 8, 12, 13, 14, 17, 18.
  These subframes are the first ten uplink subframes. All other subframes (downlink subframes, special subframes and subframes from 19 on) are read-only.

B.3.2 Downlink Direction

In downlink direction, the maximum number of the real configurable subframes depends on the selected Duplexing mode, TDD Frame Structure Settings. In downlink direction, the special subframes are also configurable (in addition to the downlink subframes).

The subframe to be configured is selected by means of the parameter "Subframe Selection". The maximum value for this parameter is then determined by the number of the last configurable subframe (see also Table B-2).

Table B-2: Value range for the parameter Number of Configurable DL Subframes

Duplexing mode	UL/DL Configuration	DL and special subframes in the first four frames (see Figure 3-5)	Number of DL and special subframes per frame	Value range for the parameter "Number of Configurable DL Subframes"
TDD	0	0, 1, 5, 6, 10, 11, 15, 16, 20, 21, 25, 26, 30, 31, 35, 36	4	1 to 16
	1	0, 1, 4, 5, 6, 9 10, 11, 14, 15, 16, 19 20, 21, 24, 25, 26, 29, 30, 31, 34, 35, 36, 39	6	1 to 24
	2	0, 1, 3, 4, 5, 6, 8, 9 10, 11, 13, 14, 15, 16, 18, 19 20, 21, 23, 24, 25, 26, 28, 29, 30, 31, 33, 34, 35, 36, 38, 39	8	1 to 32
	3	0, 1, 5, 6, 7, 8, 9 10, 11, 15, 16, 17, 18, 19 20, 21, 25, 26, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39	7	1 to 28

Duplexing mode	UL/DL Configuration	DL and special subframes in the first four frames (see Figure 3-5)	Number of DL and special subframes per frame	Value range for the parameter "Number of Configurable DL Subframes"
	4	0, 1, 4, 5, 6, 7, 8, 9 10, 11, 14, 15, 16, 17, 18, 19 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39	8	1 to 32
	5	0, 1, 3, 4, 5, 6, 7, 8, 9 10, 11, 13, 14, 15, 16, 17, 18, 19 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39	9	1 to 36
	6	0, 1, 5, 6, 9 10, 11, 15, 16, 19, 20, 21, 25, 26, 29, 30, 31, 35, 36, 39	5	1 to 20
FDD	-	0 .. 39	10	1 to 40

Glossary: 3GPP Specifications, References, Documents with Further Information

Symbols

[17]: Rohde&Schwarz
C. Gessner, "Long Term Evolution. A concise introduction to LTE and its measurement requirements", ISBN 978-3-939837-11-4, First edition 2011

1MA166: Rohde&Schwarz
Application Note 1MA166 “Testing LTE-Advanced”

1MA169: Rohde&Schwarz
White Paper 1MA169 "LTE-Advanced Technology Introduction"

1MA232: Rohde&Schwarz
White Paper 1MA232 “LTE-Advanced (3GPP Rel. 11) Technology Introduction”

1MA252: Rohde&Schwarz
White Paper 1MA252 “LTE-Advanced (3GPP Rel. 12) Technology Introduction”

1MA266: Rohde&Schwarz
White Paper 1MA266 “Narrowband Internet of Things”

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TR 25.892: "Feasibility study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement"

TR 25.913: "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)"

TR 36.912 V 9.1.0: "Technical Specification Group Radio Access Network; Feasibility study for further advancements for E-UTRA (LTE-Advanced), Release 9", December 2009

TS 25.141: "Base Station (BS) conformance testing (FDD)"

TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"

TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception"

TS 36.106: "Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater radio transmission and reception"

TS 36.113: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"

TS 36.124: "Evolved Universal Terrestrial Radio Access (E-UTRA); ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"

TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management"

TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing"

TS 36.143: "Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing"

TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation"

TS 36.212: "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding"

TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"

TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements"

TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities"

TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification"

TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)"

TS 36.521: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1, 2, 3"

TS 36.523: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Part 1, 2, 3"

List of Commands

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