R&S®SMW-K14x/-K17x
3GPP 5G NR Signal Generation
User Manual

1178801302
Version 16

ROHDE&SCHWARZ
Make ideas real

This document describes the following software options:

- R&S®SMW-K144 5G NR Release 15 (1423.8608.xx)
- R&S®SMW-K145 5G NR Closed-Loop BS Test (1414.6506.xx)
- R&S®SMW-K148 5G NR Release 16 (1414.6664.02)
- R&S®SMW-K170 5G NR Sidelink (1413.8640.02)
- R&S®SMW-K171 5G NR Release 17 (1413.7280.02)
- R&S®SMW-K175 U-Plane Generation (1413.3261.02)

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMW200A.

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1178.8013.02 | Version 16 | R&S®SMW-K14x/-K17x

The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW

Contents

1 Welcome to the 5G New Radio option

The R&S SMW-K144/-K148 are firmware applications that add functionality to generate signals in accordance with the 3GPP standard 5G New Radio.

Preamble

All supported features are in line with the official 3GPP specifications (releases 15, 16 and 17). You can check in the user interface to which version of the specification the firmware currently corresponds to (see Chapter 3, "Find out the implemented 3GPP specification", on page 35).

The R&S SMW-K144 key features

The R&S SMW-K144 provides 3GPP release 15 features.

The R&S SMW simulates signals at the physical channel level. The following list gives an overview of the functions provided for generating an 5G New Radio signal:

- Supports uplink and downlink
- Intuitive user interface with graphical display of time plan
- PSS/SSS, PBCH (incl. MIB), PDCCH (i.e. CORESET), PDSCH, CSI-RS, PDSCH PTRS, PUSCH, PUCCH, SRS, PRACH supported
  PBCH, PDSCH, PDCCH and PUSCH incl. DMRS
- Support of downlink and uplink DCI content inside CORESET;
- Automatic PDSCH scheduling from DCI
- PDSCH time domain scheduling
- Support of two codewords for PDSCH
- Support of SRS codebook
- PUSCH/PUCCH spatial multiplexing
- Configurable multilayer transmissions for PDSCH and PUSCH, incl. USCH channel coding and antenna ports
- Support of FRCs and TMs
- All modulation schemes supported
- Carrier aggregation, including cross-carrier scheduling
- Test case wizard for 3GPP 38.141 test cases

The R&S SMW-K148 key features

The R&S SMW-K148 provides 3GPP release 16 features.

The R&S SMW-K148 requires an R&S SMW-K144.

Release 16 features include:

- PRS (positioning reference signals)
- Support of the DCI types and their corresponding RNTI types included in the release 16

- MIB system frame number (SFN) increments independently from the configured ARB sequence length
- Uplink timing adjustment commands can be received
  Requires also the option R&S SMW-K145
- Support of up-to 50 users

The R&S SMW-K170 key features

The R&S SMW simulates 5G NR sidelink signals at the physical channel level.

- Support for PSSCH and PSCCH
- Support of S-SS/PSBCH
- Support of sidelink bandwidth part configuration, including resource pool configuration
- Support of SSCH channel coding
- Support of sidelink control information (SCI)
- Support of sidelink carrier aggregation

The R&S SMW-K171 key features

The R&S SMW-K171 provides 3GPP release 17 features.

The R&S SMW-K171 requires an R&S SMW-K144 and R&S SMW-K148.

Release 17 features include:

- New deployment frequency range (FR2-2, up to 71 GHz).
- New channel bandwidths introduced with FR2-2 (800 MHz, 1600 MHz and 2000 MHz).
- New subcarrier spacings for various channels (user allocations, SS/PBCH, PRACH etc.) introduced with FR2-2.
- New channel bandwidths introduced with release 17 (35 MHz and 45 MHz).
- Support of 1024QAM modulation in FR1.
- New operating bands, test models and FRCs introduced with release 17.

This user 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 SMW user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMW200A

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMW service manual.

1.1 Accessing the 5G New Radio dialog

To open the dialog with 5G New Radio settings

► In the block diagram of the R&S SMW, select "Baseband > 5G NR".

A dialog box opens that displays the provided general settings.

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

1.2 What's new

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMW200A.

For a detailed list of new features, refer to the release notes published with the corresponding firmware version.

- Introduction of the FRC wizard.
- Possibility to restart the slot index within a frame.
- New power mode average active signal.
- New filter mode to optimize the EVM.
- Support of transport block transmission over multiple non-consecutive slots.
- Test models and FRCs: added various release 17 test models and FRCs.
- Test case wizard: added release 17 test cases for conducted and radiated performance characteristics.
- Test case wizard: Test now support power limits defined in 3GPP 38.104
- Test case wizard: Information dialog that shows all settings that have been changed for the selected test case.

1.3 Documentation overview

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

www.rohde-schwarz.com/manual/smw200a

1.3.1 Getting started manual

Introduces the R&S SMW 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.

1.3.2 User manuals 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 getting started manual.
- Software option manual
  Contains the description of the specific functions of an option. Basic information on operating the R&S SMW is not included.

The contents of the user manuals are available as help in the R&S SMW. 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.

1.3.3 Tutorials

The R&S SMW provides interactive examples and demonstrations on operating the instrument in form of tutorials. A set of tutorials is available directly on the instrument.

1.3.4 Service manual

Describes the performance test for checking compliance with rated specifications, firmware update, troubleshooting, adjustments, installing options and maintenance.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com

1.3.5 Instrument security procedures

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

1.3.6 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

1.3.7 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMW. 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/smw200a

1.3.8 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 software makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smw200a

1.3.9 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/smw200a and www.rohde-schwarz.com/manual/smw200a

1.3.10 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: https://www.youtube.com/@RohdeundSchwarz

On the menu bar, search for your product to find related videos.

Figure 1-1: Product search on YouTube

1.4 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 saving 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 checking the system configuration, configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMW user manual.

1.5 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.

2 About the 5G New Radio option

The implementation of the option 5G New Radio R&S SMW-K144 is based on the 3GPP Rel. 15 specification group TS 38.xxx. According to these specifications, the 3GPP defines a great flexibility of the signal on the air interface.

This section is a brief summary of the main air interface parameters, see Table 2-1.

Availability of main air interface parameters

Several main air interface parameters have been upgraded with 3GPP release 16 and 3GPP release 17, in particular the extended frequency deployment ranges, certain channel bandwidths (for example 35 MHz and 35 MHz) or certain subcarrier spacings and are therefore only available with the corresponding option (R&S SMW-K148 and R&S SMW-K171).

If you do not have R&S SMW-K171 and the distinction between FR2-1 and FR2-2, you only see FR2. All settings that depend on the frequency deployment range are treated as if they were in FR2-1 in that case.

Table 2-1: Main air interface parameters

Parameter	Frequency range FR1*	Frequency range FR2*
Frequency bands**	410 MHz to 7.125 GHz 7.125 GHz to 24.250 GHz	FR 2-1: 24.250 GHz to 52.60 GHz FR 2-2: 52.60 GHz to 71.00 GHz
Carrier aggregation	≤ 16 carriers Initially 1	≤ 16 carriers
Channel bandwidth	5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 MHz and 100 MHz	FR 2-1: 50, 100, 200, 400 FR 2-2: 400, 800, 1600, 2000 MHz
Subcarrier spacing (SCS)	15, 30, 60 kHz	FR 2-1: 60, 120 kHz FR 2-2: 120, 480, 960 kHz (depending on channel bandwidth)
Modulation schemes	Up to 1024QAM	Up to 1024QAM
MIMO schemes	• DL: 2x2 and 4x4 MIMO (≤ 8 layers) • UL: SISO and 2x2 MIMO (≤ 4 layers)	≤ 2 layers: • DL: 2x2 MIMO • UL: SISO and 2x2 MIMO
Multiple access schemes	• DL: CP-ODFMA • UL: CP-OFDMA and optionally DFT-s-OFDM	• DL: CP-ODFMA • UL: CP-OFDMA and optionally DFT-s-OFDM

*) Throughout this description, the designations are used interchangeably.

**) Frequency bands as defined by the 3GPP specification group TS 38.104 (currently release 17). You can however select also any other frequency within the frequency range your R&S SMW supports (see Chapter 2.1, "Required options", on page 22).

2.1 Required options

The basic equipment layout for generating 5G New Radio signals includes the options:

- Standard or wideband baseband generator (R&S SMW-B10/-B9)
- Baseband main module (R&S SMW-B13) or wideband baseband main module (R&S SMW-B13XT)
- Option 5G New Radio (R&S SMW-K144)
  (per signal path)
- Frequency option (e.g. R&S SMW-B1003)
- Optional, option logfile generation (R&S SMW-K81)
- Optional, option real-time feedback (R&S SMW-K145)
- Optional, option 5G NR Release 16 (R&S SMW-K148).
  Requires R&S SMW-K144.
- Optional, option 5G NR Sidelink (R&S SMW-K170).
- Optional, option 5G NR Release 17 (R&S SMW-K171).
  Requires R&S SMW-K144 and R&S SMW-K148.

You can generate signals via play-back of waveform files at the signal generator. To create the waveform file using R&S WinIQSIM2, you do not need a specific option.

To play back the waveform file at the signal generator, you have two options:

- Install the R&S WinIQSIM2 option of the digital standard, e.g. R&S SMW-K255 for playing LTE waveforms
- If supported, install the real-time option of the digital standard, e.g. R&S SMW-K55 for playing LTE waveforms

For more information, see data sheet.

2.2 5G NR numerology

5G NR signals can be transmitted in several frequency ranges. For each of the frequency range, the 3GPP specifies the allowed subcarrier spacing (SCS) and the supported cyclic prefix (CP), see Table 2-2.

However, not all combinations of frequency range, SCS and CP are allowed. Moreover, the 3GPP specification defines the allowed combinations indirectly, as the so called numerology. A numerology is thus the combination of the SCS and the CP, where the SCS is defined as follows:

$\Delta f = 15\ \text{kHz} * 2^{\mu}$, with $\mu = 0$ to 4.

Table 2-2: Supported combinations of SCS and CP per frequency range

μ	SCS, kHz (Δf)	Max. channel band-width, MHz	N_{symbol}^{slot}	N_{slot}^{frames}	$N_{frame}^{sub\text{-}slot}$	Symbol dura-tion μs	Nor-mal cyclic pre-fix (NCP)	Exten-ded cyclic prefix (ECP)	Sup-por-ted for data	Sup-ported for syn-chron-ization	FR1	FR2-1	FR2-2
0	15	50	14	10	1	66.67	x	-	x	x	x	-	-
1	30	100	14	20	2	33.33	x	-	x	x	x	-	-
2	60	100 (FR1) 200 (FR2-1)	14 (NCP) 12 (ECP)	40	4	16.67	x	x	x	-	x	x	-
3	120	400 100 (FR2-2)	14	80	8	8.33	x	-	x	x	-	x	x
4	240	-	14	160	16	4.17	x	-	-	x	-	x	-
5	480	1600	14	320	32	2.08	x	-	x	x	-	-	x
6	960	2000	14	640	64	1.04	x	-	x	x	-	-	x

2.3 Multiple accesses schemes

5G NR supports two channel access methods for uplink signals, CP-OFDM and DFT-s-OFDM (see Table 2-1). Depending on the use case, one or the other has advantages over the other. For DFT-s-OFDM, an additional signal processing stage, transform precoding, is applied. Transform precoding is the term for the digital Fourier transformation (DFT) used in the 5G NR standard.

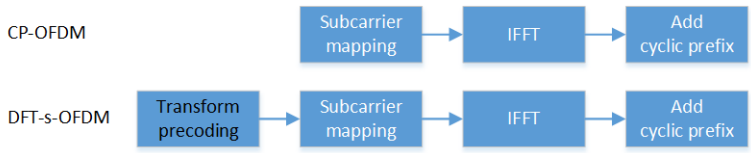


Figure 2-1: Signal processing depending on multiple access schemes

In this implementation, you can define per PUSCh which of the two access schemes is used.

2.4 Frame structure, slots and slot formats

Frame structure

As it is in LTE, the 5G NR **frame** is 10 ms long; a half-frame lasts 5 ms. Frames consist of 10 subframes, each of them with a length of 1 ms.

Subframes contain a *variable number of slots*, depending on the subcarrier spacing (SCS). Moreover, subframes can use different SCS in different bandwidth parts (BWP), see Figure 2-4.

Because the frame (subframe) lengths are constant but the number of slots and their lengths varies, the common time boundaries between the different numerologies are the frames (or the subframes).

Slots and slots formats

The basic transmission unit in 5G NR is the **slot**. Slots can have different formats; slots comprise of 14 or 12 OFDM symbols, depending on the used cyclic prefix (CP). Hence, depending on the used CP, there are different numbers of slots per frame (and subframe) and the CP itself depends on the used numerology, see Table 2-2.

Slots can have different formats, defined by the slot format index (SFI). The SFI is signaled by group common PDCCHs. The slot formats differ in the number of symbols that can be used for DL (D) and UL (U) transmission. Most of the symbols are usually used for transmission of user data (payload). Slots can also contain flexible symbols (x), that can be used for dynamic DL/UL transmission or as a gap for the DL to UL and vice versa switching.

The slot formats are defined in TS 38.211, table 4.3.2-3.

2.5 Resource blocks and resource grid

Resource grid

The basic granularity in 5G NR resource grid is the **resource element** (RE), which consists of one OFDM symbol over one subcarrier and is the same as in LTE. Another granularity unit is a resource block (RB), which spans 12 subcarriers in frequency domain.

Resource blocks

The 5G NR specification defines different types of resource blocks:

- Common resource blocks (CRB)
  The term CRB is typically used when referring to the whole carrier. A CRB grid is defined for each numerology.
  The center of subcarrier #0 of the CRB#0 is referred as **Reference point A**; it is signaled relative to SS/PBCH or ARFCN.
  See Figure 2-2 and Figure 2-3.

- Usable resource blocks (URBs)
  The term URB is used to specify the subset of the CRBs of a specific numerology where transmission is allowed; that is, these RBs are not in the guard bands. The URBs define the so called transmission bandwidth (TxBW) for the respective numerology, see Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.
- Physical resource blocks (PRB)
  The term PRB describes the RBs inside the bandwidth parts (BWP). PRBs are numbered relative to the beginning of the bandwidth part.
  See Carrier bandwidth part (BWP) and Figure 5-6.

2.6 Transmission bandwidths TxBWs

As listed in Table 2-2, there are different numerologies (that is different combinations of subcarrier spacing SCS and cyclic prefix CP) supported for each deployment and channel bandwidth combination. The different SCSs results in transmission bandwidths TxBWs, which span different frequency ranges and according to TS 38.104 use different number of resource blocks N_{RB}. The start of the TxBW is signaled relative to the Reference point A and is numerology-specific.

To achieve a common alignment between the different TxBWs within a carrier, the 3GPP specification defines the following rules:

- Alignment is achieved, if the center of the first subcarrier (SC#0) of an RB is aligned to the center of the SC#0 of the RBs of all numerologies with a smaller μ.
- The TxBWs are centered on the carrier center, that is around the center of the "Channel Bandwidth" for the corresponding carrier.
- If not applicable, the TxBWs can be shifted with ±6 subcarriers relative to the carrier center, where for each TxBWs the corresponding SCS applies.

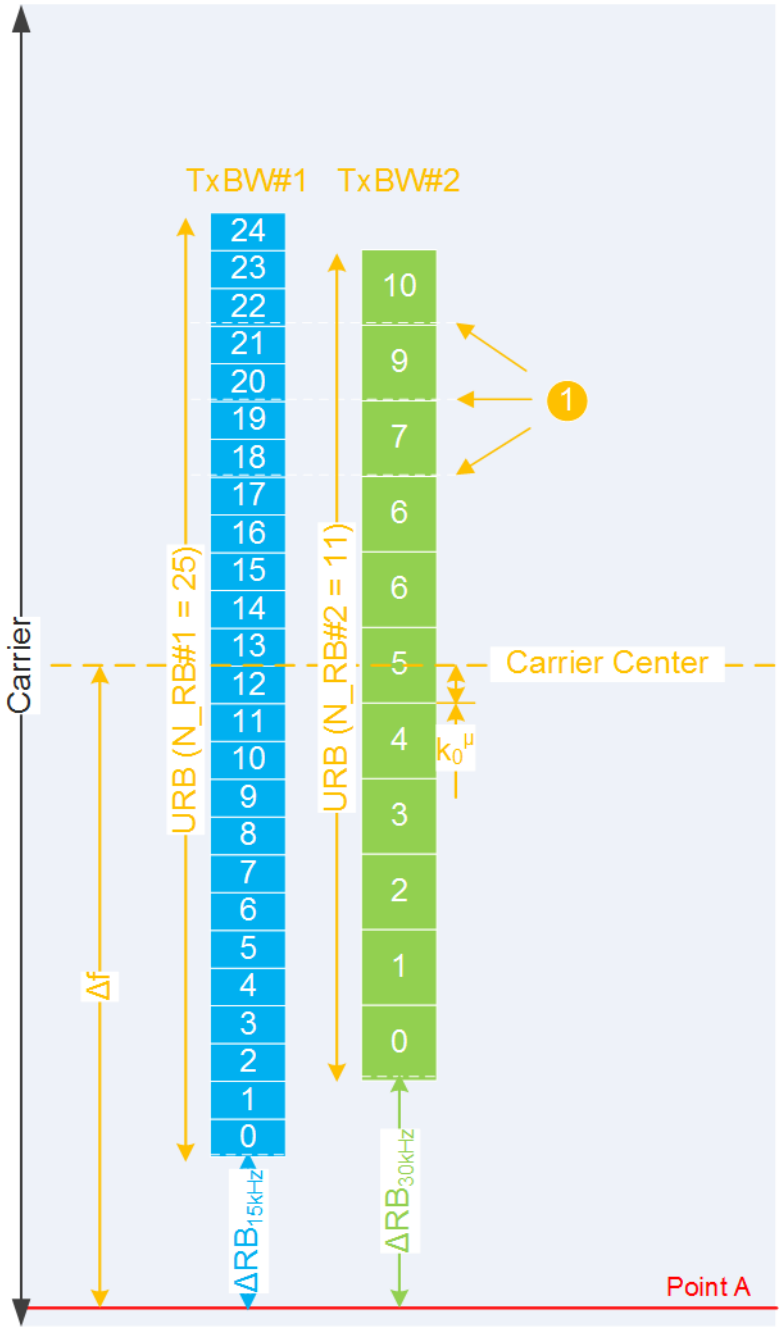


Figure 2-2: Transmission bandwidth (example)

Carrier	= Channel bandwidth = 5 MHz
RB	= Resource blocks
SCS	= Subcarrier spacing
TxBWs	= Transmission bandwidth
TxBWs#1	= SCS 15 kHz, usable resource blocks USB = "N_RB = 25"; TxBWs is not centered on the carrier center, a frequency shift with k0μ = -6 subcarriers is applied
TxBWs#2	= SCS 30 kHz, usable resource blocks USB = "N_RB = 11"; TxBWs is centered on the carrier center ("k_0^{μ} = 0")
k_0^{μ}	= Number of subcarriers the TxBW is shifted related to the carrier center, see k0μ
ΔRB	= Usable RB to common RBs, see TxBW Offset

1	=	Aligned centers of the first subcarrier (SC#0) of resource blocks
Point A	=	Common reference point for all numerologies and TxBWs; does not have to be within the carrier bandwidth. Point A is the center of subcarrier #0 of the CRB#0
Carrier center	=	Center frequency of the carrier
Δf	=	Offset between the baseband center frequency and the reference point A, see Point A to Baseband Center.

From all possible TxBWs for a specific channel bandwidth, the base station decides which TxBWs to use. The base station/network signals the position of the used TxBWs to the users as function of the following:

- The position of the Reference point A, that is common to all numerologies.
- The frequency offset ΔRB between the usable resource blocks of the TxBWs and the Reference point A, see TxBW Offset.
- The used frequency shift k_0^{μ} = {-6, 0, 6}, see k0μ.

2.7 Synchronization signals and SS/PBCH block

The 3GPP specifies two synchronization signals (SS), the primary synchronization signal (PSS) and the secondary synchronization signal (SSS). Together with the physical broadcast channel (PBCH), they are bundled in a synchronization signal block (SS/PBCH block). PSS/SSS are used for radio frame synchronization and detection of the physical layer cell ID. The location of the synchronization signal is variable.

The PBCH carries general system information. It is polar-coded and QPSK modulated. The PBCH symbols carry its own DMRS, which position depends on the physical layer cell ID.

An SS/PBCH block is transmitted on a fixed schedule. Each half-frame contains of either 4, 8 or 64 SS/PBCH blocks, depending on the subcarrier spacing (SCS). The SS/PBCH block is transmitted twice in a slot, if that slot carries the synchronization signal.

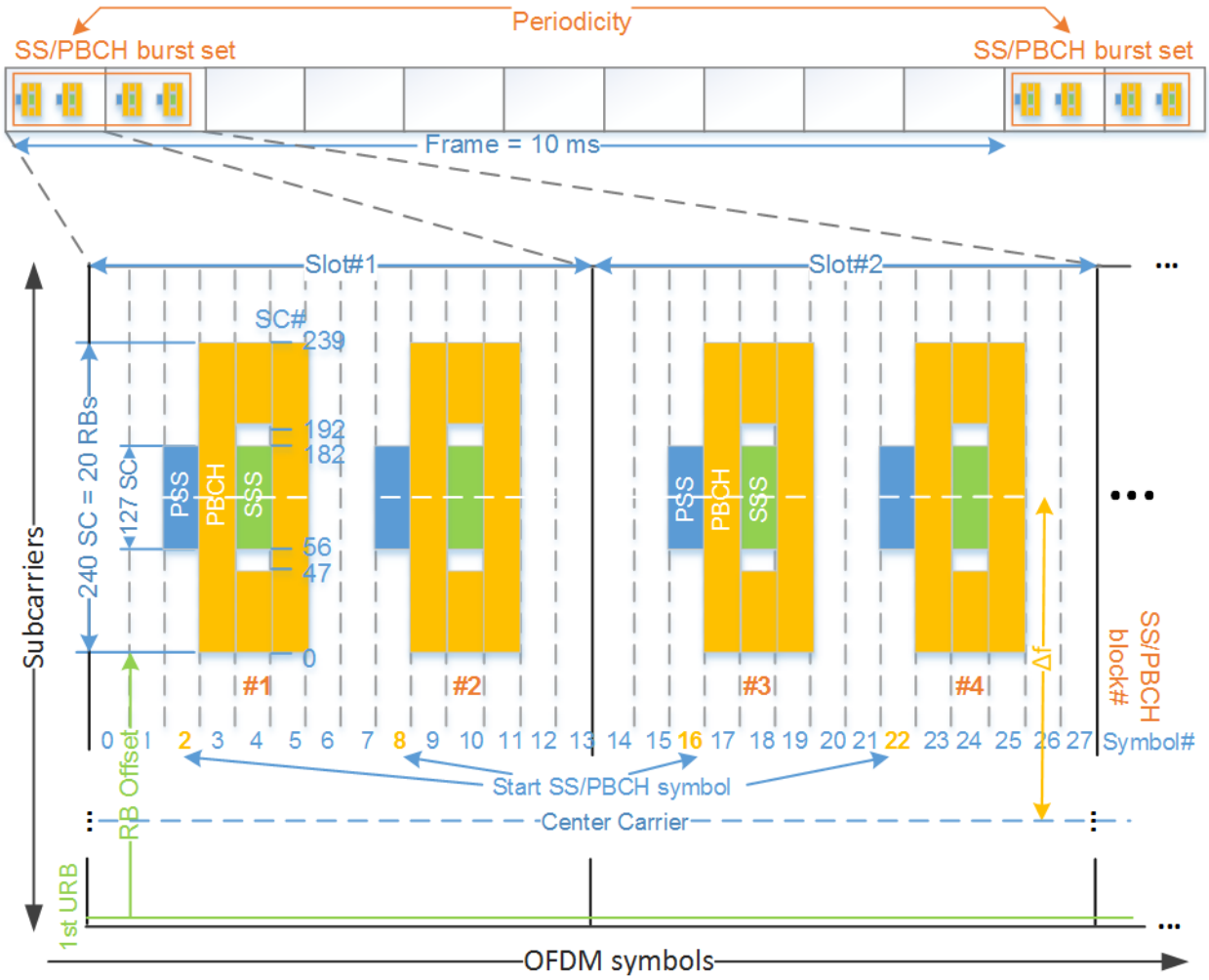


Figure 2-3: Location of synchronization signals in a succession of several slots (Case A - 15 kHz SCS, f < 3 GHz)

PSS/SSS	= Primary/secondary synchronization signals
PBCH	= Physical broadcast channel
SS/PBCH block	= SS and PBCH are always transmitted together in a block
SS/PBCH burst set	= A group of 4, 8 or 64 SS/PBCH blocks, depending on the SCS (in this example, burst set = 4 blocks)
Frame	= 10 ms = 10 slots
1 slot	= 1 subframe = 1 ms
SC	= Subcarrier
Start SS/PBCH symbol	= {2, 8} + 14n, where n = 0,1; Start symbols = 2, 8, 16 and 22
RB offset	= Defines the SS/PBCH allocation position in the frequency (see RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS)); within an RB, the allocation can be further shifted (see SC Offset/SC Offset (15 kHz SCS)/SC Offset (60 kHz SCS))
Periodicity	= Defines how often the burst set is repeated (in this example, periodicity = 10 ms; the SS/PBCH burst set is repeated every frame), see Burst Set Periodicity
1st URB	= First usable resource block (URB), that is the first RB within the TxBW, see Figure 2-2
Carrier center	= Center frequency of the cell
Δf	= Offset between the center frequency of SS/PBCH block and the carrier center frequency

The SSs are allocated on predefined symbols but the allocated resource blocks and subcarriers are user-defined. The TS 38.213 specifies the number of and the start of the symbols depending on the used SCS and frequency range, see Figure 2-3. In 3GPP, these different start positions of the SS/PBCH blocks are referred as case A to case E.

2.8 Carrier bandwidth part (BWP)

In 5G NR, the bandwidth used for the communication with a specific user (UE) is typically smaller than the channel bandwidth. These user-specific bandwidths are managed by the different-sized, so called (carrier) bandwidth parts (BWP). Each of BWP uses its own numerology and thus can use different SCS, symbol duration and CP length (see Table 2-2).

Using BWPs with different bandwidths allows flexible resource allocation, for example, for support of UE with reduced bandwidth capabilities or supporting non-contiguous spectrum. Bandwidth parts can overlap, in which case UEs share the resource elements.

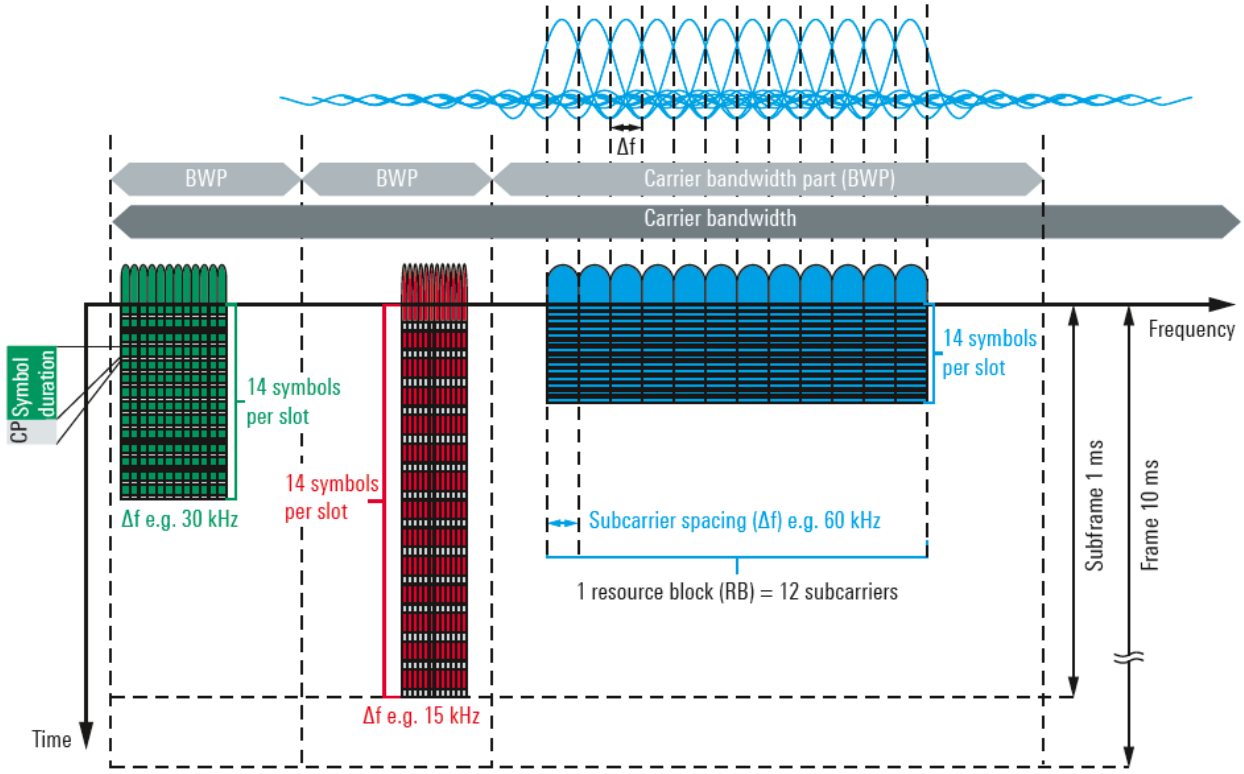


Figure 2-4: 5G NR numerology and BWP [1]

A BWP is a contiguous set of physical resource blocks that has the same subcarrier spacing and thus numerology. UEs can be configured with up to 4 BWPs in DL and UL, but only one can be active at a time. UEs are not expected to receive and transmit outside its active BWP.

2.9 Carrier aggregation

The 5G NR specification defines the aggregation of multiple 5G carriers. Two up to 16 component carriers (CC, in 5G phase 1) can be grouped to provide wider transmission bandwidths. Up to 1 GHz of spectrum can be aggregated. A UE could simultaneously receive or transmit on one or multiple CCs depending on its capabilities.

Spectrum deployment can be either contiguous with adjacent component carriers, or non-contiguous with non-adjacent component carriers. 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 base station provide the same cell coverage.

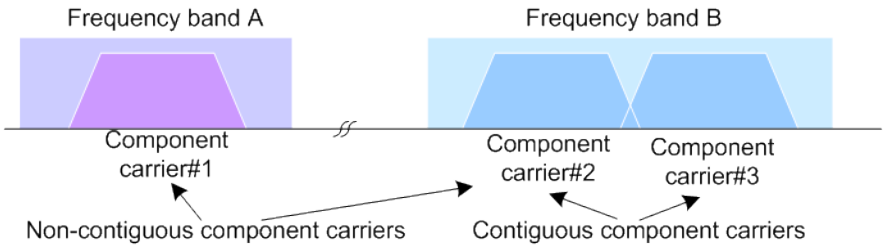


Figure 2-5: Carrier aggregation

The 5G NR 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).

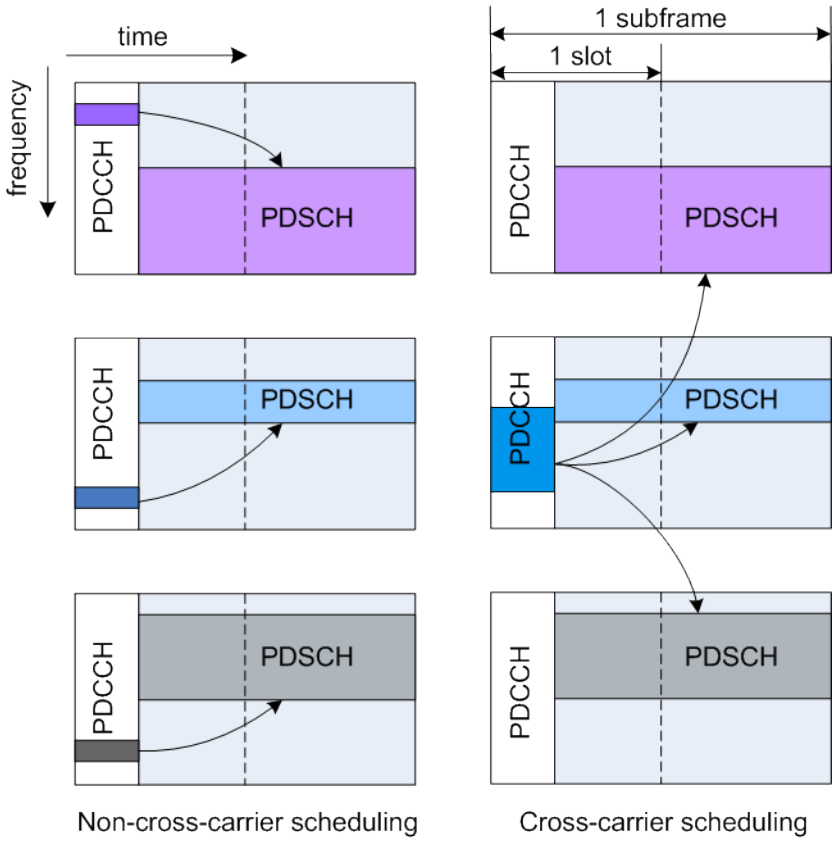


Figure 2-6: 5G NR scheduling approaches

In the dedicated/non-cross-carrier approach, the PDCCH on a component carrier assigns PDSCH resources on the same component carrier.

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 DCI field CIF (carrier indicator field).

Related settings

See:

- Enable fading on the SMW.
  Set "System Config > System Configuration > Fading/Baseband Config > Mode" to "Advanced".
- Chapter 5.2.2, "Carriers settings", on page 56
  Set at least 2 carrier.

2.10 Antenna port mapping

Antenna ports are not physical antennas, but rather are a logical concept. Each antenna port carries certain signal components (= physical channels) that have to be transmitted under the same conditions. Physical channels can be transmitted on a sin-

gle antenna port, or on several antenna ports. Each antenna port in turn can be mapped to one of the physical antennas. Typically, one physical antenna combines several antenna ports. However, one specific antenna port can also be transmitted on more than one physical antenna.

In this implementation, you can map the antenna ports used by the various physical channels defined by 3GPP to one or two layer configurations in the dedicated "Antenna Ports" dialogs.

These dialogs display the antenna port-mapping settings in a table form, as an antenna port-mapping table.

The mapping table is a matrix with number of rows equal to the number of physical Tx antennas (basebands) and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration. The yellow matrix elements in the mapping table indicate the default antenna port to physical antenna (TX antenna/baseband) mapping.

The number of rows depends on the selected "System Configuration".

Signal/Channel	Antenna port
• PSS / SSS • PBCH • S-PSS / S-SSS • PSBCH	The synchronization signals are assumed to be transmitted on antenna port 4000.
PDSCH	The PDSCH can be transmitted on multiple antenna ports (1000 to 1011). By default, the PDSCH is transmitted on antenna port 1000 (for physical antenna 1) and antenna port 1001 (for physical antenna 2).
PSSCH	The PSSCH can be transmitted on antenna ports 1000 to 1001.
PUSCH	The PUSCH can be transmitted on multiple antenna ports (0 to 11). By default, the PUSCH is transmitted on antenna port 0 (for physical antenna 1) and antenna port 1 (for physical antenna 2).
• PDCCH • PUCCH • PSCCH	The PDCCH/PUCCH are assumed to be transmitted on antenna port 2000.

Related settings:

- "Users/BWPs > UL BWPs > NZP CSI-RS" > Resource-Settings > Antenna Port Mapping
- "Users/BWPs > UL BWPs > SRS > SRS Resource Set Settings" > Antenna Ports > Config
- "Scheduling > PDSCH/PUSCH" > Antenna ports

2.11 5G NR channels and signals overview

Channels:

- DL: PBCH, PDCCH (CORESET), PDSCH

- UL: PRACH, PUCCH, PUSCH

Signals:

- DL: PSS/SSS, CSI-RS, PRS, DMRS (for PBCH, PDCCH, PDSCH), TRS, PTRS
- UL: DMRS (for PUCCH, PUSCH), PTRS, SRS

The following channels and signals are supported in the current firmware version:

- PSS/SSS, PBCH, PDCCH (CORESET), PDSCH, PUSCH, PUCCH; PBCH incl. MIB, PDSCH, PDCCH and PUSCH incl. DMRS, PTRS, SRS, CSI-RS, PRS

Related settings:

- Chapter 5.2.13, "PBCH settings", on page 94
- Chapter 5.3.6.6, "ZP CSI-RS settings", on page 151 and Chapter 5.3.6.7, "NZP CSI-RS settings", on page 154
- "PTRS Config ..." on page 135 and Chapter 5.5.6, "PTRS settings", on page 238
- Chapter 5.3.6.2, "PDSCH settings", on page 122
- Chapter 5.3.7.4, "PUSCH settings", on page 170 and Chapter 5.3.7.5, "PUSCH UCI settings", on page 188
- Chapter 5.3.7.6, "SRS settings", on page 190
- Chapter 5.5, "PDSCH and PUSCH settings", on page 220
- Chapter 5.6, "CORESET settings", on page 245
- Chapter 5.3.7.2, "PUCCH settings", on page 164 and Chapter 5.9, "PUCCH settings", on page 282
- Chapter 5.10, "PRACH settings", on page 289

2.12 Overlap handling

The TS 38.211 defines channels and signals that share the available resources in the time-frequency domain.

Flexible scheduling is one of the main functions in 5G new radio. But this flexibility in scheduling can lead to allocations of the same or different type that overlap fully or partly in the time-frequency domain. Because the specification does not define all possible combinations of channels and signals, a proprietary internal mechanism decides what bits are mapped to the affected subcarries.

The handling of overlapping resources depends on the priority of the affected channels, see Table 2-3.

Table 2-3: Priority

Priority	Channel or signal
High	CORESET, PBCH, PDSCH, PRACH, PUCCH All signals
Middle	PDSCH PUSCH
Low	Dummy allocations

Overlap handling rules:

- Overlapping of signals and/or channels with different priorities
  The channel with the higher priority is transmitted completely. The overlap is not indicated, not in the "Scheduling" dialog or in the "Time Plan".
- Overlapping of allocations with the same priority
  If channels with the same priority are scheduled to share resources, the signals of the channels are added.
  Both the "Scheduling" dialog and the "Time Plan" indicate the overlapping resources.

Example: Unresolved conflict

Figure 2-7 shows the scheduling table and the time plan of overlapping allocations (PDSCH) with the same priorities.

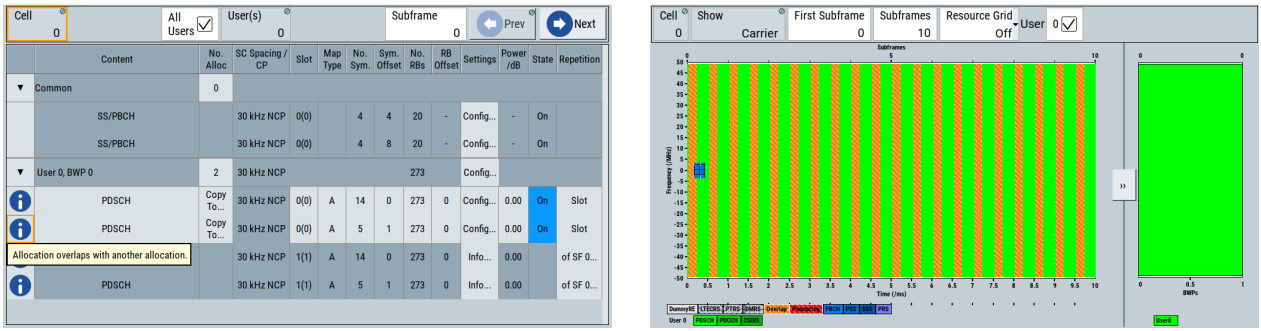


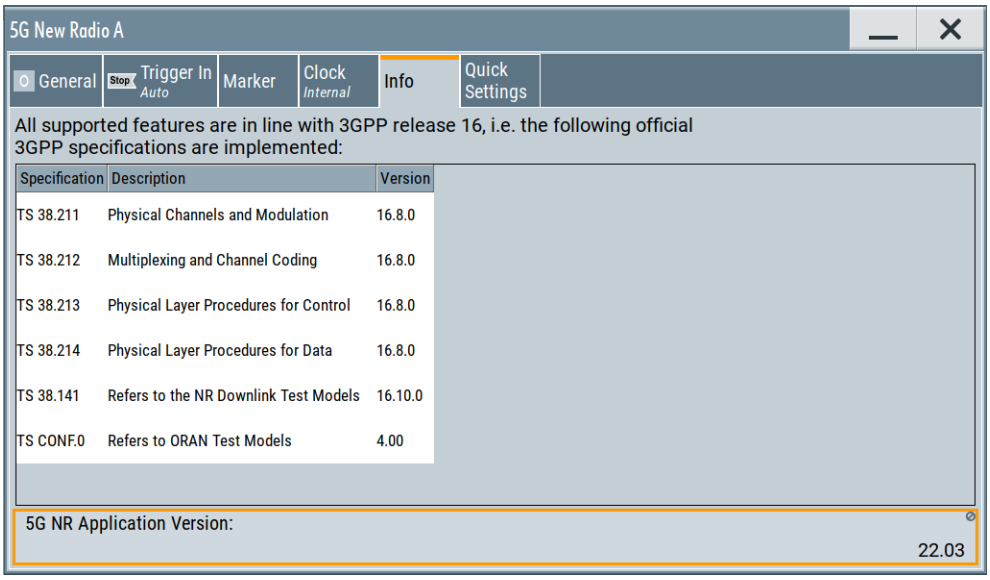
Figure 2-7: Overlapping allocations

3 Find out the implemented 3GPP specification

The "Info" dialog displays the currently supported version of the 3GPP standard and the installed version of the 5G New Radio application.

Access:

► Select "5G New Radio > Info".



Settings:

3GPP Specification Table

Displays the 3GPP specifications and versions implemented in the R&S SMW features.

Remote command:

`[:SOURce]:BB:NR5G:VERSion?` on page 608

5G NR Application Version

Displays the installed version of the 5G New Radio application.

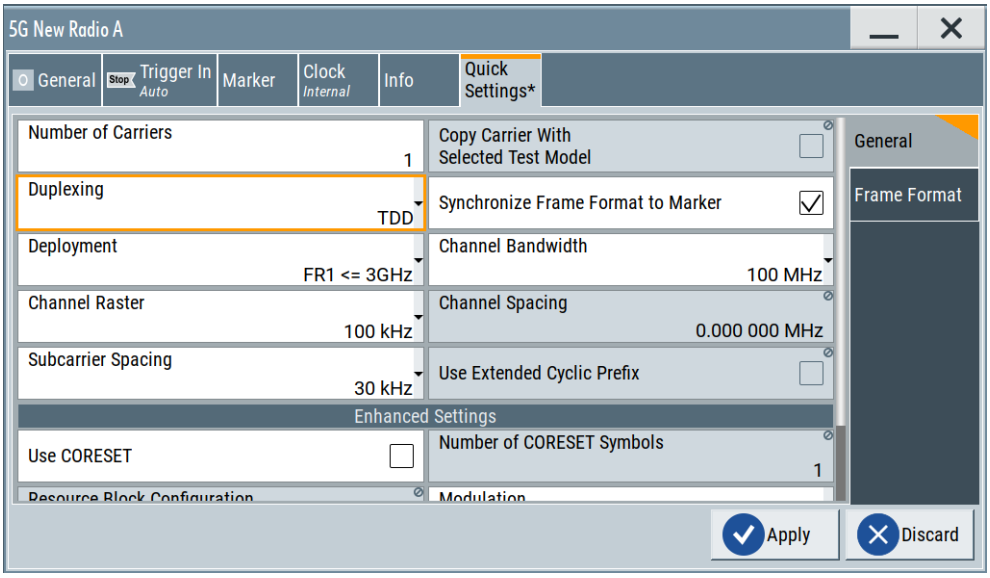
Remote command:

`[:SOURce]:BB:NR5G:PLVersion?` on page 603

4 5G NR quick settings

Access:

1. Select "Baseband > 5G NR".
2. Select "Quick Settings".



With the provided settings, you can quickly configure a 5G new radio signal. Configured is signal with the selected settings and one BWP, one user, one frame and if TDD is used, the power mode active subframe is selected automatically. If enabled, CORESET is configured, too (see "Use CORESET" on page 39).

The remote commands required to define these settings are described in Chapter 12, "Remote-control commands", on page 569.

Applying quick settings automatically adjusts the corresponding marker settings.

Settings:

4.1 General settings

Access:

1. Select "Baseband > 5G NR".
2. Select "Quick Settings > General".

Settings:

Number of Carriers
Selects the number of carriers. Needed for carrier aggregation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:NCARier` on page 617

Copy Carrier With Selected Test Model
Creates a copy of a component carrier based on a test model configuration.

To copy carriers like this, proceed as follows.
- Select a test model for the first carrier.
- Increase the number of carrier in the "Quick Settings".
- Copy the carrier with the test model with "Copy Carrier with Selected Test Model".
- "Apply" the changes.

After confirmation ("Apply"), the copied carriers are displayed in the carrier settings dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CCTModel` on page 615

Duplexing
Selects the duplexing mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:DUPLexing` on page 617

Synchronize Frame Format to Marker
Turns synchronization of the frame format and markers on and off.

If on, the application automatically places the markers according to the selected duplexing pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:SFFM:STATe` on page 619

Deployment
Selects one of the frequency ranges, specified for 5G NR transmission, see Table 2-1.

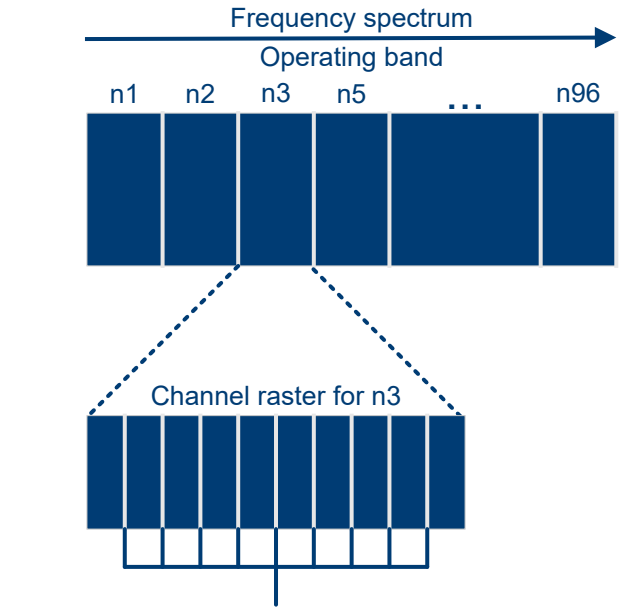
Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CARDeply` on page 615

Channel Bandwidth
Selects the bandwidth of the node carrier from a list with predefined values, see Table 2-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CBW` on page 615

Channel Raster
Sets the "Channel Raster" based on the set "Deployment".

Shows the distance between the RF reference frequencies in the selected operating band. The distance between frequencies depends on the channel raster the operating band belongs to (channel raster are defined by 3GPP).



For most operating bands, the channel raster is a fix value of 15 kHz, 60 kHz or 100 kHz.

A few selected operating bands support multiple channel raster.

The channel raster is the basis for the calculation of the channel spacing (distance between component carriers) for intra-band contiguous carrier aggregation.

For details about the channel raster and its effects, see 3GPP 38.104, chapter 5.4.2.

Available channel raster values depend on the selected frequency range.

- FR1: channel raster can be 15 kHz or 100 kHz.
- FR2-1: channel raster is 60 kHz.
- FR2-2: channel raster is 100 kHz.

"Channel Raster" is not displayed when the "Number of Carriers" is shown inactive.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CHRaster` on page 615

Channel Spacing
Displays the value for the "Channel Spacing". It is by default automatically calculated by the set "Channel Raster" and the set "Channel Bandwidth".

The value can be adjusted manually, but is recalculated if the "Channel Raster" or the "Channel Bandwidth" is adjusted.

"Channel Spacing" is not displayed when the "Number of Carriers" is shown inactive. In this case, it is used like "Carrier Spacing" equals 0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CHSPacing` on page 616

Subcarrier Spacing
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:SCSPacing` on page 616

Use Extended Cyclic Prefix
Show if the extended cyclic prefix is enabled or disabled.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ECPState` on page 616

Use CORESET
If enabled, a CORESET is scheduled with the number of symbols, set with the parameter Number of CORESET Symbols.

All other configurations are performed automatically. The CORESET is scheduled at the beginning of the slot. PDSCH is shortened or reallocated automatically.

CORESET is fully allocated; dummy REs are used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:CS:STATe` on page 617

Number of CORESET Symbols
Sets the number of symbols in the CORESET.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:CSLength` on page 618

Use Transform Precoding
Turns transform precoding on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:TP:STATe` on page 619

Resource Block Configuration
Sets the configuration mode for the resource block configuration.

This value is according to TS 38.521 table 6.1-1 and 6.1-2.

Resource block configuration is available for uplink signals. Availability of resource block configurations also depends on the selected channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBConfig` on page 618

Modulation
Sets the modulation scheme.

3GPP release 17 introduces 1024QAM modulation on the downlink. Release 17 features require R&S SMW-K171. 1024QAM modulation on the uplink is also available with that option.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:MOD` on page 617

Number of Resource Blocks
Sets the number of resource blocks.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBNumber` on page 618

Resource Block Offset
Sets the resource block offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBOFfset` on page 618

Apply
Select to apply the configuration.

Note: Settings which are not configured by the "Quick Settings" are set to their default values by using the "Apply" button.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:APPLy` on page 622

Discard
Ignores the configuration, i.e. the configuration in the "Quick Settigns" dialog is not applied; configurations made in this dialog are lost.

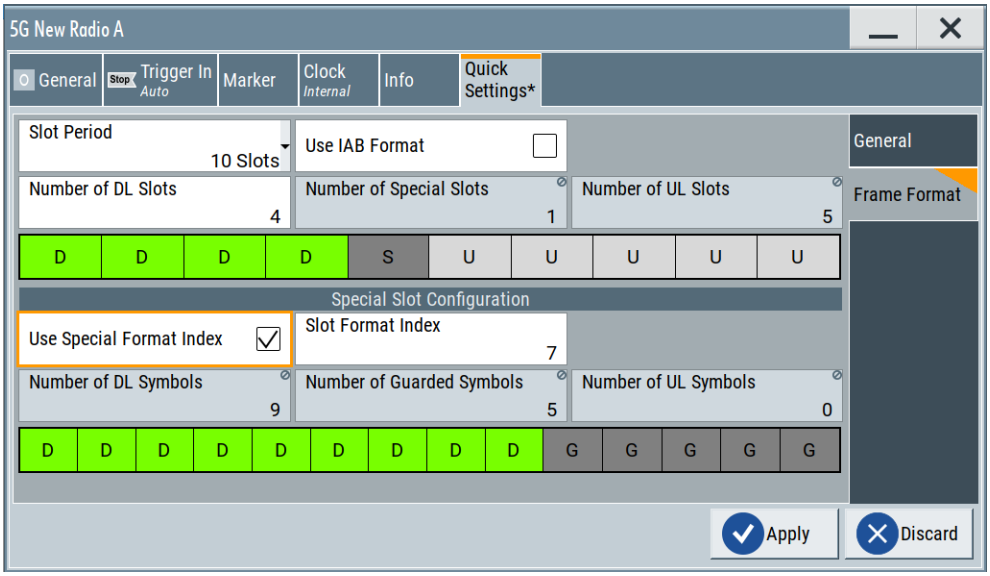
Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:DISCard` on page 622

4.2 Frame format

Access:

1. Select "Baseband > 5G NR".
2. Select "Quick Settings > General".
3. Select "Duplexing > TDD".
4. Select "Frame Format".

   You can configure the number of slots in the frame, the slot format and the special slot configuration. The resulting configuration is graphically represented.



Settings:

Slot Period

Sets the duration of the frame in slots.

Remote command:

`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SLINt` on page 619

Use IAB Format
Option: R&S SMW-K148

Turns usage of the frame formats for integrated access backhaul (IAB) applications on and off. Using the IAB format changes the order of uplink, downlink and the special slot within the frame.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:IAB:STATe` on page 619

Number of DL Slots
If "Link Direction > Downlink", sets the number of DL slots in the frame.

In uplink duration, the value is calculated as follows:

"Number of DL Slots" = "Slot Period" - "Number of UL Slots" - "Special Slots".

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NDLSlots` on page 619

Number of Special Slots
Indicates that there is 1 special slot in the frame.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NSSLots?` on page 620

Number of UL Slots
If "Link Direction > Uplink", sets the number of UL slots in the frame.

In downlink duration, the value is calculated as follows:

"Number of UL Slots" = "Slot Period" - "Number of DL Slots" - "Special Slots".

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NULSlots` on page 620

Use Special Format Index
Turns usage of the special format index on and off.

If on, you can select one of the slot formats defined by 3GPP.

If off, you can configure a custom slot format by entering the required number of downlink symbols or uplink symbols.

Entering the number of downlink symbols is possible when you are in downlink mode.

Entering the number of uplink symbols is possible when you are in uplink mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe` on page 622

Slot Format Index
Sets the special slot format index according to TS 38.213 and thus defines the slot structure.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SLFMt` on page 620

Number of DL Symbols
Indicates the number of DL symbols, depending on the selected slot format index.

In downlink mode, defining the number of downlink symbols is possible when you turn off usage of a special format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NDLSymbols` on page 620

Number of Guarded Symbols
Indicates the number of guard symbols, depending on the selected slot format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NGSYmbols?` on page 621

Number of UL Symbols
Indicates the number of UL symbols, depending on the selected slot format index.

In uplink mode, defining the number of uplink symbols is possible when you turn off usage of a special format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NULSymbols` on page 621

5 5G New Radio configuration and settings

Access:

► Select "Baseband > 5G NR".

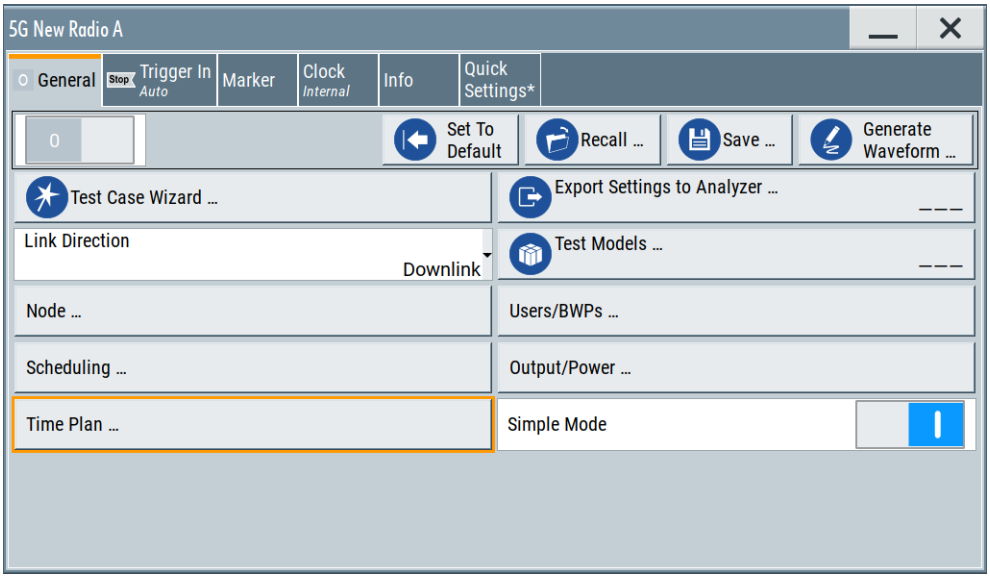
The remote commands required to define these settings are described in Chapter 12, "Remote-control commands", on page 569.

Settings:

5.1 General settings

Access:

► Select "Baseband > 5G NR".



This dialog comprises the standard general settings, the default and the "Save/Recall" settings, and access to dialogs with further settings.

Settings:

State

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

Remote command:

`[:SOURce<hw>]:BB:NR5G:STATe` on page 608

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"
"Link direction"	Downlink
"Channel bandwidth"	100 MHz
"Dummy REs > State"	On
"Dummy REs > SC Spacing/CP"	30 kHz NCP

Remote command:
`[:SOURce<hw>]:BB:NR5G:PRESet` on page 604

Save/Recall
Accesses the "Save/Recall" dialog, that is the standard instrument function for storing and recalling the complete dialog-related (or in coupled sources entity-related) settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The filename and the directory, in which the settings are stored, are user-definable; the file extension is predefined.

On recall, the instrument checks if the saved configuration is compatible with the software and hardware options installed on the current instrument. For example, the number of block outputs (see Output settings) and the number of internal entities (i.e. the currently selected system configuration) have to be the same.

See also, chapter "File and Data Management" in the R&S SMW user manual.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:CATalog?` on page 604
`[:SOURce<hw>]:BB:NR5G:SETTing:LOAD` on page 604
`[:SOURce<hw>]:BB:NR5G:SETTing:STORe` on page 605
`[:SOURce<hw>]:BB:NR5G:SETTing:DEL` on page 604

Generate Waveform File
With enabled signal generation, triggers the instrument to save the current settings of an arbitrary waveform signal in a waveform file with predefined extension `*.wv`. You can define the filename and the directory, in that you want to save the file.

Using the ARB modulation source, you can play back waveform files and/or process the file to generate multi-carrier or multi-segment signals.

If the current configuration uses coupled baseband sources and the baseband block has more than one output, with this function you trigger the software to generate the signals for all outputs. Created is a subset of waveform files, where the number of files corresponds to the number the outputs and the filenames follows the structure:
`<user-defined file name>_<output#-1>.wv`.

Example:

Select "System Config > Fading/Baseband Config > Mode > Advanced"

Select "System Config > Fading/Baseband Config > Baseband (Tx Antennas) = 4"

Select "System Config > Fading/Baseband Config > BB Source Config > Coupled"

Select "Apply"

Select "Baseband > 5G New Radio > General > State > On"

Select "Baseband > 5G New Radio > Output/Power > Output" and observe the number of outputs.

Select "5G New Radio > General > Generate Waveform > On"

In the "Generate Waveform" dialog, use the default directory and enter "Filename = 5gnr". Select "Save".

Select SAVE/RCL, select "File/Recall > File Manager" and in the directory tree open the default directory.

Displayed are four files, `5gnr.wv`, `5gnr1.wv`, `5gnr2.wv` and `5gnr3.wv`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:WAVeform:CREate` on page 609

Test Case Wizard
Accesses the "Test Case Wizard" dialog, see Chapter 8, "Performing BS tests according to TS 38.141 specifications", on page 342.

FRC Wizard
Opens a dialog for easy fixed frequency channel (FRC) configuration for base station testing.

The functionality of the FRC wizard in similar to the FRC configuration in the user and bandwidth part settings.

User: ← FRC Wizard
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Carrier ← FRC Wizard
Displays the automatically assigned carrier names.

Remote command:
via suffix at `CELL<ch>`

BWP ← FRC Wizard
Select the bandwidth parts (BWP) whose settings are displayed for configuration.

There are one or more BWPs, as set with the parameter "User/BWP Settings > UL BWPs" > Number of DL/UL BWPs.

Remote command:
via suffix at `BWP<dir0>`

FRC ← FRC Wizard
Selects one of the FRCs defined in 3GPP 38.141, 38.176 and 38.181.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WTYP` on page 611

Deployment ← FRC Wizard
Selects the frequency deployment for the selected FRC.

Note that availability of frequency deployments depends on the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WDEPloyment` on page 609

Modulation ← FRC Wizard
Shows the modulation of the PUSCH defined for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WMODulation?` on page 610

SC Spacing ← FRC Wizard
Shows the subcarrier spacing defined for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WSCSpacing?` on page 611

Payload Size ← FRC Wizard
Indicates the payload size of the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WPASize?` on page 610

RB Offset ← FRC Wizard
Sets the RB offset for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WROFfset` on page 610

Mapping Type ← FRC Wizard
Sets the PUSCH mapping type for the selected FRC.

Note that you can select the mapping type for certain FRCs only. For others, the mapping type is already defined and read-only.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WMAType` on page 610

Export Settings to Analyzer

Exports the current NR 5G signal description to an `.allocation` file that you can transfer to a Rohde & Schwarz signal analyzer.

Note that the settings transfer includes only settings that are supported by the analyzer.

There are two ways to transfer settings:

- Save the settings in an `.allocation` file on the generator with "Export Settings to Analyzer" and import that `.allocation` file on an analyzer.
- Download the generator settings with the functionality available on the analyzer. For details, refer to the user manual of the NR 5G application of the analyzer.

Remote command:

`[:SOURce<hw>]:BB:NR5G:ANALyzer:CONTent` on page 603

Link Direction

Selects the transmission direction.

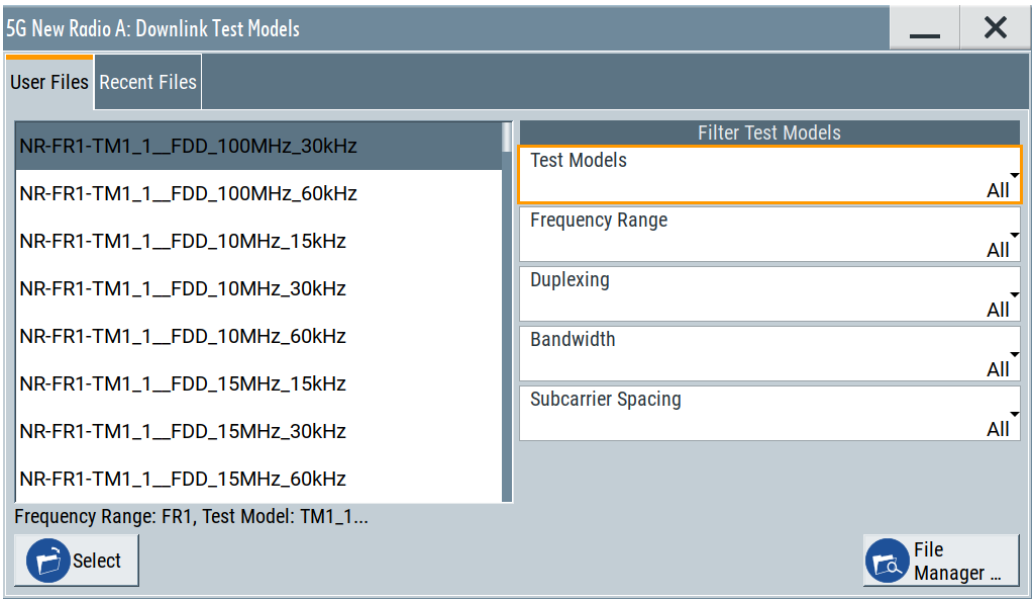
"Downlink"	The transmission direction selected is base station to user equipment. The signal corresponds to that of a base station.
"Uplink"	The transmission direction selected is user equipment to base station. The signal corresponds to that of a user equipment.
"Sidelink"	The transmission direction selected is user equipment to user equipment (V2X communication).

Remote command:

`[:SOURce<hw>]:BB:NR5G:LINK` on page 603

Test Models ...

Accesses a dialog for selecting of files with predefined 5G NR configurations.



User Files ← Test Models ...
Shows the 5G NR test models (NR TM) defined in TS 38.141-1/TS 38.141-2 and TS 38.104.

The NR FR1/FR2 test models are predefined configurations of 5G NR settings. The 3GPP specifications define three main groups of test models, the NR-RF-TM1, NR-FR-TM2 and NR-FR-TM3. Each TM is defined for a subset of different channel bandwidths and subcarrier spacings.

The test model uses common physical channel parameters for PDSCH and PUCCH, and specific physical channels parameters per test model.

The following naming convention is used:

`NR-<FR>-TM<TestModel>__<Duplexing>_<ChBW>MHz_<SCS>kHz`, where:

- `<FR>` designates 5G NR test modules for the frequency range **FR1** and **FR2**
- `<TestModel>` is the TM designation according to TS 38.141-1/TS 38.141-2
- `<Dupplexing>` indicates if FDD or TDD duplexing is used
- `<ChBW>` is one of the defined base station channel bandwidths
- `<SCS>` indicates the subcarrier spacing.

Test models for bandwidths introduced with 3GPP release 17 require Option: R&S SMW-K171.

When you have installed R&S SMW-K175 and have selected standard = "ORAN", the list shows available ORAN test cases.

"NR FR1/FR2 Test Models"

The test models are defined for the following test purpose:

5G NR Test Model	Defined for tests on
NR-FR1-TM1.1 NR-FR2-TM1.1	• BS output power • TAE • Unwanted emissions • Occupied bandwidth • ACLR • Transmitter intermodulation • Transmitter spurious emissions • Operating band unwanted emissions
NR-FR1-TM1.2	• ACLR • Unwanted emissions • Operating band unwanted emissions
NR-FR1-TM2/2a/2b* NR-FR2-TM2	• Total power dynamic range (lower OFDM symbol power limit at min power) • EVM of single 64QAM/256QAM/1024QAM* PRB allocation (at min power) • Frequency error (at min power)
NR-FR1-TM3.1/3.1a/3.1b* NR-FR2-TM3.1	• Output power dynamics • Transmitted signal quality (Frequency error and EVM for 64QAM/256QAM* modulation, at max power) • Transmitted signal quality • Frequency error • EVM for 64QAM/256QAM/1024QAM* modulation (at max power)
NR-FR1-TM3.2	• Transmitted signal quality • Frequency error • EVM for 16QAM modulation
NR-FR1-TM3.3	• Transmitted signal quality • Frequency error • EVM for QPSK modulation

Remote command:

`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL:CATalog?` on page 605

`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL:CATalog?` on page 605

Filter Test Models ← Test Models ...

Applies the selected filter to the files shown in User Files.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog` on page 606

Standard ← Filter Test Models ← Test Models ...

Available with Option: R&S SMW-K175.

Applies a standard filter to the files listed in User Files. Supported standards are "ORAN" and "NR" (3GPP).

If you filter by "ORAN", the user files list contains only the ORAN test cases. The naming conventions are similar to the 3GPP test models:

`ORAN-<FR>-TC<TestCase>__<Duplexing>_<ChBW>MHz_<SCS>kHz`

Remote command:

`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TMSTandard` on page 608

Test Models ← Filter Test Models ← Test Models ...
Available if Standard = NR

Applies a test model filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TMODel` on page 607

Test Case ← Filter Test Models ← Test Models ...
Available if Standard = ORAN

Applies an ORAN test case filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TCASe` on page 607

Frequency Range ← Filter Test Models ← Test Models ...
Applies a frequency range filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:FREQ` on page 606

Duplexing ← Filter Test Models ← Test Models ...
Applies a duplexing filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:DUPLexing` on page 606

Bandwidth ← Filter Test Models ← Test Models ...
Applies a bandwidth filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:BW` on page 605

Subcarrier Spacing ← Filter Test Models ← Test Models ...
Applies a subcarrier spacing filter to the files listed in User Files.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:SCS` on page 607

Select ← Test Models ...
Loads the settings defined in the selected test model.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL` on page 605
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL` on page 605

Node
Accesses the "Node" dialog, see Chapter 5.2, "Node settings", on page 54.

Remote command:
n.a.

Users/BWPs
Accesses the "Users/BWPs" dialog, see Chapter 5.3, "Users / BWPs settings", on page 100.

Remote command:
n.a.

Scheduling
Accesses the "Scheduling" dialog, see Chapter 5.4, "Scheduling settings", on page 205.

Remote command:
n.a.

Output/Power
Accesses the "Output/Power" dialog for setting the signal output and power-related settings.

The symbol ⚠ in the "Output/Power" field indicates the presence of Conflicts in the Output settings.

See:
- Chapter 6.6, "Output settings", on page 322
- Chapter 6.7, "Time domain windowing settings", on page 326.

Remote command:
n.a.

Logfile Generation
Accesses the "Logfile Generation" dialog, see Chapter 10, "Generating logfiles for design cross-verification", on page 563.

Simple Mode
Turns simple mode on and off. The simple mode removes all parameters related to control information (DCI) from the user interface.

DCI related parameters are in the following dialogs:
- Chapter 5.2.3, "System information settings", on page 64 (carrier configuration)
- Chapter 5.6.2, "Payload settings", on page 250 (CORESET configuration)
- Chapter 5.3.6.5, "Control settings (DCI)", on page 142 (DL BWP configuration)
- Chapter 5.3.6.2, "PDSCH settings", on page 122 (DL BWP configuration)
- Chapter 5.3.6.4, "PDCCH settings", on page 142 (DL BWP configuration)
- Chapter 5.3.7.2, "PUCCH settings", on page 164 (UL BWP configuration)
- Chapter 5.3.7.4, "PUSCH settings", on page 170 (UL BWP configuration)
- Chapter 5.3.7.6, "SRS settings", on page 190 (UL BWP configuration)
- Chapter 5.3.2.2, "Control settings", on page 107 (UL & DL BWP configuration)

Note that the SCPI commands for the DCI related parameters still work when you turn on the simple mode, but won't have an effect on the generated signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SIMPle` on page 608

U-Plane Generation
Opens a dialog to turn user plane data generation according to the O-RAN standard on and off.

For more information, see Chapter 11, "Generating user plane data", on page 567.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UPLane:STATe` on page 608

5.2 Node settings

Access:

► Select "Baseband > 5G New Radio > Node".

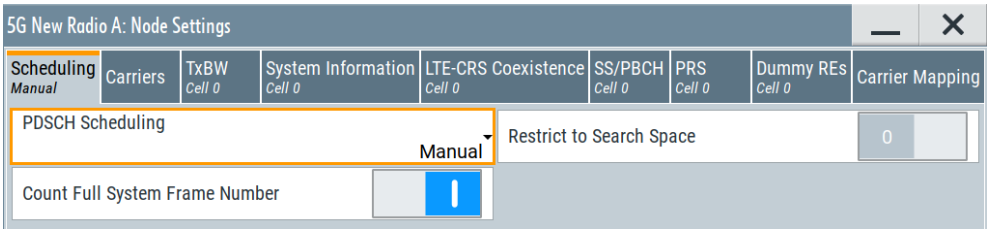
The settings in this dialog describe the basic physical structure of the generated signal.

Settings:

5.2.1 Scheduling

Access:

1. Select "5G New Radio > Link > Downlink".
2. Select "5G New Radio > General > Node > Scheduling".



Settings:

PDSCH Scheduling

Defines whether the PDSCH scheduling is performed manually or according to the configuration made for the DCIs.

"Manual" This mode 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 CORESET DCIs and the PDSCHs settings. You are responsible for the content of the PDSCH allocations.

"Auto/DCI" This mode assures a 3GPP compliant signal; the PDSCH allocations are configured automatically according to the configuration of the CORESET DCIs.

The following settings are configured automatically:

- "Users/BWPs > Properties" > DSCH Channel Coding = "On"
- "Scheduling > CORESET > Custom DCI" > Channel Coding = "On"
- For all DCI 1_1 and 1_0 in "Scheduling > CORESET > DCI Table", Create PDSCH = "On"
- In the "Scheduling" dialog, you can configure only Content = "CORSET" (the PDSCH allocations are configured automatically).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHeduling:MODE` on page 785

Restrict to Search Space

The term search space describes a set of CCEs that a UE monitors. The UE can decode only the control information on a PDCCH/CORESET that is transmitted over CCEs within the search space this UE monitors.

This parameter defines how the search space and the CCE indexes are defined. Together with other parameters it influences the way the search space is defined. For details, see "Search Space" on page 249.

"Off" Define the search space by the CCE start index, see CCE Index.

"On" The CCE start indexes are selected automatically so that they are within the search space.
The "Scheduling > CORESET > Payload" > CCE Index indicates the selected CCE index where the value is defined by the combination of Aggregation Level and candidate number (Candidate).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHeduling:RSSPace` on page 785

Count Full System Frame Number

Option: R&S SMW-B9/-K148.

Enables the full counting of the system frame number carried by the PBCH block from 0 to 1023, independent of the configured ARB Sequence Length.

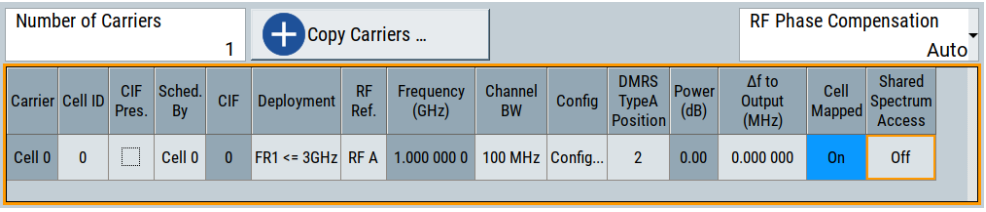
If System Frame Number Offset is set, the counting starts at the configured SFN offset value and restarts when the SFN offset value is reached again, as follows: offset, (offset+1), (offset+2), ..., 1023, 0, 1, 2, ..., (offset-1).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHeduling:SFN:STATe` on page 785

5.2.2 Carriers settings

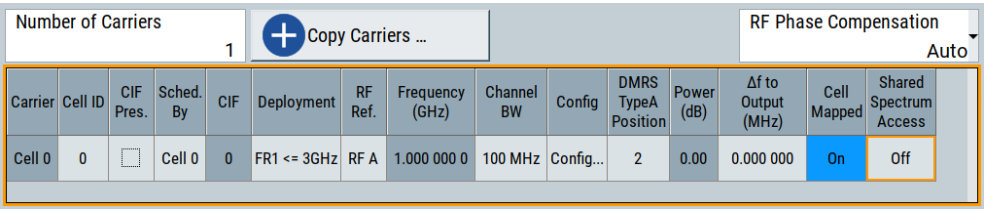
Access:

1. **Carriers** settings for downlink:
   a) Select "5G New Radio > General > Link Direction > Downlink".
   b) Select "5G New Radio > General > Node > Carriers".



This dialog comprises the carrier settings for downlink.

2. **Carriers** settings for uplink:
   a) Select "5G New Radio > General > Link Direction > Uplink".
   b) Select "5G New Radio > General > Node > Carriers".



This dialog comprises the carrier settings for uplink.

Settings:

Number of Carriers

Sets the number of simulated carriers. The carrier table displays one carrier per row.

According to the 3GPP specifications, carrier aggregation is user-specific and thus different users served by the same base station can use different carriers. Moreover, the different users can also have different primary cell (PCell). In this implementation, however, all users use the same carrier aggregation configuration, or with other words, the primary and secondary cells (SCells) are the same for all configured users. Hence, there are *16 carriers per node, not per user*.

The number of simulated carriers is set automatically. It has the following default values depending on the selected system configuration:

- For "System Configuration > BB Sources" = "Separate", "Number of Carriers" = 1.
- For "System Configuration > BB Sources" = "Coupled", "Number of Carriers" = "System Configuration > Entities".
- For "System Configuration > BB Sources" = "Coupled Sources per Entity", "Number of Carriers" = 1.

You can reconfigure the "Number of Carriers" according to your needs.

The changes in the number of carriers are reflected in the Carriers settings tab and in the Carrier-mapping settings tab.

Set the "Number of Carriers ≥ 2" to enable carrier aggregation. The maximum value is 16 carriers.

Example: Reconfiguring the number of carriers

Usually the "System Configuration" of the instrument determines the usage.

You can change the "Number of Carriers" if you need to use an existing system configuration originally intended for Carrier aggregation for other purposes.

For example, you can configure MIMO or multi-user usage in instruments withiout R&S SMW-B14 or R&S SMW-B15 installed by changing the number of carriers.

If you configure a 2x1x1 coupled system in an R&S SMW-B14 or R&S SMW-B15, you cannot use this configuration for MIMO.

See Figure 5-1 for example of a 2x1x1 coupled system configuration.

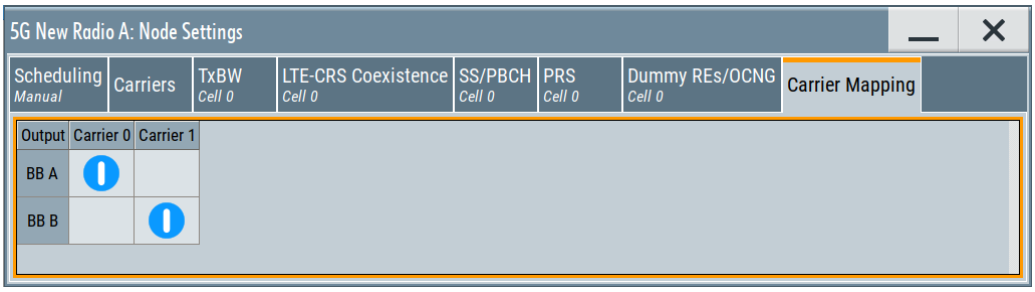


Figure 5-1: Carrier mapping of two carriers in a 2x1x1 coupled system

You can reduce the number of carriers from 2 to 1 to be able to use the instrument for MIMO.

If you reduce the number of carriers of a 2x1x1 system, the "Carrier 1" column is removed automatically in the Carrier-mapping settings as shown in Figure 5-2.

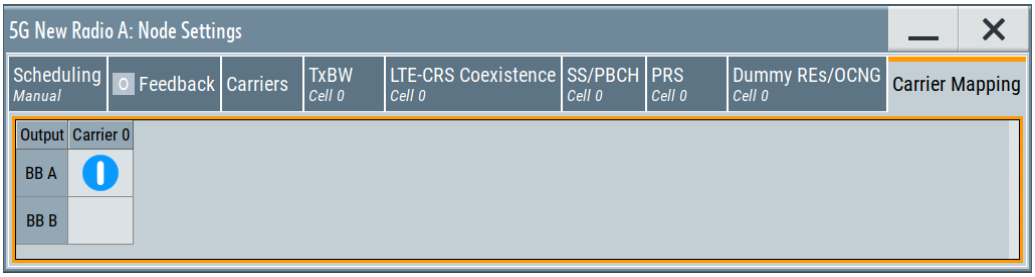


Figure 5-2: Carrier mapping of one carrier in a 2x1x1 coupled system

See Example"Reconfiguring a 2x1x1 coupled system for MIMO usage" on page 599 for a programming example.

Depending on the required number of carriers with MIMO configuration, you can need more than one R&S SMW. The signal generators need to be synchronized, for example, via a common trigger source and a connected external reference.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:NCARrier` on page 623

Copy Carriers

Opens a dialog to create an exact duplicate of an existing carrier. Copying a carrier creates a new carrier with the same configuration as the source carrier.

As the copy is an exact duplicate of an existing carrier, you have to adjust any settings that could or should be different in the copied carrier after you have copied (especially user settings).

Number of New Carriers ← Copy Carriers
Defines the number of additional carriers. The new carriers are added to the carrier table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:NEWCarriers` on page 630

Copy / Load From ← Copy Carriers
Selects the source of the new carrier configuration.

"Other Carrier"	The source is one of the carrier listed in the carrier table.
"5G NR Recall File"	The source is a carrier configuration previously saved to a file. For more information about saving signal configurations, see "Save/ Recall" on page 46.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYSel` on page 629

Recall File ← Copy Carriers
Opens a dialog box to restore a previously saved signal configuration (`.nr5g` file extension).

Available if Copy / Load From = "5G NR Recall File".

When you load carriers from a file, the R&S SMW duplicates all settings except the user properties ("Users/BWPs" > "Properties"). After copying a carrier, check if these settings also apply to the new carrier.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:LOAD` on page 629

Load Carrier ← Copy Carriers
Selects the carrier you want to duplicate.

If only one carrier exists in the table or in the file you have loaded, this is a read only field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYFrom` on page 629

Carrier Info ← Copy Carriers
Shows basic information like deployment range, carrier bandwidth or subcarrier spacing about the carrier you want to duplicate. This information is only shown if you duplicate a carrier from a file.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:CINFo?` on page 628

Copy To New Carrier ← Copy Carriers
Shows the index number of the carriers that are created. This is always the next available number. For example, if 2 carriers (carrier 0 and 1) already exist, the new carriers get numbers 2 and 3.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYTo?` on page 629

Apply ← Copy Carriers
Creates the new carriers.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CC:ADD` on page 628

RF Phase Compensation
This parameter compensates the symbol phase difference caused by uplink/downlink processes, as specified in TS 38.211.

It uses the parameter Frequency in GHz to set the carrier frequency to be compensated.

If you set the "RF Phase Compensation" to "Manual", the Frequency in GHz field activates for manual input of the carrier frequency value to be compensated.

If you set the "RF Phase Compensation" to "Auto", the system determines the phase compensation frequency value from one of the configured RF frequencies automatically. If an "RF Phase Compensation" is assigned automatically, the Frequency in GHz grays out and is not editable. If no "RF Phase Compensation" can be assigned automatically, the system assigns a default value of 1 GHz and activates the Frequency in GHz field so that you can edit the default value.

If you set the "RF Phase Compensation" to "Off", the phase compensation is disabled and the Frequency in GHz shows a "-" symbol.

This value is set to "Auto" by default.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:RFPHase:MODE` on page 623

Carrier table
Comprises the carrier settings. There is one table row per carrier.

Carrier ← Carrier table
Displays the automatically assigned carrier names.

Remote command:
via suffix at `CELL<ch>`

Cell Indicator ← Carrier table
Sets the cell indicator, to identify each of up to 16 carriers.

The cell indicator is unique and unambiguous index used to address the cell, for example for cross-carrier scheduling.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CINDicator` on page 624

Cell ID ← Carrier table
Sets the cell identity of the selected cell.

The physical layer cell ID N_{ID}^{cell} is used for synchronization between network and user equipment. It identifies a specific radio cell in the 5G NR network.

For the uplink and downlink, the cell ID is a value between 0 and 1007, calculated as follows:

$N_{ID}^{cell} = 3N_{ID}^{(1)} + N_{ID}^{(2)}$

Unlike the Cell Indicator, cells can use the same "Cell ID".

For the sidelink, the cell ID is called SL SSID and can have a value between 0 and 671. It is calculated like this: $N_{ID}^{SL} = ID_{ID,1}^{SL} + 336ID_{ID,2}^{SL}$

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CELLid` on page 623

N1 ID/N2 ID ← Carrier table
Indicates the physical cell indicator group ($N_{ID}^{(1)}$) and the physical layer identity ($N_{ID}^{(2)}$), derived from the selected N_{ID}^{cell} (Cell ID).

(Sidelink: $N_{ID,1}^{SL}$ / $N_{ID,2}^{SL}$)

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:N1ID?` on page 625
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:N2ID?` on page 625

CIF Present ← Carrier table
Defines whether the carrier indicator field (CIF) is included in the PDCCH DCI formats transmitted from the corresponding cell.

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.

According to the 5G NR specification, cross-carrier scheduling is enabled by higher-level signaling. To simulate a cross-carrier scheduling in this implementation, enable the "Node > Carriers > CIF Present" per each cell.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CIFPresent` on page 624

Scheduled By ← Carrier table
Displays in which cell coordinates the carrier aggregation, if there is intra-band CA.

Defines the component carrier/cell that signals the UL and DL grants for the selected cell. The signaling cell is determined by its cell index.

According to the 5G NR specification, cross-carrier scheduling has to be enabled per user and per component carrier.

To enable signaling for one particular cell on the primary cell, i.e. cross-carrier scheduling, set the "Scheduled By" to 0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SCHBy` on page 627

CIF ← Carrier table
Displays the value of the carrier indicator field (CIF).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CIF` on page 624

Deployment ← Carrier table
Selects one of the frequency ranges, specified for 5G NR transmission, see Table 2-1.

The selected frequency range (FR) determines the following parameters:
- SC Spacing/CP
- Case (i.e. the synchronization signal pattern).

3GPP release 17 introduces frequency deployment range FR2-2 which requires R&S SMW-K171.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CARDeply` on page 625

RF Ref. ← Carrier table
Selects the reference frequency for automatic RF phase compensation for the corresponding carrier. Available for instruments with two baseband generators.

"None"	Allows you to configure the frequency manually.
"RF A"	Takes the frequency from baseband path A.
"RF B"	Takes the frequency from baseband path B.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:RFPHase:REFerence` on page 627

Frequency in GHz ← Carrier table
Sets the carrier frequency at which the RF Phase Compensation is applied.

If RF Phase Compensation is set to "Manual", this field is enabled for manual input of the carrier frequency value at which the phase compensation is applied.

If RF Phase Compensation is set to "Auto", this field is grayed out and the carrier frequency value is set automatically.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PCFReq` on page 627

Channel Bandwidth ← Carrier table
Selects the bandwidth of the node carrier from a list with predefined values, see Table 2-1.

The available values depend on the selected Deployment. Together with the selected SCS (SCS or SC Spacing/CP), the channel bandwidth affects the number of available RBs (N_RB and No. RBs).

Signals, channels (e.g. SS/PBCH) and bandwidth parts (BWPs) can only be configured within the selected channel bandwidth. Thus, the value selected here sets the upper limit for the bandwidth-related settings.

You can select channel bandwidths that are larger than the baseband bandwidth available in the R&S SMW, because the used sample rate can be smaller than the channel bandwidth.

- The 70 MHz channel bandwidth in uplink requires the release 16 option (R&S SMW-K148).
- The 35 MHz and 45 MHz channel bandwidths require the release 17 option (R&S SMW-K171).
- The channel bandwidths > 400 MHz supported by FR2-2 frequency deployment require the release 17 option (R&S SMW-K171).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CBW` on page 625

Carrier Config ← Carrier table
Opens a dialog to configure the system information of the carrier.

For details, see:
- Chapter 5.2.3, "System information settings", on page 64
- Chapter 5.2.4, "Timing & Phase Settings", on page 66

DMRS Type A Position ← Carrier table
Depending on the used mapping type (A or B), the demodulation reference signals (DMRS) are mapped to different symbols of the PDSCH/PUSCH allocation.

This parameter defines the position of the first DMRS symbol l_0 (`dmrs-TypeA-Position`) within the slot, if mapping type A is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TAPos` on page 628

Delta f to Output/MHz ← Carrier table
("System Configuration > BB Source Config > Separated")

Shifts the signal relative to the center output frequency.

Use different frequency offsets to separate the channels of the configured and enabled cells.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DFReq` on page 626

Cell Mapped ← Carrier table
If enabled, the signal of the selected cell is mapped to the output.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:MAPPed` on page 626

Shared Spectrum Access ← Carrier table
Turns an increased number of available SS/PBCH blocks on and off.

The setting has an effect for FR1 deployments and block patterns A and C.

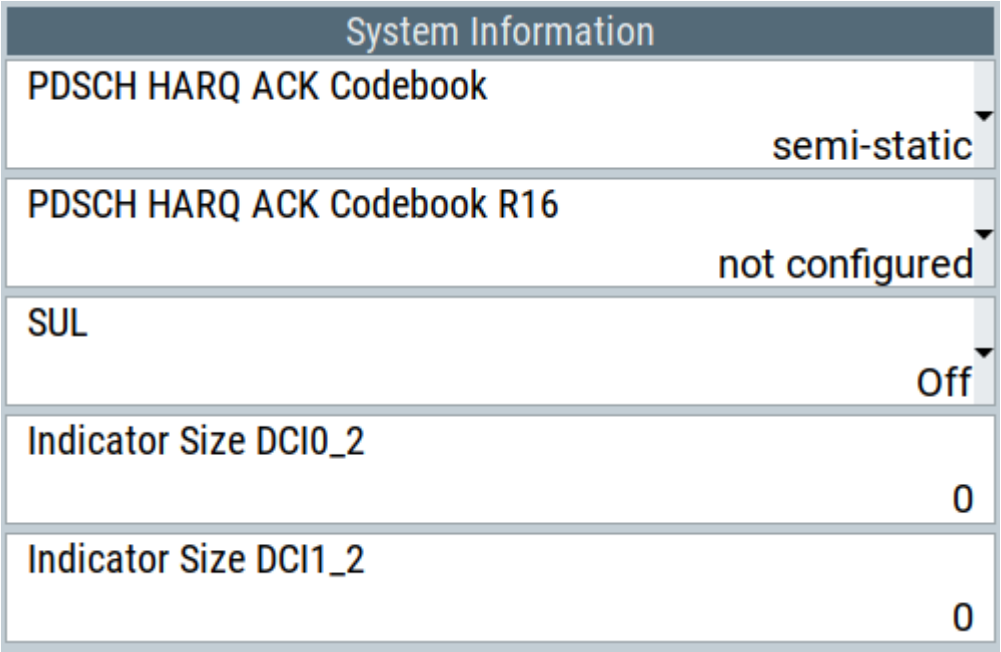
Available with 3GPP release 16.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SHSPec` on page 626

5.2.3 System information settings

Access:

1. Select "Simple Mode" = "Off".
2. Select "5G New Radio > General > Node > Carriers > Config".



Settings:

PDSCH HARQ ACK Codebook

Defines the HARQ ACK reporting according to the PDSCH HARQ ACK codebook.

"Semi-static" Sets the HARQ ACK reporting according to the PDSCH HARQ ACK codebook to "semi-static".
A UE reports HARQ ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ feedback timing indicator field in a corresponding DCI format 1_0 or DCI format 1_1.
The UE reports NACK values for HARQ ACK information bits in an HARQ ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ feedback timing indicator field in a corresponding DCI format 1_0 or DCI format 1_1.

"Dynamic" Sets the HARQ ACK reporting according to the PDSCH HARQ ACK codebook to "dynamic".
For a serving cell, an active DL BWP, and an active UL BWP the UE determines a set of occasions for candidate PDSCH receptions for which the UE can transmit corresponding HARQ ACK information in a PUCCH in slot . If the serving cell is deactivated, the UE uses as the active DL BWP for determining the set of occasions for candidate PDSCH receptions a DL BWP provided by the first active downlink BWP identifier.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:HACBook` on page 630

PDSCH HARQ ACK Codebook R16
Defines the state of the higher layer parameter `pdsch-HARQ-ACK-Codebook-r16` introduced with 3GPP release 16. The effects of this parameter are described in 3GPP 38.212.

"Not Configured" Does not use the release 16 codebook.

"Enhanced Dynamic" Uses the release 16 codebook and adjusts the bit lengths of various DCI fields according to 3GPP 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:HACR` on page 631

SUL
Defines whether the carrier supports supplementary uplink (SUL).

The supplementary uplink (SUL) uses one of several dedicated NR bands under 2 GHz (band n80 to n86). By this supplementary uplink, the lower frequency helps to increase the cell coverage in UL direction and the UL performance at the cell edge.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:SUL:STATe` on page 631

Indicator Size DCI0_2
Defines the bit length of the DCI field "Carrier Indicator" available in DCI formats 0_2.

Corresponds to higher layer parameter `carrierIndicatorSizeDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:IS02` on page 632

Indicator Size DCI1_2
Defines the bit length of the DCI field "Carrier Indicator" available in DCI formats 1_2.

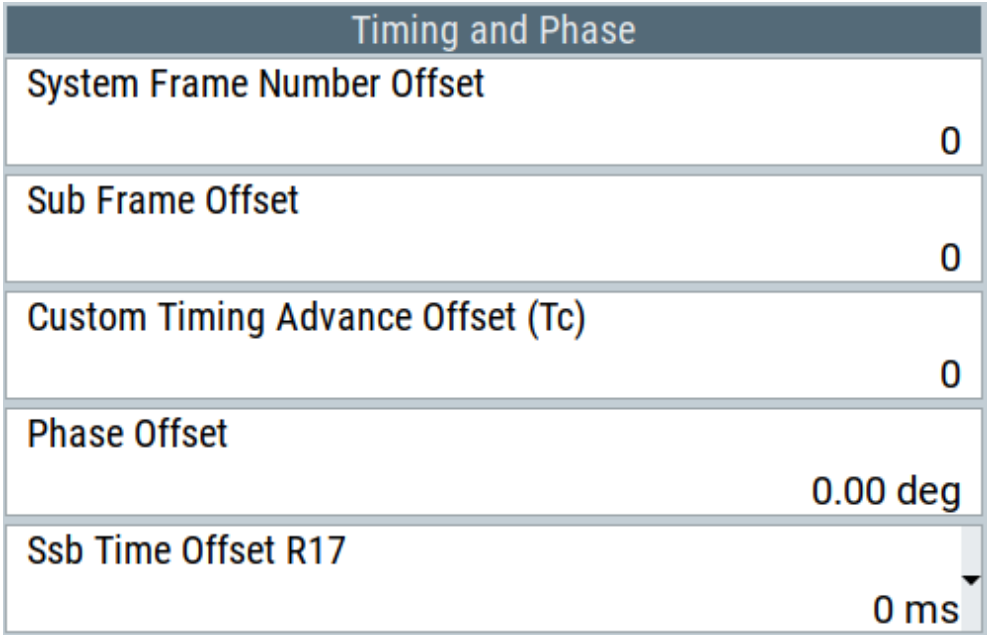
Corresponds to higher layer parameter `carrierIndicatorSizeDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:INDSize` on page 632

5.2.4 Timing & Phase Settings

Access:

► Select "5G New Radio > General > Node > Carriers > Config".



The timing and phase section contains settings related to timing and phase characteristics of the selected carrier.

Settings:

System Frame Number Offset
Sets an offset value for the system frame number. The first generated frame starts with the given system frame number offset.

A system frame number offset changes, for example, the hopping patterns and has an effect on the following settings.

- ZP CSI-RS Bitmap
- NZP CSI-RS Bitmap
- SRS positions (see SRS settings)
- CCE Index when Restrict to Search Space is enabled.
- SS/PBCH MIB System Frame Number Start Offset

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SYFNoffset` on page 633

Sub Frame Offset
Defines a cyclic subframe shift within the selected carrier. The offset defines the number of subframes that are moved from the beginning of the signal to the end of the signal. The offset is in terms of subframes.

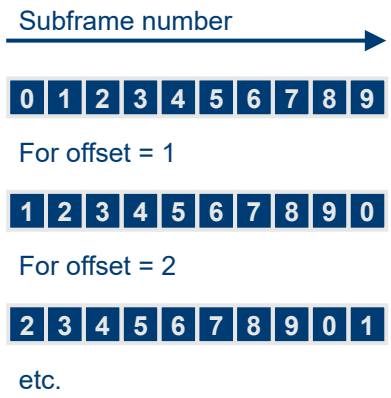


Figure 5-3: Example: Subframe shift in a frame

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SFOFfset` on page 633

Ssb Time Offset R17
Defines a time offset for the SS/PBCH block. The SSB time offset corresponds to RRC parameter `Ssb-TimeOffset-r17` defined in 3GPP 38.331.

Note that the time offset only changes the position of the SS/PBCH block and moves it into the correct subframe, if necessary. Using a subframe offset or system frame number offset also changes the position of other signal parts in time.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SSBToffset` on page 633

Timing Advance Offset
Option: R&S SMW-K148

If Link Direction > " Uplink", sets an offset ($N_{TA\ offset}$) to the timing advance value for UL/DL switching synchronization as specified in TS 38.211.

The timing advance offset is set to 0 by default. The available $N_{TA\ offset}$ values depend on the set Deployment.

TS 38.133 specifies the $N_{TA\ offset}$ value as shown in Table 5-1.

Table 5-1: Value of $N_{TA\ offset}$ as specified in TS 38.133

Frequency range and band of cell used for uplink transmission	$N_{TA\ offset}$ (unit: T_C)
FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case	25600 (see note below)
FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	0 (see note below)
FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	39936 (see note below)

Frequency range and band of cell used for uplink transmission	$N_{TA\ offset}$ (unit: T_C)
FR2-1	13792
FR2-2	13792 or 25600
Note: The UE identifies $N_{TA\ offset}$ based on the information `n-TimingAdvanceOffset` as specified in TS 38.331. If the UE is not provided with the information `n-TimingAdvanceOffset`, the default value of $N_{TA\ offset}$ is set as 25600 for FR1 band. In case of multiple UL carriers in the same timing advance group (TAG), the UE expects that the same value of `n-TimingAdvanceOffset` is provided for all the UL carriers according to TS 38.213 and the value 39936 of $N_{TA\ offset}$ can also be provided for an FDD serving cell.	

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>[:TMPH]:TAOFfset` on page 633

Custom Timing Advance Offset (Tc)
Defines a cyclic signal offset for the selected component carrier in the time domain. The offset defines the part of a signal that is moved from the beginning of the signal to the end of the signal. The offset is measured in T_c as defined by 3GPP.

Available for number of carriers > 1.

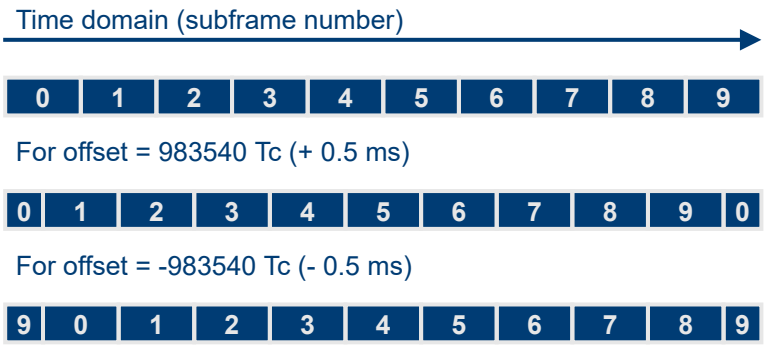


Figure 5-4: Example: Timing advance offset in a frame

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:CTOFfset` on page 632

Phase Offset
Defines a phase offset for the selected component carrier relative to 0 °. This phase offset allows you to generate component carriers with different phase characteristics, as required for beamforming, for example.

Available for number of carriers > 1.

Note that this phase offset refers to individual component carriers. When you define a phase offset for the complete signal in the block diagram, this basic phase offset is added to the phase offset of the component carriers.

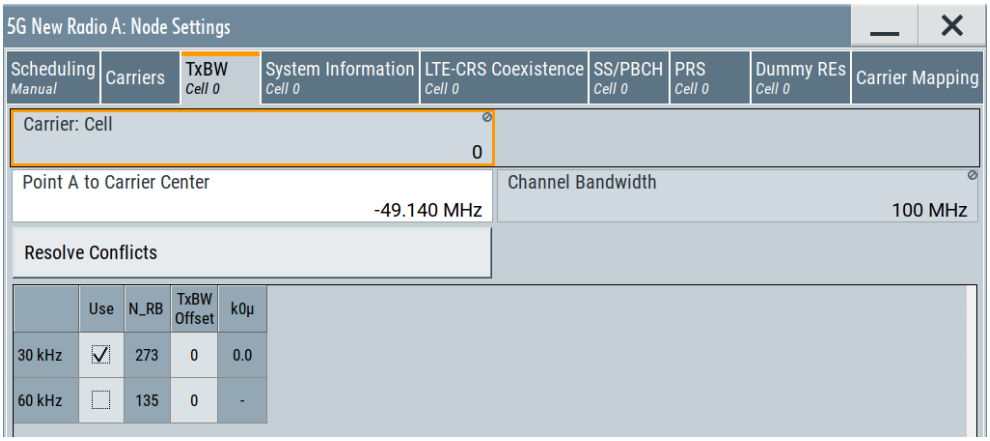
For more information about the basic phase offset, refer to the R&S SMW user manual, chapter "Shifting and Boosting the Baseband Signal".

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:PHOFfset` on page 632

5.2.5 Transmission bandwidth (TxBW) settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > General > Node > TxBW".



This dialog comprises the settings, related to the transmission bandwidths (TxBW). These settings include: the frequency offset between the center carrier and the Point A, the transmission bandwidth width in number of RBs and the k_0^{μ}.

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Point A to Baseband Center
Sets the frequency offset between the reference Point A and the baseband center frequency.

The Point A is the reference point for the frequency-dependent parameters, for example TxBW Offset and RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS).

See Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:POINta` on page 634

Channel Bandwidth
Selects the bandwidth of the node carrier from a list with predefined values, see Table 2-1.

The available values depend on the selected Deployment. Together with the selected SCS (SCS or SC Spacing/CP), the channel bandwidth affects the number of available RBs (N_RB and No. RBs).

Signals, channels (e.g. SS/PBCH) and bandwidth parts (BWPs) can only be configured within the selected channel bandwidth. Thus, the value selected here sets the upper limit for the bandwidth-related settings.

You can select channel bandwidths that are larger than the baseband bandwidth available in the R&S SMW, because the used sample rate can be smaller than the channel bandwidth.

- The 70 MHz channel bandwidth in uplink requires the release 16 option (R&S SMW-K148).
- The 35 MHz and 45 MHz channel bandwidths require the release 17 option (R&S SMW-K171).
- The channel bandwidths > 400 MHz supported by FR2-2 frequency deployment require the release 17 option (R&S SMW-K171).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CBW` on page 625

Resolve Conflicts
Recalculates the frequency-dependent settings and thus redefines the frequency position of the TxBW.

Conflicts arise if:
- TxBW Offset is not a multiple integer of RBs for the corresponding numerology
- k0μ ≠ {-6, 0, 6}.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:RESolve` on page 635

TxBW table
Comprises the frequency-related settings of the subcarrier spacings (SCS) supported for the selected Deployment.

Displayed are all supported SCS combinations. To enable a specific SCS, set Use > "On".

See Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.

SCS ← TxBW table
Indicates the SCS to that the settings apply.

Remote command:
via block `S<SCS>K`

Use ← TxBW table
From all possible TxBWs for a specific channel bandwidth, the base station decides which TxBWs to use. This parameter defines whether the SCS is supported in the particular cell and if it is used by the base station.

At least one SCS must be used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:USE` on page 635
etc.

N_RB ← TxBW table
Indicates the number of available RBs N_{RB} within the TxBWs for the selected SCS and Channel Bandwidth.

See Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:NRB?` on page 635
etc.

TxBW Offset ← TxBW table
Sets the usable RB to common RBs offset.

See Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:OFFSet` on page 636
etc.

k0µ ← TxBW table
Indicates the value of the parameter k_0^{μ}, that defines the number of subcarriers the transmission bandwidth is shifted related to the carrier center.

The value is calculated automatically, based on the selected SCS and "Channel Bandwidth".

According to the specification, k_0^{μ} = {-6, 0, 6}. If value different than these allowed values is displayed, a conflict is indicated. Use the Resolve Conflicts function to recalculate the values.

The value k_0^{μ} = "-" indicates that the SCS is not used (Use > "Off").

See Chapter 2.6, "Transmission bandwidths TxBWs", on page 25.

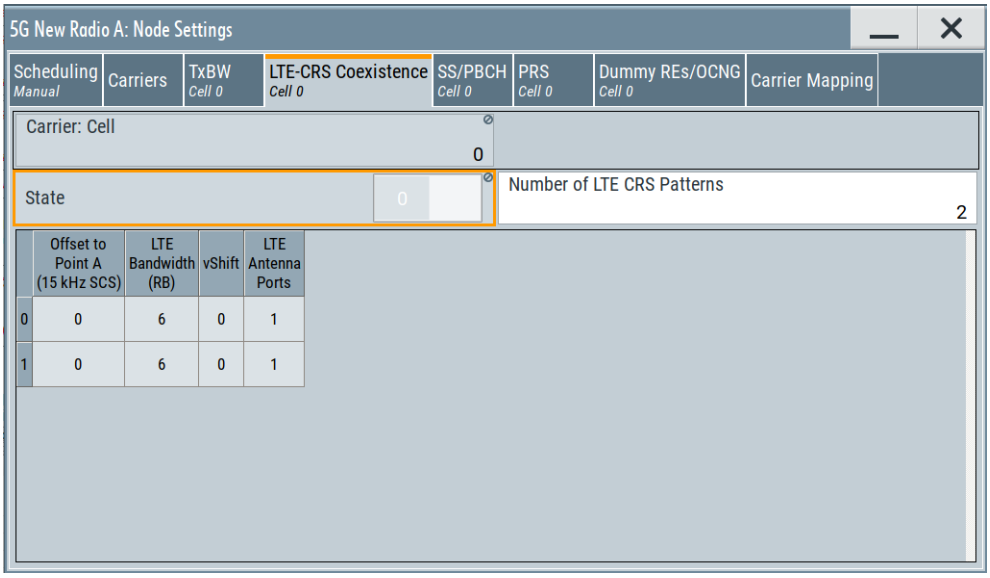
Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:KOMU?` on page 636
etc.

5.2.6 LTE-CRS coexistence settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".

2. Enable a carrier that **supports SCS of 15 kHz**, for example select "5G New Radio > General > Node > Carriers > Carrier x > Channel BW = 50 MHz".
3. Select "Node > TxBW > 15 kHz > Use = On".
4. Select "Resolve Conflicts".
5. Select "LTE-CRS Coexistence".



You can configure LTE CRS signals, if the carrier supports 15 kHz subcarrier spacing, because 15 kHz is the subcarrier spacing used in LTE.

In this dialog, you configure the allocation of the LTE-CRS as defined in TS 38.214 in terms of:

- Frequency position as offset to Point A and bandwidth within the RS are spread.
- Number of RS and their configuration defined based on the number of used LTE antenna ports and position of the CRS patterns in the frequency domain (vShift).

The resources reserved for the transmission of the LTE CRS are omitted by 5G NR, which influences among others the PDSCH resource mapping. The LTE CRS allocation must be known by the UE and by the BS.
Observe the LTE CRS resources on the "Time Plan". In the "Scheduling" dialog, observe how enabled LTE CRS reduces the number of available physical resources for PDSCH .

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

State
Enable the LTE-CRS so that the configured resources are omitted by the 5G NR allocations.

This setting is useful if you simulate LTE and 5G NR coexistence scenarios, where the same frequency band is shared between LTE and 5G NR allocations.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe` on page 637

Number of LTE CRS Patterns
Option: R&S SMW-K148

Defines the number of LTE cell specific reference signals in the resource grid.

You can configure up to four CRS patterns in a table. Each row corresponds to one CRS pattern. The number of rows in the table changes, depending on the number of CRS patterns.

For each CRS pattern, you can define various characteristics.

- Offset to point A
- vShift
- LTE bandwidth
- Number of antenna ports

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:NPAT` on page 636

Offset to Point A (15 kHz SC Spacing)
Sets the LTE carrier center subcarrier location (`carrierFreqDL`) as offset from (reference) point A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:POINta` on page 638

LTE Bandwidth (RB)
Sets the LTE bandwidth (`carrierBandwidthDL`) as number of RBs and thus defines the bandwidth used for the LTE-CRS. The LTE-CRS always span the whole LTE bandwidth.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:CBW` on page 637

vShift
Sets the parameter `v-Shift` required to configure the LTE-CRS allocation.

In LTE, vShift is defined as function of the cell ID. This parameter is used to shift the CRS patterns in LTE neighbor cells in the range of 0 to 5 subcarriers and thus prevent CRS pattern overlapping.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:VSHift` on page 638

LTE Antenna Ports
Sets the parameter `nrofCRS-Ports` giving the number of antenna ports used for LTE-CRS.

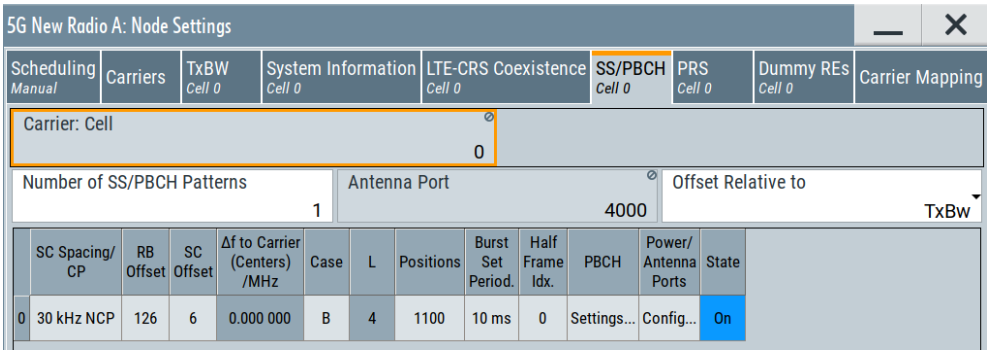
The number of antenna ports defines the number and position of LTE CRS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:NAP` on page 637

5.2.7 SS/PBCH settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > General > Node > SS/PBCH".



This dialog comprises the settings of the broadcast channel (PBCH) and the synchronization signals (SS). The SS and the PBCH are cell-specific and are always transmitted in a block. For more information, see Chapter 2.7, "Synchronization signals and SS/PBCH block", on page 27.

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Number of SS/PBCH Patterns
Defines how many patterns for the synchronization signals and the PBCH are configured. There is one table row per pattern.

See also Chapter 2.7, "Synchronization signals and SS/PBCH block", on page 27.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:NSSPbch` on page 640

Antenna Port
Indicates that antenna port 4000 is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:AP4000[:ROW<ch0>]`
on page 640

Offset Relative to
Defines the reference point, relative to which the SS/PBCH is allocated in frequency domain.

"TxBW" The frequency position of the SS/PBCH is set relative to the usable RBs that apply for the current numerology, i.e. to the start of the TxBWs.

If this reference point is used, you can select the SC Spacing/CP for that the following apples:
- TxBW spans at least 20 RBs (i.e. N_RB > 20)
- TxBW is enabled for this SCS (i.e. Use > "On".

"Point A" The frequency position of the SS/PBCH is set relative to the position of point A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:OFFSet` on page 639

SS/PBCH patterns table
Comprises the configuration of the SS/PBCH transmissions.

You can enable different SS/PBCH patterns and configure their individual settings in the SS/PBCH pattern table. There is one table row per pattern. Each row describes a periodically repeating burst set with definable timing and frequency position, defined as follows:

- Frequency: SC Spacing/CP, RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS), SC Offset/SC Offset (15 kHz SCS)/SC Offset (60 kHz SCS) and Delta f to Carrier (Centers)
- Timing: Case, Positions, Burst Set Periodicity and Half Frame Index

See also Figure 2-3.

SC Spacing/CP ← SS/PBCH patterns table

Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

The available values also depend on the following:

- SCSs that span at least 20 RBs (i.e. N_RB > 20)
- For Offset Relative to = " TxBW", only SCSs that are enabled for the TxBW (i.e. Use > "On".
- For"SC Spacing / CP" = 240 kHz, the "Offset Relative to" must be set "Point A". Additional the "Node Settings" > "TxBW" > "Use" value and the "Node Settings" > "Carriers" > "Deployment" value has an impact on the possible "SC Spacing /CP" values.

Remote command:

`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCSPacing`

on page 640

RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS) ← SS/PBCH patterns table

Sets the start resource block of the selected allocation and thus defines the allocation's position in the frequency domain.

The name of the parameter changes depending on the selected Offset Relative to as follows:

- "RB Offset": If Offset Relative to = "TxBW"
- "RB Offset (15 kHz SCS)": If Offset Relative to = "Point A" and Deployment = "f <= 3GHz" or "3GHz < f <= 6GHz"
- "RB Offset (60 kHz SCS)": If Offset Relative to = "Point A" and Deployment = "f > 6GHz"

For Offset Relative to = "TxBW", the value is set relative to the usable RBs that apply for the current numerology, i.e. to the start of the TxBWs (SC Spacing/CP), see Figure 2-3.

Example:

- If "RB Offset = 0", the SS/PBCH block is allocated on the first subcarrier in the channel.
- If "RB Offset = 10", the SS/PBCH block is allocated on the 10*12 = 120th subcarrier in the channel.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:RBOFfset`
on page 641

SC Offset/SC Offset (15 kHz SCS)/SC Offset (60 kHz SCS) ← SS/PBCH patterns table
Sets the start subcarrier of the selected allocation within a resource block, where the latter is defined with the parameter RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS).

Example:

- If "RB Offset = 0" and "SC Offset = 10", the SS/PBCH block is allocated on the 10th subcarrier in the channel.
- If "RB Offset = 10" and "SC Offset = 0", the SS/PBCH block is allocated on the 10*12 = 120th subcarrier in the channel.

See also Figure 2-3.

The name of the parameter changes depending on the selected Offset Relative to as follows:

- "SC Offset": If Offset Relative to = "TxBW"
- "SC Offset (15 kHz SCS)": If Offset Relative to = "Point A" and Deployment = "f <= 3GHz" or "3GHz < f <= 6GHz"
- "SC Offset (60 kHz SCS)": If Offset Relative to = "Point A" and Deployment = "f > 6GHz"

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCOFfset`
on page 641

Delta f to Carrier (Centers) ← SS/PBCH patterns table
Indicates the frequency offset between the center of the SS/PBCH block to the center of the carrier; thus indicates the allocation's position in the frequency domain.

The value is calculated automatically, based on the selected SCS, channel bandwidth, deployment method, RB and SC offsets.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:DFReq?` on page 641

Case ← SS/PBCH patterns table
Selects one of the SS/PBCH cases, as specified in TS 38.213. The case defines which symbols in a slot carry the synchronization signals.

The SS/PBCH cases depend on the deployment and the used SCS.

SS/PBCH case	SCS	Frequency
Case A	15 kHz	< 6 GHz
Case B*	30 kHz	< 6 GHz
Case C*	30 kHz	< 6 GHz
Case D	120 kHz	> 6 GHz

SS/PBCH case	SCS	Frequency
Case E	240 kHz	> 6 GHz
Case F**	480 kHz	> 6 GHz
Case G**	960 kHz	> 6 GHz

*) The start symbol index in case B and case C is different.

**) Requires R&S SMW-K171

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CASE` on page 642

L ← SS/PBCH patterns table
Sets the number of SS/PBCH blocks, transmitted per burst.

This value sets the pattern length, used to define the Positions of the transmitted SS/PBCH blocks.

The available values for "L" depend on the selected Deployment as follows:
- "Deployment" = "f ≤ 3 GHz": L = 4 or 8, where
  L = 8 is supported for the unpaired spectrum below 3 GHz if Case = "C"
- "Deployment" = "3 GHz < f ≤ 6 GHz": L = 8
- "Deployment" = "f > 6 GHz": L = 64

If you turn on shared spectrum access, L also depends on the SS/PBCH case.
- Case A = 15 kHz NCP: L = 10
- Case C = 30 kHz NCP: L = 20

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:L` on page 642

Positions ← SS/PBCH patterns table
A half-frame contains 4, 8 or 64 SS/PBCH blocks, depending on the selected subcarrier spacing and deployment and as set in the parameter L. The group of 4, 8 or 64 blocks is referred to as burst set, see Figure 2-3.

The "Positions" parameter defines which of these theoretically possible maximum numbers of SS/PBCH blocks are transmitted in each burst set. The definition is an internally generated sequence according to a bit pattern, where:
- Pattern length = 4, 8 or 64 and corresponds to the maximum number of SS/PBCH blocks
- Each bit applies to one SS/PBCH block
- 1: SS/PBCH block is present
- 0: SS/PBCH transmission is suppressed.

Use the "Pattern" box to define the bit pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:PATTern` on page 642

Burst Set Periodicity ← SS/PBCH patterns table
Defines how often a SS/PBCH burst set is transmitted.

The "Burst Set Periodicity = 10", for example, corresponds to a transmission in every frame.

See also Figure 2-3.

IAB periodicities are available with R&S SMW-K148.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:BSPeriodicty`
on page 643

Half Frame Index ← SS/PBCH patterns table
SS/PBCH time occasions are defined within a half-frame, i.e. 5 ms. This index defines in which half-frame of the time structure the first SS/PBCH block occasion is located.

This value depends on the configured Burst Set Periodicity. It can be set to values from 0 to ["Burst Set Periodicity"/5 - 1].

The default value is 0, it locates the first SS/PBCH occasion in the first half-frame. If you set the value to 1, the first SS/PBCH occasion is in the second half-frame (after 5 ms). A "Half Frame Index" of 2, sets the first SS/PBCH occasion in the third half-frame (after 10 ms), and so forth.

Example:

Burst Set Periodicity = 20

"Half Frame Idx." = 2

The first SS/PBCH block occasion is located in the third half-frame, i.e. after 10 ms, see Figure 5-5.

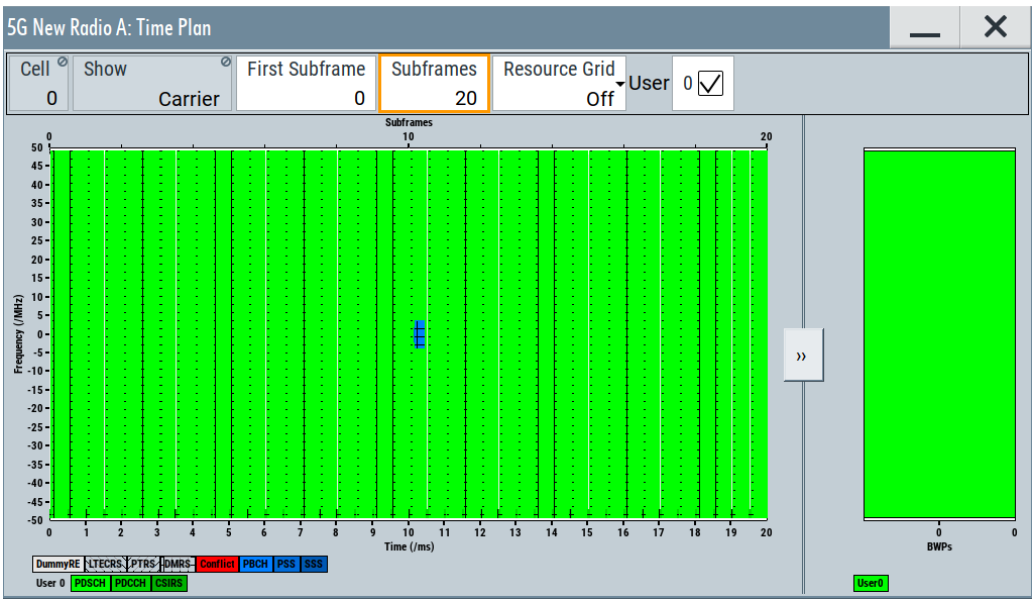
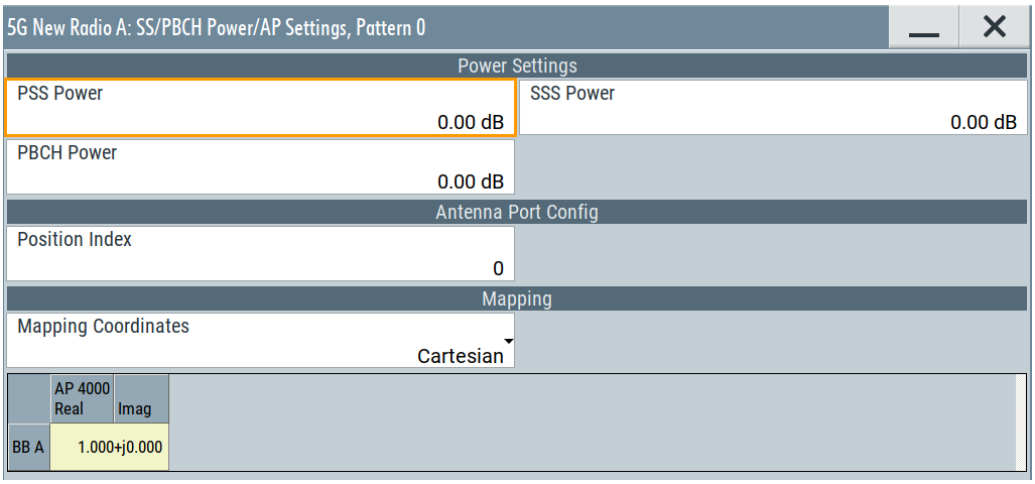


Figure 5-5: SS/PBCH in the Time Plan tab with a Half Frame Index = 2

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:HFRMidx`
on page 643

PBCH Config ← SS/PBCH patterns table
Accesses the dialog with PBCH settings, see Chapter 5.2.13, "PBCH settings", on page 94.

Power/Antenna Ports Config ← SS/PBCH patterns table
Accesses a dialog with the power and antenna port-mapping settings for the SS/PBCH pattern.



For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

PSS/SSS Power ← Power/Antenna Ports Config ← SS/PBCH patterns table
Sets the relative power of the allocations of the primary and the secondary synchronization signals (PSS and SSS).

The value is set relative to the power of the other resource elements.

Note that in the sidelink, the primary and secondary synchronization signals are called S-PSS and S-SSS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:PSSPow` on page 643
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SSSPow` on page 643

PBCH Power ← Power/Antenna Ports Config ← SS/PBCH patterns table
Sets the relative power of the PBCH allocation.

The value is set relative to the power of the other resource elements.

Note that in sidelink, the channel is called PSBCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POWer` on page 643

Position Index ← Power/Antenna Ports Config ← SS/PBCH patterns table
Defines the position of the SS/PBCH pattern to which the AP mapping configuration is applied.

The positions of a SS/PBCH pattern are defined in the Positions field.

You can configure the AP mapping independently for active positions, i.e. those with a value of 1. For example, if the Positions sequence is **1100**, you can set the "Position Index" to 0 or to 1, to configure the AP mapping of first and second position. The AP mapping settings for positions with a value of 0 are disabled.

Remote command:
via suffix at `APMap<dir0>`

Mapping Coordinates ← Power/Antenna Ports Config ← SS/PBCH patterns table
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping table ← Power/Antenna Ports Config ← SS/PBCH patterns table
The mapping table is a matrix with number of rows equal to the number of physical Tx antennas (basebands). It contains one column for the antenna port 4000. For SS/PBCH, only the antenna port 4000 is active. The headers indicate the type of coordinates being used ("Real/Imag" for Cartesian or "Magn./Phase" for cylindrical). The yellow matrix elements highlight the none zero entires.

The number of rows depends on the selected "System Configuration".

For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:REAL` on page 644
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:IMAGinary` on page 644
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:MAGNitude` on page 645
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:PHASe` on page 645

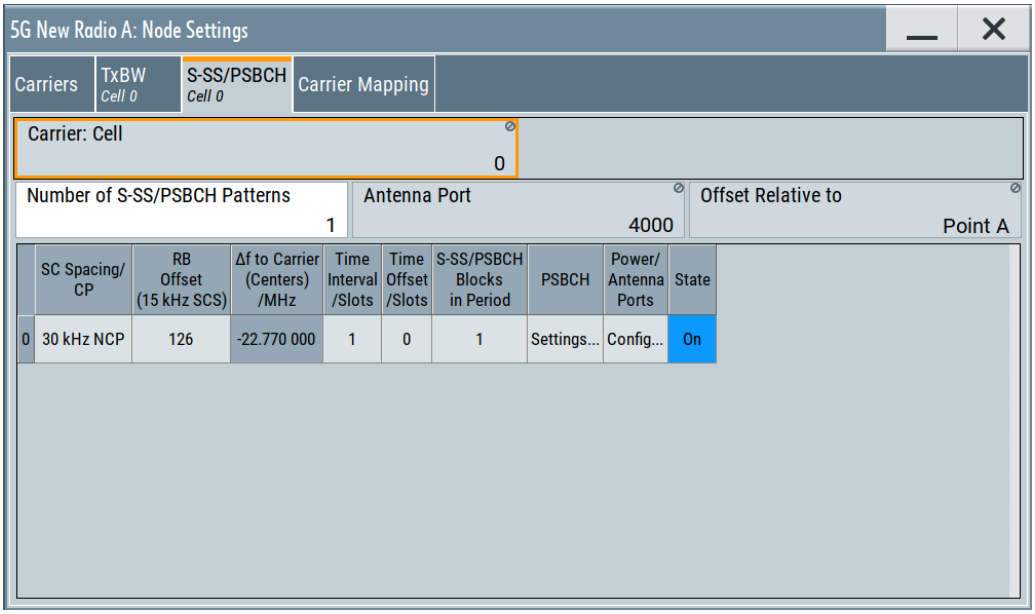
State ← SS/PBCH patterns table
Disables the transmission of SS/PBCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:STATe` on page 640

5.2.8 S-SS/PSBCH settings

Access:

1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "5G New Radio > General > Node > S-SS/PSBCH".



This dialog comprises the settings of the sidelink broadcast channel (PSBCH) and synchronization signals (S-SS). The S-SS and the PSBCH are cell-specific and are always transmitted in a block.

As in the downlink, the S-SS and PSBCH are bundled in a synchronization signal block which is transmitted on a fixed schedule. For more information about the synchronization block in the downlink, see Chapter 2.7, "Synchronization signals and SS/PBCH block", on page 27.

Most of the synchronization block settings in the sidelink are the same as in the downlink.

Cell

Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Number of S-SS/PSBCH Patterns
Defines how many patterns for the synchronization signals and the PSBCH are configured. There is one table row per pattern.

In the sidelink, you can define up to 4 S-SS/PSBCH patterns.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:NSSPbch` on page 640

Antenna Port
Shows the antenna port the synchronization block uses (always 4000).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:AP4000[:ROW<ch0>]`
on page 640

Offset Relative to
Defines the reference point, relative to which the S-SS/PSBCH is allocated in frequency domain. For the S-SS/PSBCH, the frequency position is always relative to reference point A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:OFFSet` on page 639

S-SS/PSBCH patterns table
Contains the settings to configure the S-SS/PSBCH transmissions.

The size of the table depends on the number of S-SS/PSBCH patterns you have defined. Each row corresponds to one pattern.

SC Spacing/CP ← S-SS/PSBCH patterns table
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

The sidelink supports subcarrier spacings up to 120 kHz.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCSPacing`
on page 640

RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS) ← S-SS/PSBCH patterns table
Sets the start resource block of the selected allocation and thus defines the allocation's position in the frequency domain.

The name of the parameter changes depending on the selected subcarrier spacing.
- "RB Offset (15 kHz SCS)": If Deployment = "f <= 3GHz" or "3GHz < f <= 6GHz"
- "RB Offset (60 kHz SCS)": If Deployment = "f > 6GHz"

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:RBOFfset`
on page 641

Δf to Carrier (Centers)/MHz ← S-SS/PSBCH patterns table
Indicates the frequency offset between the center of the S-SS/PSBCH block to the center of the carrier; thus indicates the allocation's position in the frequency domain.

The value is calculated automatically, based on the selected SCS, channel bandwidth, deployment method and RB offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:DFReq?` on page 641

Time Interval/Slots ← S-SS/PSBCH patterns table
Defines the number of slots between two consecutive S-SS/PSBCH blocks.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:INTerval` on page 651

Time Offset/Slots ← S-SS/PSBCH patterns table
Defines the offset between slot 0 and first S-SS/PSBCH block.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:TOFFs` on page 652

S-SS/PSBCH Blocks in Period ← S-SS/PSBCH patterns table
Defines the number of transmitted S-SS/PSBCH blocks.

The number of S-SS/PSBCH block depends on the selected subcarrier spacing.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:BINPeriod` on page 650

PSBCH Config ← S-SS/PSBCH patterns table
Opens a dialog to configure the PSBCH.

For more information, see Chapter 5.2.14, "PSBCH settings", on page 99.

Power/Antenna Ports Config ← S-SS/PSBCH patterns table
Opens a dialog to configure the power and antenna port mapping of the S-SS/PSBCH pattern.

These settings are the same as for the SS/PBCH in the downlink. For more information, see "Power/Antenna Ports Config" on page 80.

State ← S-SS/PSBCH patterns table
Turns the transmission of S-SS/PSBCH on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:STATe` on page 640

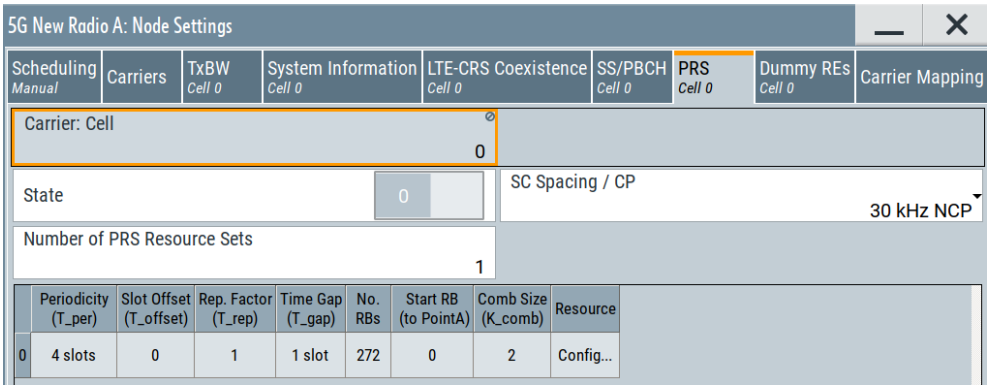
5.2.9 PRS settings

Option: R&S SMW-K148

Access:

► **PRS** settings for downlink:

a) Select "5G New Radio > General > Link Direction > Downlink".
b) Select "5G New Radio > General > Node > PRS".



This dialog comprises the PRS (positioning reference signal) settings for downlink.

Settings:

Cell

Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

State
Enables/disables the DL PRS positioning frequency layer for the given carrier cell.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:STATe` on page 658

SC Spacing / CP
Sets a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP) for the DL PRS frequency layer.

The available values depend on the numerology of the set Deployment.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:SCSPacing` on page 658

Number of PRS Resource Sets
Sets the number of resource sets included in the DL PRS frequency layer.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:NRSets` on page 653

PRS Resource Sets Table
Comprises the settings of the PRS resource sets. There is one table row per resource set.

Periodicity (T_per) ← PRS Resource Sets Table
Sets the periodicity of the DL PRS allocation in slots for the resource set.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:PER` on page 654

Slot Offset (T_offset) ← PRS Resource Sets Table
Sets a slot offset for the resource set with respect to SFN0 slot 0.

The maximum value is defined by Periodicity (T_per) - 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:SLOffset` on page 657

Repetition Factor (T_rep) ← PRS Resource Sets Table
Sets the number of repetitions of each resource within the resource set.

The set value is applied to all resources in a resource set.

The default value "1" means no resource repetition.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:REPFactor` on page 654

Time Gap (T_gap) ← PRS Resource Sets Table
Sets an offset in slots between two resources with the same resource ID within a resource set.

The time gap should not exceed the Periodicity (T_per).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:TGAP` on page 658

No. RBs ← PRS Resource Sets Table
Sets the number of resource blocks (RBs) for all resources in the resource set in multiples of 4 RBs.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RBNumber` on page 654

Start RB (to point A) ← PRS Resource Sets Table
Sets the starting RB index of the resource set with respect to the reference point A.

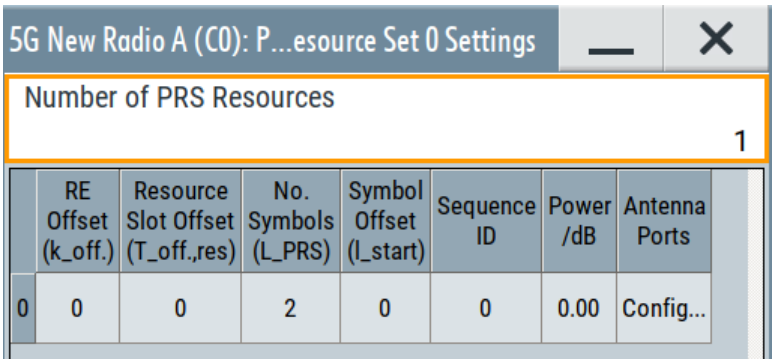
The point A is defined as the absolute frequency of the reference resource block.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RBSTart` on page 654

Comb Size (K_comb) ← PRS Resource Sets Table
Sets the resource element (RE) spacing in each symbol of a resource within a resource set.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:CMBSize` on page 653

Resource Config ← PRS Resource Sets Table
Opens a dialog comprising the settings of the PRS resources. There is one table row per resource.



Number of PRS Resources ← Resource Config ← PRS Resource Sets Table
Sets the number of resources included in the resource set.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:NRESources` on page 653

Resources Table ← Resource Config ← PRS Resource Sets Table
Comprises the settings of the PRS resources. There is one table row per resource.

RE Offset (k_off.) ← Resources Table ← Resource Config ← PRS Resource Sets Table
Sets the resource element (RE) offset in the frequency domain for the first symbol in a resource.

The maximum value is defined by Comb Size (K_comb) - 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:REOFfset` on page 656

Resource Slot Offset (k_off.,res) ← Resources Table ← Resource Config ← PRS Resource Sets Table
Set the starting slot of the resource with respect to the corresponding resource set Slot Offset (T_offset).

The maximum value is defined by Periodicity (T_per) - 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SLOFfset` on page 656

No. Symbols (L_PRS) ← Resources Table ← Resource Config ← PRS Resource Sets Table
Sets the number of symbols of the resource within a slot.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:NSYMbol` on page 656

Symbol Offset (l_start) ← Resources Table ← Resource Config ← PRS Resource Sets Table
Sets the starting symbol of the resource within a slot.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SYOFfset` on page 657

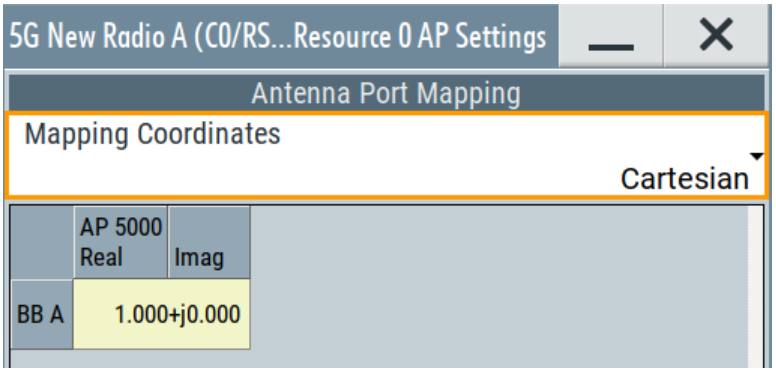
Sequence ID ← Resources Table ← Resource Config ← PRS Resource Sets Table
Sets the resource ID to initialize the c_{init} value for the generation of the DL PRS sequence.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SQID` on page 657

Power / dB ← Resources Table ← Resource Config ← PRS Resource Sets Table
Sets the resource average EPRE (energy per resource element) used for PRS transmission.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:POWer` on page 656

Antenna Ports Config ← Resources Table ← Resource Config ← PRS Resource Sets Table
Opens a dialog comprising the resource antenna port settings.



For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Mapping Coordinates ← Antenna Ports Config ← Resources Table ← Resource Config ← PRS Resource Sets Table
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping table ← Antenna Ports Config ← Resources Table ← Resource Config ← PRS Resource Sets Table
The mapping table is a matrix with number of rows equal to the number of physical Tx antennas (basebands) and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration. The yellow matrix elements in the mapping table indicate the default antenna port to physical antenna (TX antenna/baseband) mapping.

The number of rows depends on the selected "System Configuration".

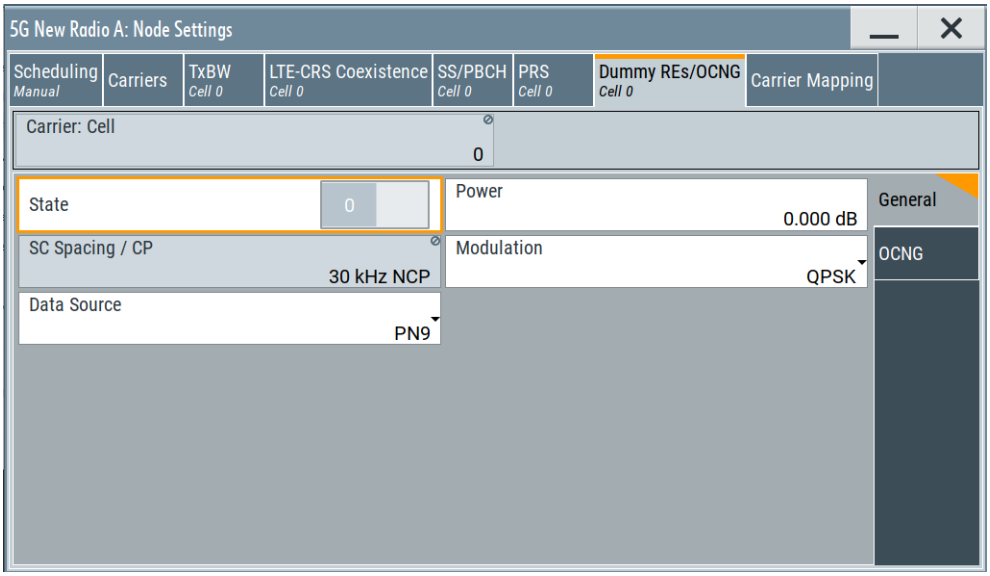
For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:REAL` on page 655
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:IMAGinary` on page 655
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:MAGNitude` on page 655
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:PHASe` on page 655

5.2.10 Dummy REs settings

Access:

► Select "5G New Radio > General > Node > Dummy REs/OCNG > General".



With the provided settings, you define if and what is transmitted in the resource elements that are not allocated.
The dummy REs are the allocations with the lowest priority. They do not include DMRS or PTRS.

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

State
If enabled, the resource elements (RE) are filled in with dummy data, modulated and formatted as selected with the settings in the "Dummy REs" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:STATe` on page 659

Power
Sets the power of the resource elements filled in with dummy data. The value is set relative to the power of the other resource elements.

See also Chapter 6.6, "Output settings", on page 322.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:POWer` on page 659

SC Spacing/CP
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:SCSPacing` on page 659

Modulation
Sets the modulation scheme for the dummy REs.

Note: “60 kHz ECP" is supported by the existing parameters "Dummy REs", for "DL-BWPs" and for "UL-BWPs".
Interdependency: The preset value from I1 is from 11 to 10 for extended cyclic prefix.

3GPP release 17 introduces 1024QAM modulation which requires R&S SMW-K171.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:MODulation` on page 659

Transform Precoding
In uplink, enables using the optional DFT-S scheme.

If disabled, both DL and UL use the CP-OFDM.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:TPSTate` on page 660

Data Source
Selects the data source for the dummy REs.

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.

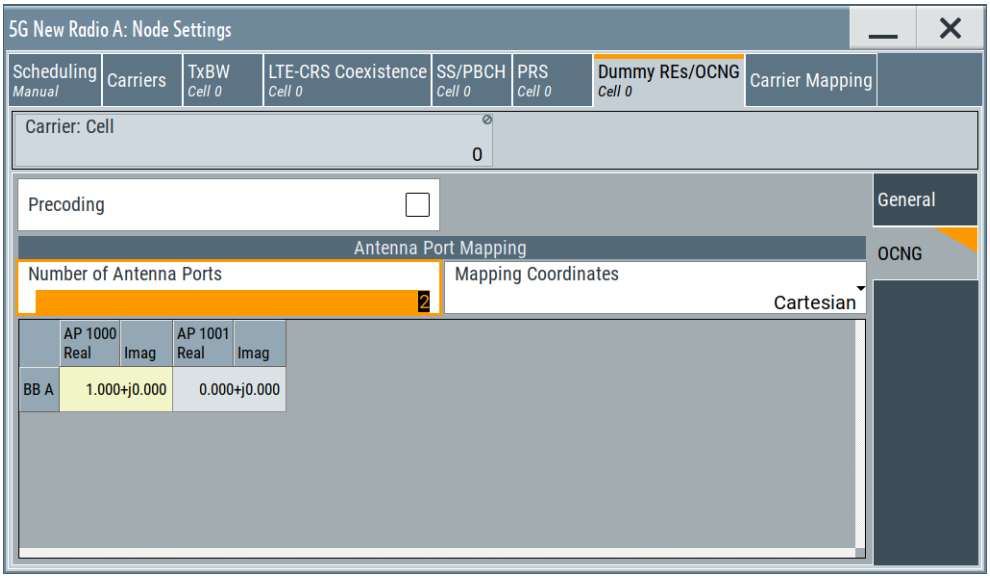
See also:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:DATA` on page 660
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:DLISt` on page 660
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:PATTern` on page 661

5.2.11 OCNG settings

Access:

► Select "5G New Radio > General > Node > Dummy REs/OCNG > OCNG".



With the provided settings, you define the spatial multiplexing characteristics for a OCNG pattern for all unused resource elements. Using these settings, you can configure OCNG patterns according to 3GPP 38.521 A.5.

Settings:

Precoding
Turns precoding for unused resource elements on and off.

The dimensions of the precoding matrix for OCNG depends on the system configuration and the number of the antenna ports.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:PREC:STATe` on page 664

Number of Antenna Ports
Selects the number of antenna ports the unused resource elements are mapped to. Depending on the number of antenna ports, the number of columns in the mapping tablr changes (one column represents one antenna port).

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:NAPS` on page 663

Mapping Coordinates
Selects the method to define mapping coordinates.

Switches representation between the "Cartesian" (Real/Imag) and Cylindrical" (Magn./Phase) coordinates.

Cartesian Coordinates defined by real and imaginary value pair.

Cylindrical Coordinates defined by magnitude and phase value pair.

Remote command:
n/a

Mapping Table
Defines the mapping of the antenna ports (AP) to the physical antennas.

Each row corresponds to a physical antenna. Each column corresponds to an antenna port.

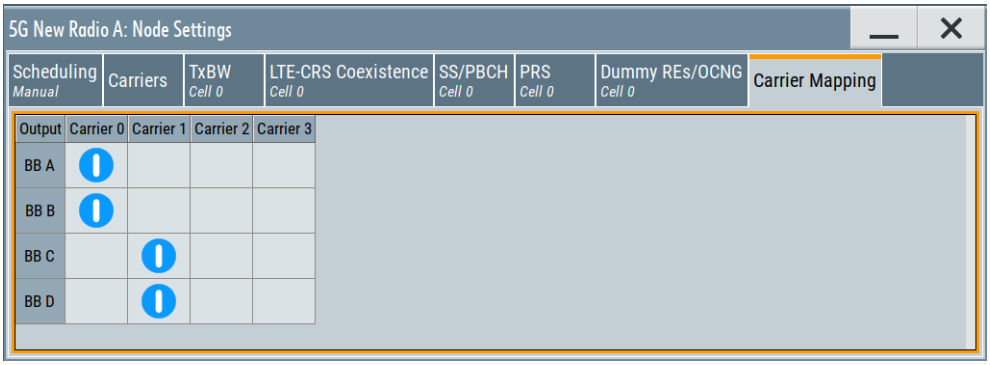
The type of values you can enter, depends on the value type you have selected.

Remote command:
Real value: `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:REAL` on page 663
Imaginary value: `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:IMAGinary` on page 661
Magnitude: `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:MAGNidute` on page 662
Phase: `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:PHASe` on page 662

5.2.12 Carrier-mapping settings

Access:

► Select "5G New Radio > General > Node > Carrier Mapping".



This dialog defines the carrier to basebands (baseband block outputs) mapping, where basebands are the number of output signals from the baseband bock.

Settings:

Output
Indicates the baseband (BB) output.

The number of the outputs at the baseband block depends on the selected "System Configuration", in particular on whether coupled sources are used.

Remote command:
via suffix at `ROW<ch0>`

Carrier
Maps the carriers to the baseband outputs by an on / off logic.

This makes it possible to map multiple carriers to a single baseband.

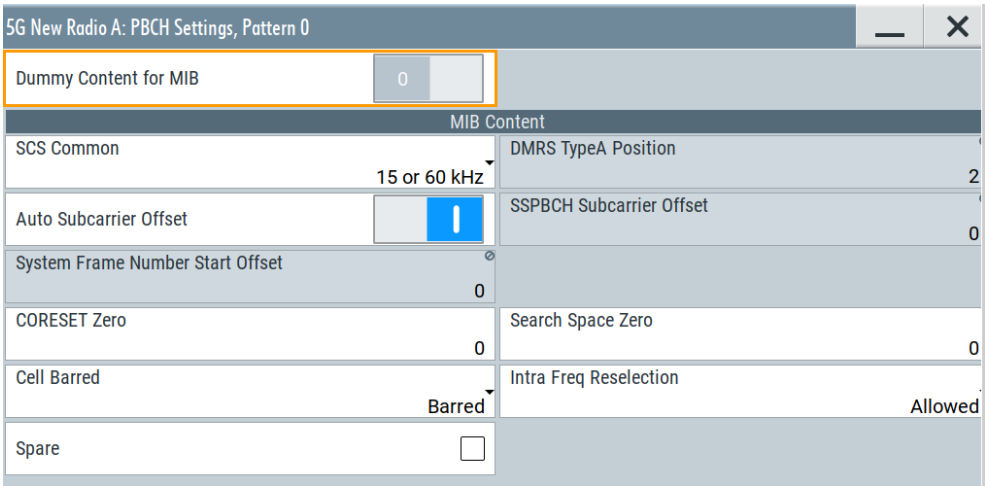
Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`
on page 664

5.2.13 PBCH settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > General > Node > SS/PBCH".

3. Select "Node > SS/PBCH > SS/PBCH Pattern Table > Pattern# > PBCH > Config".



This dialog comprises the settings of the broadcast channel (PBCH) channel coding settings.

Settings:

Dummy Content for MIB

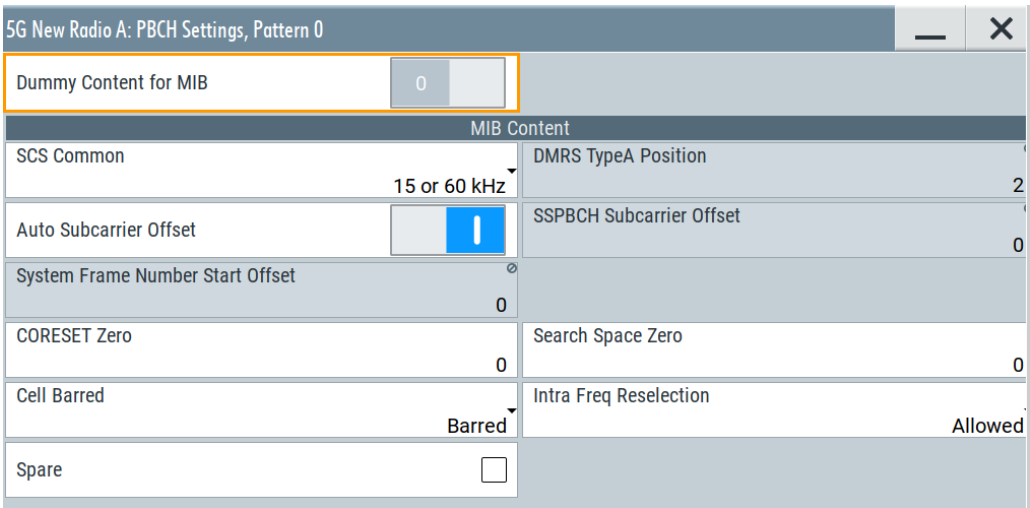
Defines how the MIB is defined:

"On" Faster way to define the MIB.
You can define if channel coding is used or not and select an arbitrary data source; further settings are not required.
See "Dummy Content Settings" on page 96.

"Off" Disable this parameter if you wish to configure the MIB content according to TS 38.331.
See "MIB Content" on page 97.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:STATe`
on page 647

Dummy Content Settings
Available for "Dummy Content for MIB > On".



Channel Coding ← Dummy Content Settings
Enables PBCH channel coding.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:STATe`
on page 646

Transport Block Size ← Dummy Content Settings
Indicates the transport block size.

Data Source ← Dummy Content Settings
Selects the PBCH data source.

The following standard data sources are available:

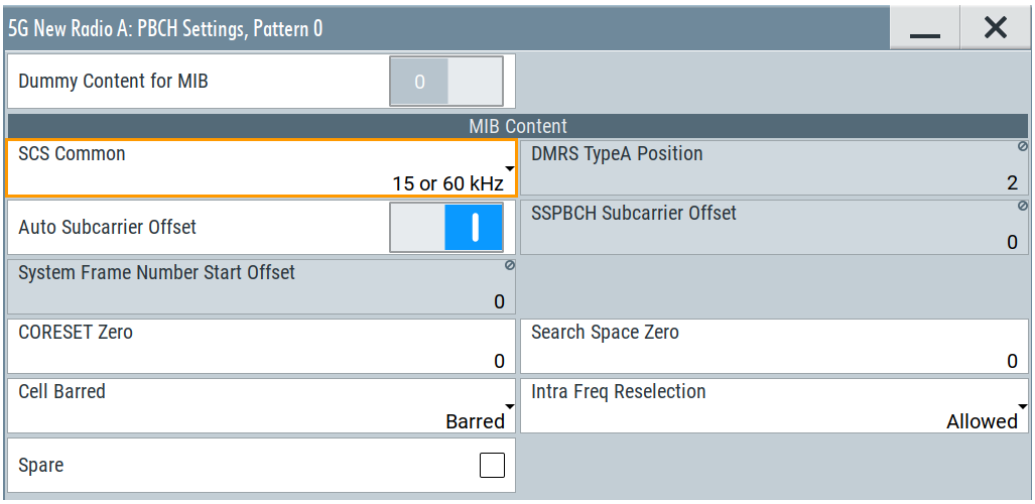
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  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:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:DATA`
on page 646
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:DLISt`
on page 646
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:PATTern`
on page 647

MIB Content
If "Dummy Content for MIB > Off", comprises the setting to configure the MIB as defined in the 3GPP specification.



SCS Common ← MIB Content
Selects the common SCS (subcarrier spacing).

The selected SCS defines the default SSPBCH subcarrier offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SCSC`
on page 647

DMRS Type A Position ← MIB Content
Indicates the first symbol that the DMRS uses, as set with the parameter "Node > Carriers" > DMRS Type A Position.

Auto Subcarrier Offset ← MIB Content
Defines if the "SSPBCH Subcarrier Offset" value is derived from the selected SCS Common or set manually with SSPBCH Subcarrier Offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:ASOF:STATe`
on page 648

SSPBCH Subcarrier Offset ← MIB Content
Indicates or sets the SS/PBCH subcarrier offset:

- If Auto Subcarrier Offset = "On", the "SSPBCH Subcarrier Offset" is calculated automatically based on the selected "Node > SS/PBCH" > SC Offset/SC Offset (15 kHz SCS)/SC Offset (60 kHz SCS).
- If Auto Subcarrier Offset = "Off", the SSPBCH subcarrier offset is user-definable.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SCOFfset`
on page 648

System Frame Number Start Offset ← MIB Content
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:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SFOFfset?`
on page 648

CORESET Zero ← MIB Content
Sets the common control resource set (CORESET) of the initial downlink BWP `controlResourceSetZero` carried by the `PDCCH-ConfigSIB1` information element, as defined in TS 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:CSZero`
on page 648

Search Space Zero ← MIB Content
Sets the common search space of the initial downlink BWP `searchSpaceZero` carried by the `PDCCH-ConfigSIB1` information element, as defined in TS 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SSZero`
on page 649

Cell Barred ← MIB Content
Cell barring (cellBarred) is system information that indicates if UEs can camp on the particular cell notBarred or not barred.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:CBARred`
on page 649

Intra Freq Reselection ← MIB Content
Sets the value of the system information parameter intraFreqReselection.

Set "Intra Freq Reselection > Allowed" to allow UEs to perform cell reselection to intra-frequency cells.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:IFRResel`
on page 649

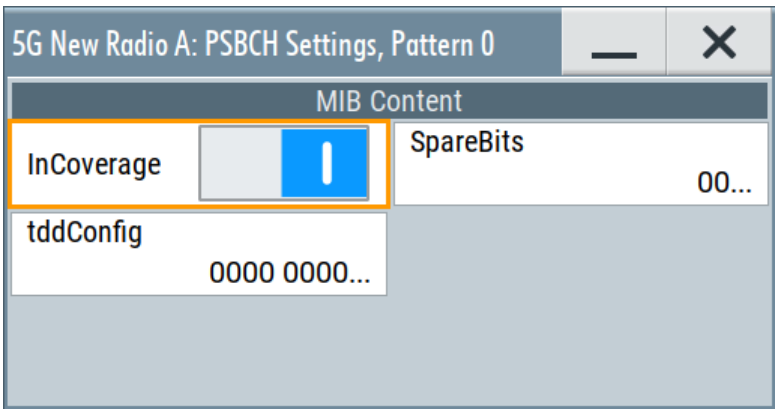
Spare ← MIB Content
Sets the system information bit spare, as defined in TS 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SPARe:STATe`
on page 649

5.2.14 PSBCH settings

Access:

1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "5G New Radio > General > Node > S-SS/PSBCH".
3. Select "Node > S-SS/PSBCH > S-SS/PSBCH Pattern Table > Pattern# > PSBCH > Config".



This dialog comprises the settings of the broadcast channel (PSBCH) channel coding settings. The settings correspond to `MasterInformationBlockSidelink` message definitions defined in 3GPP 38.331, chapter 6.6.2.

Settings:

InCoverage
Turns the higher layer parameter `InCoverage` on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:INCoverage`
on page 651

SpareBits
Defines the bit pattern for the higher layer parameter `reservedBits-r16`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:SBITs`
on page 651

tddConfig
Defines the bit pattern for the higher layer parameter `sl-TDD-Config-r16`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:TDDConf`
on page 652

5.3 Users / BWPs settings

Access:

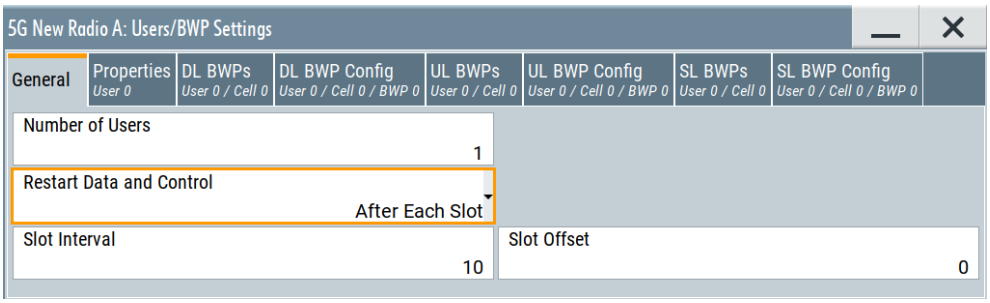
► Select "Baseband > 5G NR > Users/BWPs".

Settings:

5.3.1 General settings

Access:

► Select "5G New Radio > General > Users/BWPs > General".



In this tab, you define the number of users to be simulated.

Settings:

Number of Users

Option: R&S SMW-K148 supports up to 200 users.

Sets the number of simulated users.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:NUSer` on page 666

Restart Data and Control

Enables you to select an option for restarting the configured data sources in customized DCIs.

Off
Disables the restart of data and control. Data sources are initialized only once at the start of the generated signal.
This value is set by default.

After Each Codeword and Allocation
Enables the restart of data and control after each codeword and allocation. For example, the same payload is used for repeated allocations.

After Each Frame
Enables the restart of data and control after each frame. For example, the same payload is used for allocations which are repeated each frame.

After Each Slot
Enables the restart of data and control after each slot. For example, the same payload is used for allocations which are repeated each slot.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:RESTart` on page 672

Slot Interval

Defines the number of slots after which the data source restarts (restart every <x> slots).

Available for:

- Single numerology setups
- Restart Data and Control= "After Each Slot"

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:SINTerval` on page 667

Slot Offset

Defines an offset in terms of slots for the restart of the data source.

If you define a slot offset, the data source does not restart in the first <x> slots.

Available for:
- Single numerology setups
- Restart data and control = "After Each Slot"
- Slot interval > 1

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:SOFFset` on page 667

Restart Slot Index
Turns a restart of the slot index within a frame on and off.

"Off" No custom restart of the slot index within a frame.

"On" Slot index within a frame restarts in the defined interval.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:STATe` on page 666

Slot Interval
Defines the number of slots after which the slot index within a frame restarts (restart every <x> slots).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:INTerval` on page 666

5.3.2 DL and UL user properties settings

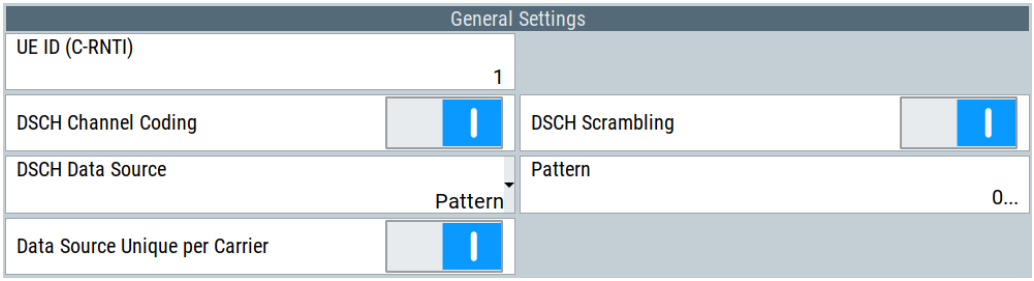
Access:

1. Select "5G New Radio > General > Link Direction > Uplink" or "Downlink".
2. Select "5G New Radio > General > Users/BWPs > Properties".

Settings:

5.3.2.1 General settings

The general settings section of the user properties contain settings to configure general properties of the selected user.



User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

UE ID (C-RNTI)
Sets the RNTI of the user. It is a unique UE identifier for the RRC connection and for scheduling.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:UEID` on page 676

Use ORAN Data Source
Requires Option: R&S SMW-K175

Turns usage of the PxSCH data source according to the ORAN standard on and off.

"Off" Select a data source as required.

"On" Automatically selects a data source that complies to the ORAN standard and adjusts the following settings according to the settings specified in the selected ORAN test case.

- State of xSCH scrambling
- Type of PxSCH data source
- Initialization value specified in the ORAN standard

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:ORAN:USDS` on page 668

ORAN Test Case
Requires Option: R&S SMW-K175

Selects the ORAN test case for ORAN data generation. Depending on the selected test case, the payload appears in different locations in the signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:ORAN:TC` on page 668

DSCH/USCH Channel Coding

Depending on the selected "Link Direction" direction, enables DSCH/USCH channel coding.

Configure the corresponding settings in "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config" > Channel coding settings dialog.

If PDSCH Scheduling = "Auto/DCI", the "DSCH Channel Coding" = "On".

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CCODing:STATe` on page 676

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:CCODing:STATe` on page 676

DSCH/USCH Scrambling

Depending on the selected "Link Direction" direction, turns PDSCH and PUSCH scrambling on and off.

Turn off scrambling to generate the raw bit pattern of the PDSCH or PUSCH. A pseudo random scrambling sequence is not applied, therefore the settings for the PDSCH scrambling sequence have no effect.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:SCRambling:STATe` on page 677

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:SCRambling:STATe` on page 677

(P)DSCH/(P)USCH Data Source

Depending on the selected "Link Direction", selects the PDSCH/PUSCH data source.

If channel coding is enabled, the parameter sets the DSCH/USCH 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:

- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DATA on page 677
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DLISt on page 677
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PATTern on page 678
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:DATA on page 677
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:DLISt on page 677
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:PATTern on page 678

Initialization
Sets an initialization value for the second m-sequence in the selected PN sequence.

Enabled if "Data Source > PNxx".

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:INITpattern on page 677
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:INITpattern on page 677

Data Source Unique per Carrier
Turns usage of a unique data source for the PxSCH in a multi-carrier scenario on and off.

"On" Uses a unique data source for each carrier.

"Off" Uses the the same data source for all carriers.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSPC:STATe on page 668

Unique Data Source for PUSCH UCI
Available in uplink only.

Turns selection of a unique data source of the PUSCH UCI on and off.

"On" Define the PUCCH payload manually for each scheduled allocation using the UCI settings.

"Off" Select a single data source applied to all scheduled allocations.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DSUNique on page 671

PUSCH UCI Data Source
Available in uplink only.

Selects the data source of the PUSCH UCI.

For an overview of available data sources, see "(P)DSCH/(P)USCH Data Source" on page 104. They are the same for the PUSCH UCI.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA on page 670

Initialization / Pattern / Data List
Available in uplink only.

The contents of this field depends on the selected data source.

- "Initialization": For data source = "PN<x>"

Sets an initialization value for the second m-sequence in the selected PN sequence.

- "Pattern": For data source = "Pattern"
  Defines the bit pattern the sequence is based on.
- "Data List": For data source = "Data List"
  Opens a dialog to select a file that contains a data list (`.dm_iqd` file format).

Remote command:
Initialization: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:INITpattern` on page 671
Bit pattern: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:PATTern` on page 671
File: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DLISt` on page 671

Unique Data Source for PUCCH Payload
Available in uplink only.

Turns selection of a unique data source of the PUCCH payload on and off.

"On"	Define the PUCCH payload manually for each scheduled allocation using the UCI settings.
"Off"	Select a single data source applied to all scheduled allocations.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DSUNique` on page 669

PUCCH Payload Data Source
Available in uplink only.

Selects the data source of the PUCCH payload.

For an overview of available data sources, see "(P)DSCH/(P)USCH Data Source" on page 104. They are the same for the PUCCH payload.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA` on page 668

Initialization / Pattern / Data List
Available in uplink only.

The contents of this field depends on the selected data source.

- "Initialization": For data source = "PN<x>"
  Sets an initialization value for the second m-sequence in the selected PN sequence.
- "Pattern": For data source = "Pattern"
  Defines the bit pattern the sequence is based on.
- "Data List": For data source = "Data List"
  Opens a dialog to select a file that contains a data list (`.dm_iqd` file format).

Remote command:
Initialization: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:INITpattern` on page 669
Bit pattern: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:PATTern` on page 670
File: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DLISt` on page 669

5.3.2.2 Control settings

The control settings section of the user properties contain settings related to DCI configuration.

Available when "Simple Mode" = "Off".

Control	
SCell Groups within Active Time 0	PDSCH Harq-Ack-One-Shot-Feedback-R16 ☐
Ack-Nack-Feedback-Mode Not Configured	NFI-TotalDAI-Included ☐
UL-TotalDAI-Included ☐	Downlink Assignment Index DCI0_2 ☐
Bits for Sidelink Assignment Index 0	PUCCH-sSCellDyn DCI1_1 ☐
HARQ-ACK Retransmission Indicator DCI1_1 ☐	Available RB Set Indicators in DCI2_0 0
Available RB Set Indicator Size DCI2_0 1	COT Duration Indicators in DCI2_0 0
COT Duration Indicator Size DCI2_0	Search Space Switching Flags in DCI2_0

SCell Groups Within Active Time
Defines the number of SCell group for dormancy within active time. This parameter represents the width of the "SCell Dormancy Indication" DCI field in DCI Format 1_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:SCGW` on page 678

PDSCH Harq-Ack-One-Shot-Feedback-R16
Turns the "One-Shot HARQ-ACK Request" DCI field in DCI format 1_1 on and off.

Corresponds to higher layer parameter `pdsch-HARQ-ACK-OneShotFeedback` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PH1F` on page 678

Ack-Nack-Feedback-Mode
Configures the higher layer parameter `ackNackFeedbackMode` as defined in 3GPP 38.331.

This parameter has an effect on the DCI field "Downlink Assignment Index" in DCI format 1_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:ANFMode` on page 678

NFI-TotalDAI-Included
Option: R&S SMW-K148

Configures the higher layer parameter `nfi-TotalDAIIncluded` as defined in 3GPP 38.331.

This parameter has an effecton DCI fields "Downlink Assignment Index" and "New Feedback Indicator" in DCI Format 1_1 as defined in 3GPP 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DAIT` on page 679

UL-TotalDai-Included
Option: R&S SMW-K148

Configures the higher layer parameter `ul-TotalDAI-Included` as defined in 3GPP 38.331.

This parameter has an effecton DCI fields "First Downlink Assignment Index" in DCI Format 0_1 as defined in 3GPP 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DAUL` on page 679

Downlink Assignment Index 0_2
Option: R&S SMW-K148

Turns the 1st and 2nd "Downlink Assignment Index" fields in DCI format 0_2 on and off.

Corresponds to higher layer parameter `downlinkAssignmentIndexDCI-0-2`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DA02` on page 679

Bits for Sidelink Assignment Index
Option: R&S SMW-K171

Turns the "Sidelink Assignment Index" field in DCI format 0_1 and 3_0 on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:NSAS` on page 681

PUCCH-sSCellDyn DCI1_1
Option: R&S SMW-K171

Turns the "PUCCH Cell Indicator" field available in DCI format 1_1 on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PSSCdyn` on page 680

HARQ-ACK Retransmission Indicator DCI1_1
Option: R&S SMW-K171

Turns the "HARQ-ACK Retransmission Indicator" field available in DCI format 1_1 on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:HARTind` on page 679

Available RB Set Indicators DCI2_0
Defines the number of the "Available RB Set Indicators" fields in DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NRBS` on page 680

Available RB Set Indicator Size DCI2_0
Defines the size of the "Available RB Set Indicator" field in DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:RBIS` on page 680

COT Duration Indicators DCI2_0
Defines the number of the "COT Duration Indicators" fields in DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CDIN` on page 680

COT Duration Indicator Size DCI2_0
Defines the size of the "COT Duration Indicator" field in DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CODS` on page 680

Search Space Switching Flags DCI2_0
Defines the number of the "Search Space Switching Flags" fields in DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NSSF` on page 681

CS-RNTI
Sets the CS-RNTI of the user. It is a unique UE identification used for semi-persistent scheduling in the downlink.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:CS` on page 672

MCS-C-RNTI
Sets the MCS-C-RNTI of the user. It is a unique UE identification used for modulation coding scheme in the downlink.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MCSC` on page 673

SP-CSI-RNTI
Sets the SP-CSI-RNTI of the user. It is a unique UE identification used for semi-persistent CSI reporting on PUSCH.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SPCSi` on page 675

SFI-RNTI
Sets the SFI-RNTI of the user. It is used to identify the slot format.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SFI` on page 674

SFIs in DCI 2_0
Sets how many slot format indicator (SFI) fields are transmitted in the DCI format 2_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:NUMSfi` on page 676

RA-RNTI
Sets the RA-RNTI of the user. It is an identifier for the random access response in the downlink during the random access procedure.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:RA` on page 674

TC-RNTI
Sets the TC-RNTI of the user. It is a unique UE identifier for the RRC connection and for scheduling with a temporary cell.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:TC` on page 675

MsgB-RNTI
Sets the MsgB-RNTI of the user. It is a unique UE identifier for the RRC connection and for scheduling with a temporary cell.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MSGB` on page 674

SL-RNTI
Sets the SL-RNTI of the user. It is an identifier for dynamically scheduled sidelink transmission.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SL` on page 675

SL-CS-RNTI
Sets the SL-RNTI of the user. It is an identifier for dynamically scheduled sidelink transmission.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SLCS` on page 675

V-RNTI
Sets the SL-RNTI of the user. It is an identifier for dynamically scheduled V2X transmission.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:V` on page 676

PEI-RNTI
Sets the PEI-RNTI of the user. It is an identifier for paging early indication.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:PEI` on page 674

MCCH-RNTI
Sets the MCCH-RNTI of the user. It is an identifier for dynamically scheduled MCCH signalling and MCCH change notification.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MCCH` on page 673

G-RNTI
Sets the G-RNTI of the user. It is an identifier for dynamically scheduled MBS PTM transmission.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:G` on page 673

G-CS-RNTI
Sets the G-CS-RNTI of the user. It is an identifier for configured scheduled multicast transmission.

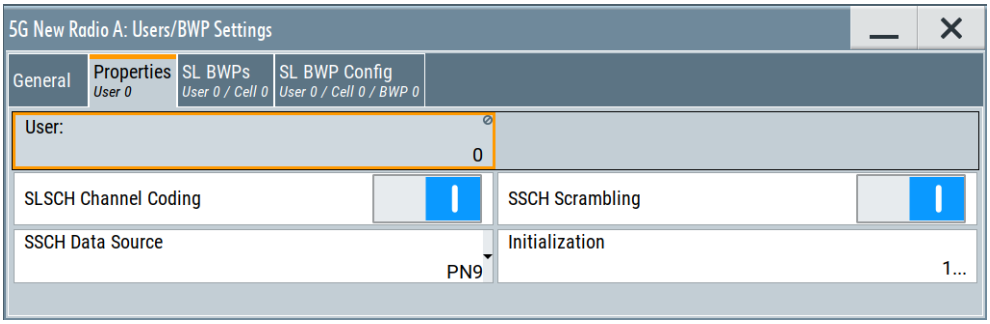
See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:GCS` on page 673

5.3.3 SL user properties settings

Access:

1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "5G New Radio > General > Users/BWPs > Properties".



This dialog comprises the user-specific general settings.

Settings:

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

SSCH Channel Coding
Turns PSSCH channel coding on and off.

Configure the corresponding settings in "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config" > Channel coding settings dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe` on page 681

SSCH Scrambling
Turns PSSCH scrambling on and off.

Turn off scrambling to generate the raw bit pattern of the PSSCH. A pseudo random scrambling sequence is not applied in that case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:SCRambling:STATe` on page 683

SSCH Data Source
Selects the PSSCH data source.

If channel coding is enabled, the parameter sets the SSCH data source.

PSSCH data sources are the same as PDSCH data sources. For more information about the PSSCH data sources, see "(P)DSCH/(P)USCH Data Source" on page 104.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DATA` on page 682
Bit pattern definition:
Data list selection: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DLISt` on page 682

Initialization
Sets an initialization value for the second m-sequence in the selected PN sequence.

Enabled if "Data Source > PNxx".

For more information about data sources, see "(P)DSCH/(P)USCH Data Source" on page 104.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:INITpattern` on page 682

Pattern
Opens an input field to define a bit pattern.

Enabled if "Data Source > Pattern".

For more information about data sources, see "(P)DSCH/(P)USCH Data Source" on page 104.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:INITpattern` on page 682

Data List
Opens a dialog box to select a file containing the data list ().

Enabled if "Data Source > Data List".

For more information about data sources, see "(P)DSCH/(P)USCH Data Source" on page 104.

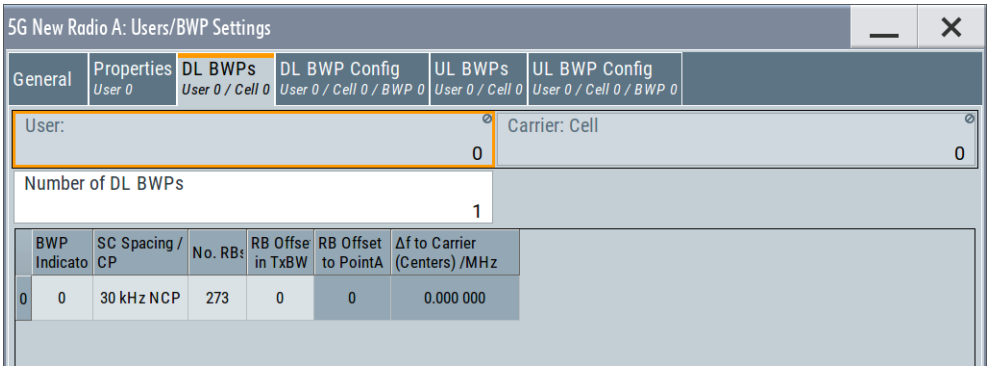
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:INITpattern` on page 682

Data Source Unique per Carrier
See "Data Source Unique per Carrier" on page 105 for details.

5.3.4 DL/UL BWPs settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "General > Users/BWPs" > "DL BWPs".



The dialog comprises the settings for the DL/UL bandwidth parts (BWP) configuration. The UL BWPs dialog is displayed for DL and UL direction, whereas the DL BWP - only for DL direction.

For each user and carrier combination, you can configure one or more BWPs. You can configure BWPs in the bandwidth part configuration table. This table consists of several rows, each of which corresponds to a BWP. The size of the table therefore depends on the number of BWPs you have selected.

Each BWP is indicated by a BWP indicator. The bandwidth of the BWP depends on the number of RBs it occupies. Its allocation in the frequency, on the selected RB offset. The resulting frequency offset between the BWP center and the center of the carrier is indicated, too.

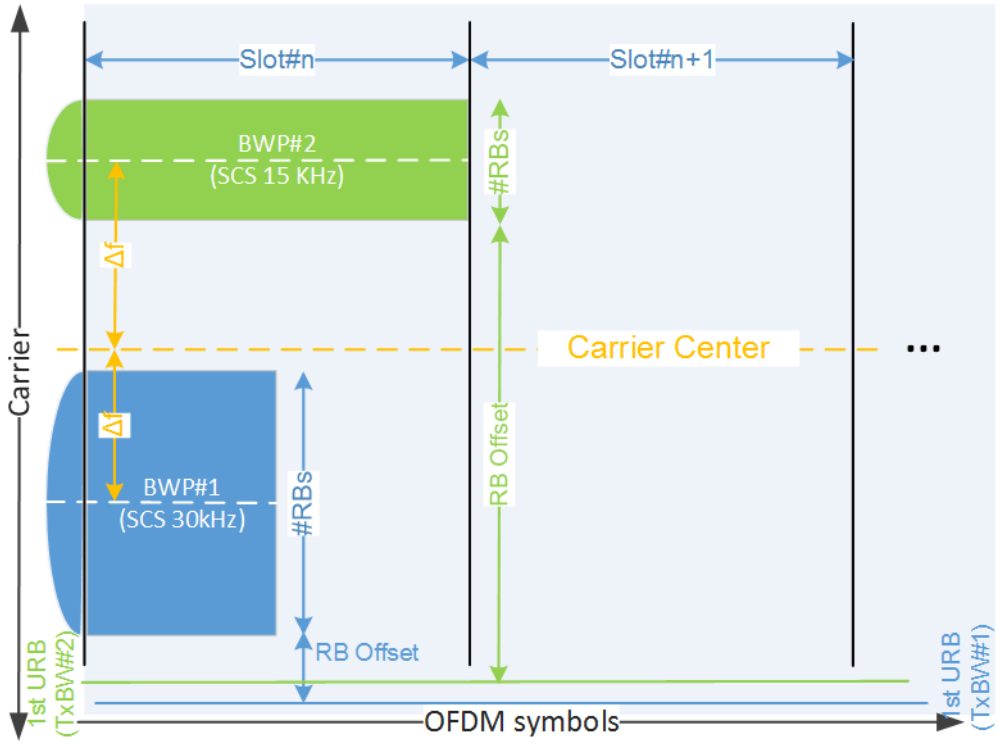


Figure 5-6: Bandwidth parts

BWP#	= Bandwidth part and indicator
SCS	= Subcarrier spacing
Center carrier	= Center frequency of the carrier (cell)
#RB	= Number of resource blocks or channel bandwidth per BWP
RB offset	= Frequency offset between the first usable resource block (URB) and the start of the BWP
1st URB	= First usable resource block (URB), that is the first RB within the transmission bandwidth TxBW, see Figure 2-2
Δf	= Frequency offset between the center frequency of the BWP and the center frequency of the carrier
Carrier	= Channel bandwidth of the carrier
OFDM symbol	= Represent the time domain

Settings:

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Number of DL/UL BWPs
Sets the number of downlink bandwidth parts (BWP).

There is one table row per enabled DL/UL BWP.

See also:
- Figure 5-6
- Chapter 7, "Observing current allocations on the time plan", on page 339.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:NBWParts` on page 684
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:NBWParts` on page 684

BWPs table
Comprises the BWPs settings.

There is one table row per enabled DL/UL BWP, see "Number of DL/UL BWPs" on page 116.

BWP Indicator ← BWPs table
Sets the unique indicator for the selected BWP, used to address the BWP within the DCI.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:INDicator` on page 684
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:INDicator` on page 684

SC Spacing/CP ← BWPs table
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Note: The possible values for SC spacing depend on the selected "Node" > "TxBW" values.

Note: “60 kHz ECP" is supported by the existing parameters "Dummy REs", for "DL-BWPs" and for "UL-BWPs".
Interdependency: The preset value from I1 is changed from 11 to 10 for extended cyclic prefix.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SCSPacing` on page 686
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SCSPacing` on page 686

No. RBs ← BWPs table
Defines the number of resource blocks (RB) the bandwidth part (BWP) occupies. This value defines the frequency width of the BWP.

The number of available RBs (N_{RB}) depends on the SC Spacing/CP and Channel Bandwidth, where the latter depends on the selected deployment.

The number of available RBs is updated whenever the SCS or channel bandwidth is changed. The selected value is the maximum number of RB for the combination of SCS and channel bandwidth.

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RBNumber` on page 688
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:RBNumber` on page 688

RB Offset in TxBW ← BWPs table
Defines the offset between the first resource block in the BWP relative to the first usable resource blocks (URB).

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RBOFfset` on page 688
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:RBOFfset` on page 688

RB Offset to Point A ← BWPs table
Indicates the frequency starting position of the BWP relative to the point A, calculated as follows:

"RB Offset to Point A" = RB Offset in TxBW + TxBW Offset

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PRBoffset?` on page 689
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PRBoffset?` on page 689

Δf to Carrier (Centers) /MHz ← BWPs table
Indicates the frequency offset between the BWP center and the center frequency of the carrier; it thus defines the BWP position in the frequency domain.

The value is calculated automatically, based on the selected SCS, channel bandwidth, deployment method, number of RBs and RB offset.

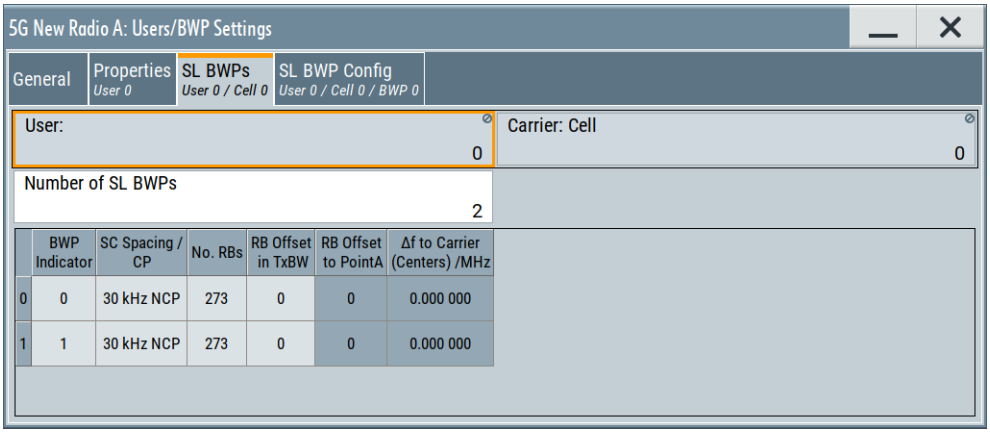
See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DFReq?` on page 689
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:DFReq?` on page 689

5.3.5 SL BWPs settings

Access:

1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "General > Users/BWPs" > "SL BWPs".



The dialog comprises the settings for the SL bandwidth parts (BWP) configuration. For more information about bandwidth parts in general, see Chapter 5.3.4, "DL/UL BWPs settings", on page 114.

Settings:

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Number of SL BWPs
Sets the number of sidelink bandwidth parts (BWP).

There is one table row per enabled BWP.

See also:
- Figure 5-6
- Chapter 7, "Observing current allocations on the time plan", on page 339.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:NBWParts` on page 691

BWPs table
Contains the BWPs settings.

There is one table row per enabled SL BWP, see "Number of SL BWPs" on page 119.

BWP Indicator ← BWPs table
Sets the unique indicator for the selected BWP, used to address the BWP within the SCI.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:INDicator` on page 690

SC Spacing/CP ← BWPs table
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Note: The possible values for SC spacing depend on the selected "Node" > "TxBW" values.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:SCSPacing` on page 691

No. RBs ← BWPs table
Defines the number of resource blocks (RB) the bandwidth part (BWP) occupies. This value defines the frequency width of the BWP.

The number of available RBs (N_{RB}) depends on the SC Spacing/CP and Channel Bandwidth, where the latter depends on the selected deployment.

The number of available RBs is updated whenever the SCS or channel bandwidth is changed. The selected value is the maximum number of RB for the combination of SCS and channel bandwidth.

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RBNumber` on page 691

RB Offset in TxBW ← BWPs table
Defines the offset between the first resource block in the BWP relative to the first usable resource blocks (URB).

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RBOFfset` on page 691

RB Offset to Point A ← BWPs table
Indicates the frequency starting position of the BWP relative to the point A, calculated as follows:

"RB Offset to Point A" = RB Offset in TxBW + TxBW Offset

See also Figure 5-6.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:PAOFfset?` on page 690

Δf to Carrier (Centers) /MHz ← BWPs table
Indicates the frequency offset between the BWP center and the center frequency of the carrier; it thus defines the BWP position in the frequency domain.

The value is calculated automatically, based on the selected SCS, channel bandwidth, deployment method, number of RBs and RB offset.

See also Figure 5-6.

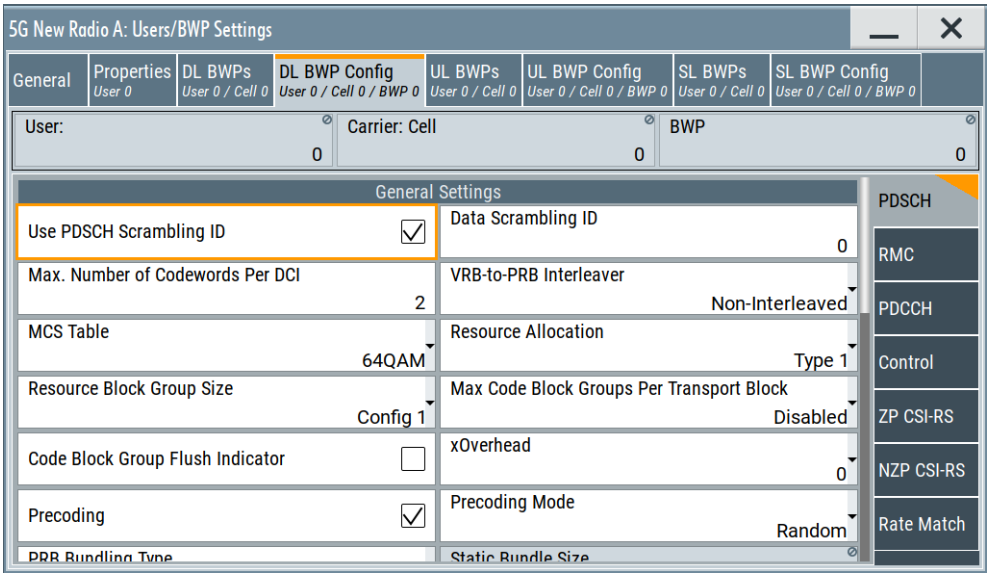
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:DFReq?` on page 690

5.3.6 DL BWP configuration settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".

2. Select "General > Users/BWPs" > "DL BWP Config".



The dialog comprises the settings for the DL bandwidth parts (BWP) configuration.

Settings:

5.3.6.1 User, carrier, BWP settings

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

BWP
Select the bandwidth parts (BWP) whose settings are displayed for configuration.

There are one or more BWPs, as set with the parameter "User/BWP Settings > DL BWPs" > Number of DL/UL BWPs.

Remote command:
via suffix at `BWP<dir0>`

5.3.6.2 PDSCH settings

Access:

► Select "User/BWP Settings > DL BWP Config > PDSCH".

The dialog comprises the DMRS and PTRS settings, divided per DMRS-mapping type A and B, as defined in TS 38.211 and TS 38.214.
For description of the remote-control commands, see Chapter 12.20.1, "PDSCH commands", on page 692.

About PDSCH and DMRS sequence generation

According to TS 38.211, the **PDSCH** sequence is generated based among others on the value of the variable n_{ID}, that can be:

- $n_{ID} = N_{ID}^{cell}$ (i.e. equal to the physical cell identifier) or
- n_{ID} = `dataScramblingIdentityPDSCH` (higher-layer parameter).

In this implementation, you set which of the two variants is used by the parameter Use PDSCH Scrambling ID and the n_{ID} value on both case by the parameters "Node > Carriers" > Cell ID and Data Scrambling ID.

According to TS 38.211, the **DMRS** sequence is generated based among others on the values of the variables N_{ID}^0,N_{ID}^1 and $N_{ID}^{n\_SCID}$ or N_{ID}^0 and $N_{ID}^{n\_SCID}$ with n_SCID = {0, 1}.

Which of these two combinations of variables is used depends on whether the PDSCH is scheduled by PDCCH using DCI format 1_1 or DCI format 1_0.

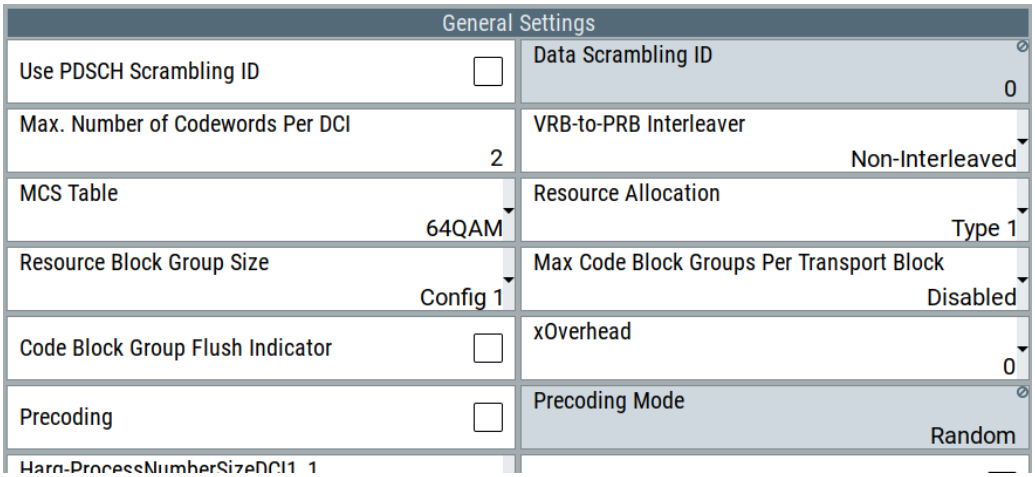
In this implementation, you define the values as follows:

- N_{ID}^0, N_{ID}^1 per DMRS type are set with "User/BWP > DL BWP > PDSCH" > Scrambling ID 0/Scrambling ID 1.
- If N_{ID}^0 **or** N_{ID}^1 is used, is set with "Scheduling > PDSCH > DMRS" > N_SCID.
- If $N_{ID}^{n\_SCID} = N_{ID}^{cell}$ or $N_{ID}^{n\_SCID} = N_{ID}^0$ or N_{ID}^1 is set with "Scheduling > PDSCH > DMRS" > Sequence Generation.
- The DCI Format 1_0 field "DMRS Sequence Initialization".

Settings:

General settings

The general settings section of the PDSCH properties contain settings to configure general properties of the selected user.



Use PDSCH Scrambling ID

Defines the value of the variable n_{ID} used for the initialization of the generator of the PDSCH scrambling sequence.

"Off" $n_{ID} = N_{ID}^{cell}$ (i.e. the physical layer cell identity)

"On" n_{ID} is the values set with the parameter "Data Scrambling ID" on page 124.

See also "About PDSCH and DMRS sequence generation" on page 122.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:SCRambling:STATe` on page 705

Data Scrambling ID
If Use PDSCH Scrambling ID > "On", sets the identifier `dataScramblingIdentityPDSCH` used to initialize data scrambling (c_init) for PDSCH.

The value of this parameter influences the PDSCH allocations.

See also "About PDSCH and DMRS sequence generation" on page 122.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DSID` on page 705

Max. Number of Codewords per DCI
Sets if one or two codewords are transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCWDci` on page 705

VRB-to-PRB Interleaver
As defined in TS 38.211, the virtual resource blocks (VRB) are mapped to the physical resource blocks (PRB) interleaved or non-interleaved.

With this parameter, you set whether the interleaved or non-interleaved mapping is used in general, *for all PDSCH allocations*.

"Non-interleaved"
Sets non-interleaved VRB-to-PRB mapping. The value applies for all PDSCH allocations, also for those allocations configured automatically from DCI format 1_0 or 1_1, if "Node > Scheduling > PDSCH Scheduling = Auto/DCI".
For all PDDCHs scheduled by DCI formats expect the 1_0 format, the VRB number *n* is mapped to PRB number *n*.
For all PDDCHs scheduled by DCI format 1_0 in common search space, the VRB number *n* is mapped to PRB number $n + N_{start}^{CORE-SET}$.

"2", "4"
Set one of these values to enable VRB-to-PRB interleaving in general and define the PRB bundle size, carried by the higher-level parameter `vrb-ToPRB-Interleaved`, defined in TS 38.331.

You can change the *interleaving state per PDSCH* later:
- If "Node > Scheduling > PDSCH Scheduling = Manual", with this parameter.
- If "Node > Scheduling > PDSCH Scheduling = Auto/DCI", for PDSCH created automatically from DCI formats 1_0 and 1_1, with the DCI field VRB-to-PRB Mapping.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:VPINter` on page 708

MCS Table
Sets the MCS table and thus defines the used modulation scheme.

3GPP release 17 introduces the MCS table for 1024QAM modulation on the downlink. Release 17 features require R&S SMW-K171.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCSTable` on page 705

Resource Allocation
Sets the PxSCH resource allocation scheme and defines the allocation in the frequency domain.

Type 0 and dynamic switch are not available when transform precoding is on.

"Type 0", "Type 1"
Selects the downlink resource allocation scheme, according to TS 38.214.

"Dynamic Switch"
- If PDSCH Scheduling > "Auto/DCI":
  UE uses downlink resource allocation type 0 or type 1, as defined by the DCI field "Frequency domain resource assignment".
- If PDSCH Scheduling > "Manual":
  UE uses downlink resource allocation type 0 or type 1, as set with the parameter Resource Allocation.

This parameter defines the **PDSCH** allocation in the frequency domain globally and if you configure the allocations manually.

To configure the PDSCH based on the DCI:
- Set "Node > Scheduling > PDSCH Scheduling = Auto/DCI"
- Enable a DCI format 1_1 ("Scheduling > CORESET > Payload > DCI Format = 1_1") with "Config > Frequency Domain Resource Assignment = 262 143"
  Set "Create PDSCH > On"
- Observe the allocation information for PDSCH ("Scheduling > PDSCH > Info > Content > frequency domain allocation")

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RESalloc` on page 706
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:RESalloc` on page 754

Resource Block Group Size
For Resource Allocation = "Type 0/Dynamic Switch", the resource block assignment is defined in terms of resource block groups (RBG). An RBG is a set of consecutive virtual resource blocks and its size (`rbg-Size`) is defined as function of the BWP size and one of two possible configurations.

This parameter sets which of the two configurations defined in TS 38.214 is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RBGSize` on page 706
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:RBGSize` on page 754

Max Code Block Groups Per Transport Block
Enables limiting the number of code block groups per transport block.

The precoding matrices change according to the precoding granularity (defined per PDSCH allocation) following the PDSCH PRB bundling concept. The precoder chooses the matrices randomly.

Disabled	Default value, which disabled the limitation of code block groups per transport block.
2, 4, 6, 8	Limits the number of code block groups per transport block to 2, 4, 6, or 8.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCBGroups` on page 698
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MCBGroups` on page 750

Code Block Group Flush Indicator
Indicates if the code block group buffer is empty.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:CBGF:STATe` on page 695

xOverhead
Selects the size of the "xOverhead" parameter defined in 3GPP 38.214, chapter 5.1.3.2. The xOverhead parameter is used in RMCs for IAB-MT and determines the transport block size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:XOVerhead` on page 704

Precoding
Enabled or disables precoding.

The precoding matrices change according to the precoding granularity (defined per PDSCH allocation) following the PDSCH PRB bundling concept.

The applied matrices depends on the precoding mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:STATe` on page 704

Precoding Mode
Selects the precoding method.

"Random" The precoder chooses the precoding matrix randomly.

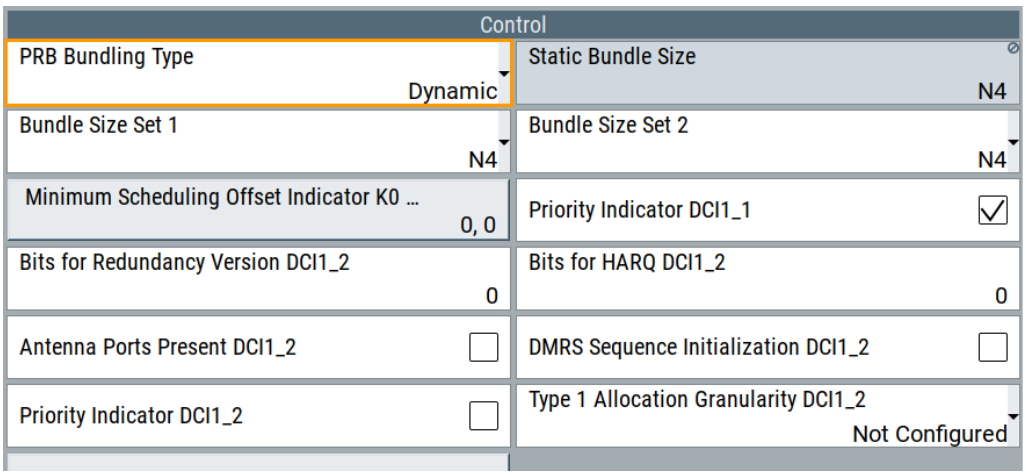
"Codebook" The precoder chooses the precoding matrix from a codebook.
The codebook precoding method automatically changes the precoding granularity to "Wideband".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD` on page 704

Control settings

The control settings section of the PDSCH properties contain settings related to DCI configuration.

Available when "Simple Mode" = "Off".



PRB Bundling Type

Indicates the PRB bundle type and bundle sizes. If "dynamic" is chosen, the actual bundle size set to use is indicated via DCI.

Only available if "Precoding" is enabled.

The PRB bundling type supports the UE to reduce the computational effort to receive the information which PRBs use the same precoding. The UE only has to do channel estimation per PRB bundle not per PRB. Without this information, the UE has to decode all the information itself based on the DMRS.

PRB Bundling Type, Static Bundle Size, Bundle Size Set 1, and Bundle Size Set 2 are RRC parameters relevant only for the Node > Scheduling > PDSCH Scheduling > Auto/DCI mode. For the Manual mode, the precoding granularity for a PDSCH allocation can be set under "Scheduling > Config > Precoding Granularity".

"Not Configured"
PRB bundling is not configured.

"Static" PRB bundling is set to static and can be adjusted by the "Static Bundle Size".

"Dynamic" PRB bundling is set to dynamic and can be adjusted by the "Bundle Size Set 1" and "Bundle Size Set 2".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BTYPe` on page 701

Static Bundle Size

Configures the static PRB bundle type.

Only available if "Precoding" is enabled and "Static" is selected as "PRB Bundling Type".

PRB Bundling Type, Static Bundle Size, Bundle Size Set 1, and Bundle Size Set 2 are RRC parameters relevant only for the Auto/DCI mode. For the Manual mode, the precoding granularity for a PDSCH allocation can be set under "Scheduling > Config > Precoding Granularity".

"N4" Static PRB bundle is set to N4.

"Wideband" Static PRB bundle is set to wideband.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BSIZe` on page 699

Bundle Size Set 1

Configures the dynamic PRB bundle type.

Only available if "Precoding" is enabled and "Dynamic" is selected as "PRB Bundling Type".

PRB Bundling Type, Static Bundle Size, Bundle Size Set 1, and Bundle Size Set 2 are RRC parameters relevant only for the Auto/DCI mode. For the Manual mode, the precoding granularity for a PDSCH allocation can be set under "Scheduling > Config > Precoding Granularity".

"N4" Dynamic PRB bundle size set 1 is set to N4.

"Wideband" Dynamic PRB bundle size set 1 is set to wideband.

"N2-Wideband"
Dynamic PRB bundle size set 1 is set to N2-wideband.

"N4-Wideband"
Dynamic PRB bundle size set 1 is set to N4-wideband.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BBSet1` on page 699

Bundle Size Set 2
Configures the dynamic PRB bundle type.

Only available if "Precoding" is enabled and "Dynamic" is selected as "PRB Bundling Type".

PRB Bundling Type, Static Bundle Size, Bundle Size Set 1, and Bundle Size Set 2 are RRC parameters relevant only for the Auto/DCI mode. For the Manual mode, the precoding granularity for a PDSCH allocation can be set under "Scheduling > Config > Precoding Granularity".

"N4" Dynamic PRB bundle size set 2 is set to N4.

"Wideband" Dynamic PRB bundle size set 2 is set to wideband.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BSSet2` on page 699

Minimum Scheduling Offset Indicator K0
Option: R&S SMW-K148.

Opens a dialog box to configure the minimum applicable offset indicator for DCI format 1_1.

Corresponds to higher layer parameter `minimumSchedulingOffsetK0` as defined in 3GPP 38.331.

Number of Entries ← Minimum Scheduling Offset Indicator K0
Defines the number of K0 values you can configure for the minimum applicable offset indicator.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MAOFfset:NMOFfset` on page 700

Value for MinAppOffset ← Minimum Scheduling Offset Indicator K0
Defines the value of the corresponding minimum applicable offset indicator.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MAOFfset:VAL<gr0>` on page 700

Priority Indicator DCI1_1
Turns the "Priority Indicator" DCI field in DCI formats 1_1 on and off.

Turn on this parameter if you want to define the bit length of the "Priority Indicator" DCI field.

Corresponds to higher layer parameter `priorityIndicatorDCI-1-1` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PI11` on page 701

Bits For Redundancy Version DCI1_2
Defines the bit length of the DCI field "Redundancy Version" available in DCI format 1_2.

Corresponds to higher layer parameter `numberOfBitsForRV-DCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RV12` on page 701

Bits For HARQ DCI1_2
Defines the bit length of the DCI field "HARQ Process Number" available in DCI formats 1_2.

Corresponds to higher layer parameter `harq-ProcessNumberSizeDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:HA12` on page 702

Antenna Ports Present DCI1_2
Turns the "Antenna Ports" DCI field in DCI format 1_2 on and off.

Turn on this parameter if you want to define the bit length of the "Antenna Ports" DCI field.

Corresponds to higher layer parameter `antennaPortsFieldPresenceDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:AP12` on page 702

DMRS Sequence Initialization DCI1_2
Turns the "DMRS Sequence Initialization" DCI field in DCI format 1_2 on and off.

Turn on this parameter if you want to define the bit length of the "DMRS Sequence Initialization" DCI field.

Corresponds to higher layer parameter `dmrs-SequenceInitializationDCI-1_2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DI12` on page 702

Priority Indicator DCI1_2
Turns the "Priority Indicator" DCI field in DCI formats 1_2 on and off.

Turn on this parameter if you want to define the bit length of the "Priority Indicator" DCI field.

Corresponds to higher layer parameter `priorityIndicatorDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PI12` on page 701

Type 1 Allocation Granularity DCI 1_2
Option: R&S SMW-K148.

Configures the higher layer parameter `resourceAllocationType1GranularityDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:AG12` on page 702

TCI States Activation
Opens a dialog to configure TCI's according to 3GPP 38.321, 6.1.3.24.

Number of Mapped TCI Codepoints ← TCI States Activation
Defines the number of mapped TCI codepoints.

The number of TCI codepoints adjusts the number of rows in the TCI codepoint table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:NTCP` on page 703

TCI Codepoint Table ← TCI States Activation
The TCI codepoint table contains the following information for each TCI codepoint. Each row corresponds to a TCI codepoint.

Codepoint Value ← TCI States Activation
Index number of each codepoint beginning at 0.

Remote command:
not supported

State ID 1 ← TCI States Activation
Defines the value of the state ID 1 as defined in 3GPP 38.321.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:ID1` on page 703

Use State ID 2 ← TCI States Activation
Turns usage of state ID 2 for the corresponding TCI codepoint on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:STATe` on page 704

State ID 2 ← TCI States Activation
Defines the value of the state ID 2 as defined in 3GPP 38.321.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:ID2` on page 703

Harq-ProcessNumberSizeDCI1_1
Option: R&S SMW-K171.

Selects the size of the "HARQ Process Number" DCI field in DCI format 1_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:HP5Bits` on page 698

Priority Indicator DCI4_2
Option: R&S SMW-K171.

Turns the "Priority Indicator" field in DCI format 4_2 on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PRINdicator` on page 694

PUCCH-sSCellDyn DCI1_2
Turns the "PUCCH Cell Indicator" field available in DCI format 1_2 on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PSSCdyn` on page 695

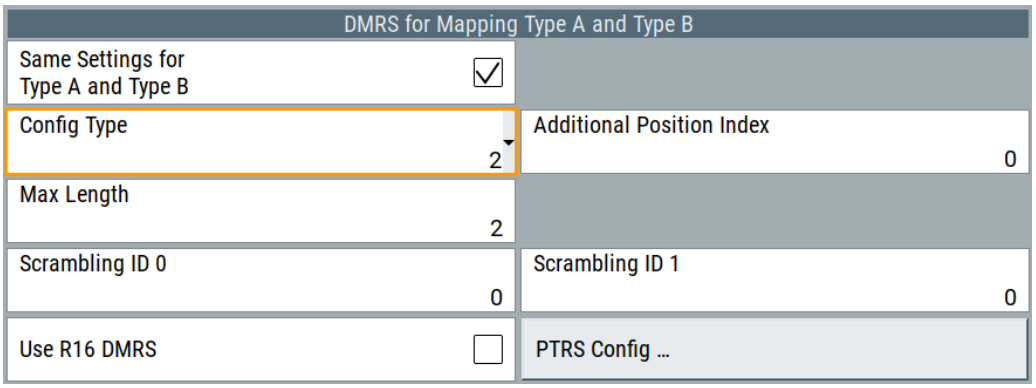
HARQ-ACK Retransmission Indicator DCI1_2
Option: R&S SMW-K171

Turns the "HARQ-ACK Retransmission Indicator" field available in DCI format 1_2 on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:HARTind` on page 694

DMRS settings

The DMRS settings section of the PDSCH properties contain settings related to DMRS.



Same Settings for Type A and Type B

Per default, the same configuration applies for DMRS mapping type A and B. Disable "Same Settings for Type A and Type B" to modify the mapping type B settings.

Mapping type A and B define the DMRS position in the PxSCH, the starting symbol and length. The UE informs the BS about the mapping type supportability via the UE capability information message.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:BSAMe` on page 696

Config Type

Sets the configuration type (type 1 or type 2). It thus defines the mapping of the demodulation reference signal (DMRS) to the physical resource elements in the frequency domain, as defined in TS 38.211.

The configuration type is carried by the higher-layer parameter `dmrs-Type`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:CTYPe` on page 696
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:CTYPe` on page 696

Additional Position Index
Sets the parameter `dmrs-AdditionalPosition` that is required to select the positions of the DMRS symbols l˜, as defined in TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:APINdex` on page 696
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:APINdex` on page 696

Max Length
Sets the parameter `maxLength` and defines whether single- or double-symbol DMRS is used.

If "Max Length = 1", only single-symbol DMRS is allowed.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:MLENgth` on page 697
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:MLENgth` on page 697

Scrambling ID 0/Scrambling ID 1
Sets the higher-layer parameters `scramblingID0` and `scramblingID1` (N_{ID}^0,N_{ID}^1).

The values are used to calculate the initialization sequence of the pseudo-random sequence generator.

See also "About PDSCH and DMRS sequence generation" on page 122.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:SID0` on page 697
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:SID1` on page 697
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:SID0` on page 697
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:SID1` on page 697

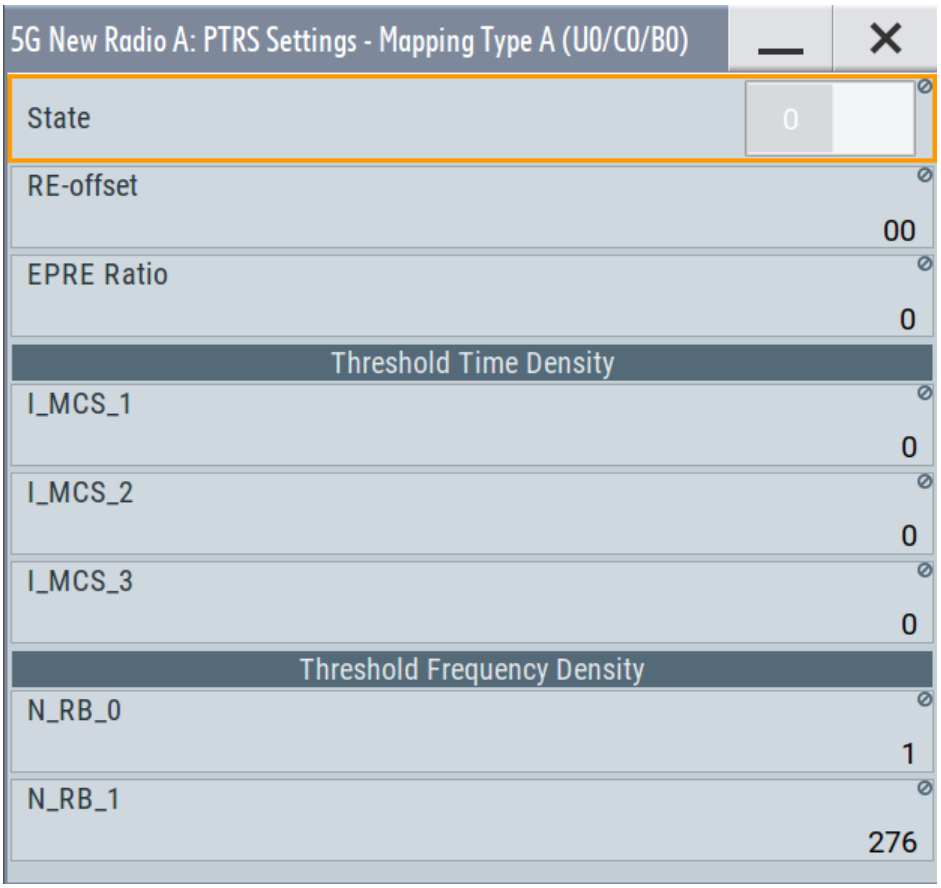
Use R16 DMRS
Option: R&S SMW-K148.

Turns the higher layer parameter "dmrs-downlink-r16" on and off.

This parameter reduces the peak-to-average power ratio (PAPR) of the PDSCH DMRS as defined 3GPP, release 16. Using the low PAPR also results in a different calculation of the DMRS sequence.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:UR16` on page 697
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:UR16` on page 697

PTRS Config ...
Comprises the settings of the phase-tracking reference signals (PTRS) for PxSCH, as defined in TS 38.214.



The phase tracking reference signal (PTRS) is a UE-specific reference signal that is used to compensate for the phase noise of the oscillator. Phase-tracking reference signals can be transmitted only in the resource blocks used for the PxSCH and if the transmission is enabled.

If the PTRS "State" is on, you can define its "Power" relative to the PxSCH and its location in the resource grid.

State ← PTRS Config ...
If DSCH/USCH Channel Coding > "On", enables the transmission of phase-tracking reference signals.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:STATe` on page 713
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:STATe` on page 713

RE-offset ← PTRS Config ...
Sets the parameter `resourceElementOffset` k_{ref}^{RE} required to define the precoding and mapping to the physical resources.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:REOF` on page 713
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:REOF` on page 713

EPRE Ratio ← PTRS Config ...
Sets the higher layer parameter `epre-Ratio` ratio, needed to define the ratio of PTRS EPRE to PDSCH EPRE per layer per RE for PTRS port.

The abbreviation EPRE stands for energy per resource element.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:EPRE` on page 714
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:EPRE` on page 714

I_MCS_1/I_MCS_2/I_MCS_3 ← PTRS Config ...
Sets the threshold values ptrs-MCS_I with I = {1, 2, 3} transmitted by the higher-layer parameter `timeDensity` in `PTRS-DownlinkConfig` .

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS1` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS2` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS3` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS1` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS2` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS3` on page 715

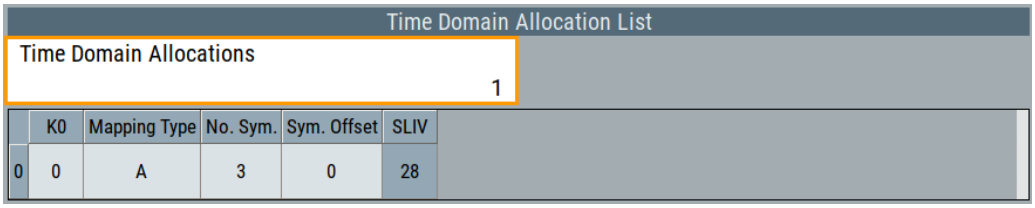
N_RB_1/N_RB_2 ← PTRS Config ...
Sets the threshold values NRB_I with I = {0, 1} transmitted by the higher-layer parameter `frequencyDensity` in `PTRS-DownlinkConfig` .

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:RB0` on page 716
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:RB1` on page 716
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:RB0` on page 716
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:RB1` on page 716

Time domain allocation

The time domain allocation list section of the PDSCH properties contain settings related to PDSCH time domain scheduling according to TS 38.214.

Available when "Simple Mode" = "Off".



Time Domain Allocations
Sets the number of allocations.

There is one row per allocation in the time domain allocation table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDANum` on page 706

K0
Sets the slot offset K_0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:KNULl` on page 707

Mapping Type
Sets the DMRS-mapping type A and B, as defined in TS 38.211

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:MAPPing` on page 707

Start
Sets the start ODFM symbol (S) of the allocation, where the value range depends on the selected SC Spacing/CP.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:STARt` on page 707

Length
Sets the number of consecutive OFDM symbols (L) the allocation spans, where the value depends on the selected SC Spacing/CP and the following applies:
- S + L ≤ 14, if normal cyclic prefix is used (NCP)
- S + L ≤ 12, if extended cyclic prefix is used (ECP)

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:LENGth` on page 707

SLIV
Indicates the resulting start and length indicator SLIV, selected automatically from the values of the parameters K0, Start and Length.

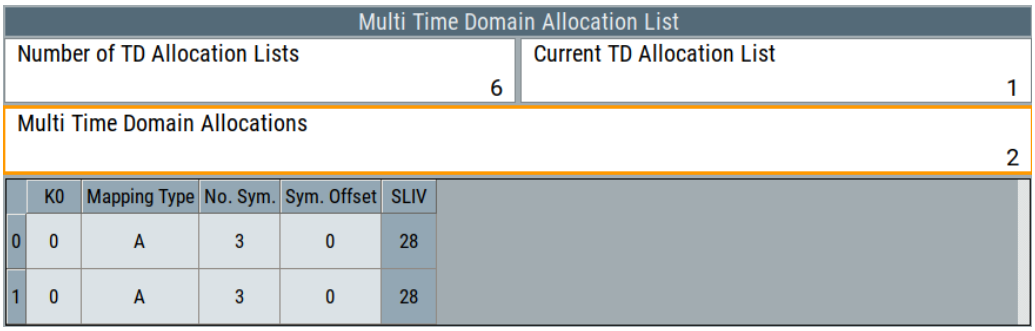
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:SLIV?` on page 708

Multi time domain allocation lists

Requires Option: R&S SMW-K171

The time domain allocation list for multi PDSCH is a feature introduced with 3GPP release 17 (TS 38.331). Using the time domain allocation lists for multi PDSCH, you can configure the PDSCH time domain scheduling according to TS 38.214.

Available when "Simple Mode" = "Off".



Number of TD Allocation Lists
Defines the number of time domain allocation lists.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` on page 708

Current TD Allocation List
Selects the allocation list you want to configure.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:LSELected` on page 709

Multi Time Domain Allocations
Defines the number of multi time domain allocations in the selected time domain allocation list.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TDANum` on page 709

K0
Sets the slot offset K_0 for an allocation in a time domain allocation list.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:KNULl` on page 709

Mapping Type
Sets the DMRS-mapping type A and B for an allocation in a time domain allocation list, as defined in TS 38.211

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:MAPPing` on page 710

No. Sym.
Sets the number of consecutive OFDM symbols (L) the allocation in a time domain allocation list spans, where the value depends on the selected SC Spacing/CP and the following applies:

- S + L ≤ 14, if normal cyclic prefix is used (NCP)
- S + L ≤ 12, if extended cyclic prefix is used (ECP)

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:LENGth` on page 710

Sym. Offset
Sets the start ODFM symbol (S) of the allocation, where the value range depends on the selected SC Spacing/CP.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:STARt` on page 711

SLIV
Indicates the resulting start and length indicator SLIV, selected automatically from the values of the parameters K0, No. Sym. and Sym. Offset.

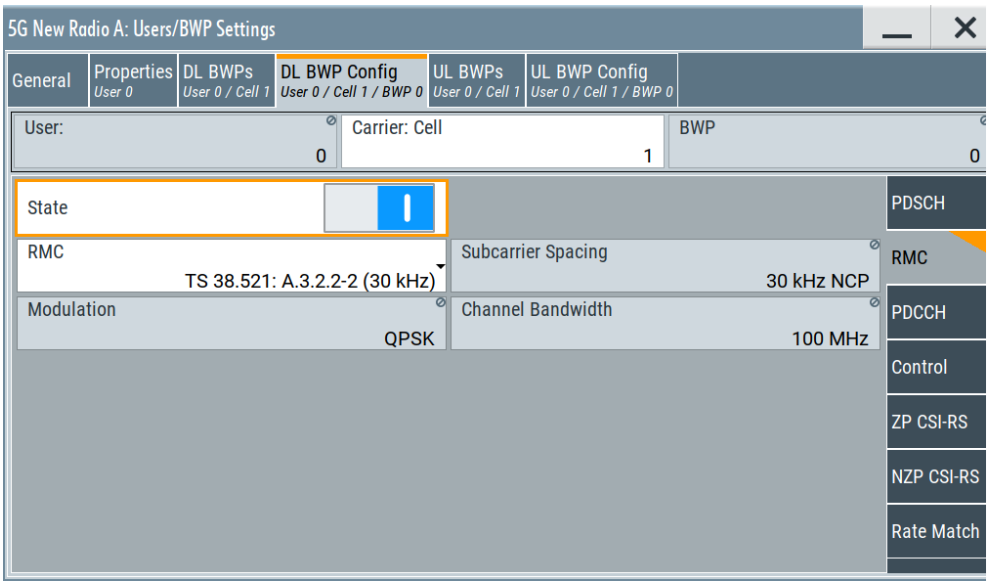
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:SLIV?` on page 711

5.3.6.3 RMC settings

Access:

► Select "User/BWP Settings > DL BWP Config > RMC".

Reference measurement channels (RMC) have a specific configuration defined by 3GPP for conformance testing. The exact channel settings depend on the subcarrier spacing, the modulation and the duplexing method. For a comprehensive overview of the dependencies in FR1, see the tables in the annex of 3GPP 38.521-1.



State
Turns the use and configuration of reference measurement channel (RMC) on and off. The corresponding settings are only displayed after you have turned on RMCs.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:STATe` on page 718

RMC
Selects the RMC to be used.

The RMCs in the list are sorted by 3GPP specification (TS 38.521 / TS 38.176).

Sorting for TS 38.521 RMCs:
- Duplexing method
- Modulation scheme
- Subcarrier spacing

Note that you can only select the RMC that corresponds to the subcarrier spacing in the bandwidth part you are configuring. RMC are unavailable for subcarrier spacings with an extended cyclic prefix (for example 60 kHz ECP).

Sorting for TS 38.521 RMCs:
- Frequency range

The name of the RMC indicates several things:
- The 3GPP document the RMC is defined in (for example 38.521).
- For TS 38.176 RMCs: The frequency range of the RMC (for example M-FR1)
- The chapter in the annex of the 3GPP document (for example A.3.2.2-2).
- For TS 38.521 RMCs: The subcarrier spacing the RMC applies to (for example 60 kHz).

The other three fields in the RMC dialog are read only and indicate the subcarrier spacing, the channel bandwidth and modulation of the RMC. The modulation is automatically adjusted, depending on the RMC you select.

Remote command:
RMC selection: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:ID` on page 716
Modulation query: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:MODulation?` on page 717
SCS query: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:SCS?` on page 718

CQI Index
Selects the CQI index for the RMC. The CQI index controls certain characteristics of the RMC like the modulation.

The CQI index is available for certain RMCs only (for example the RMCs "TS 38.176: M-FR1-A3_5_1").

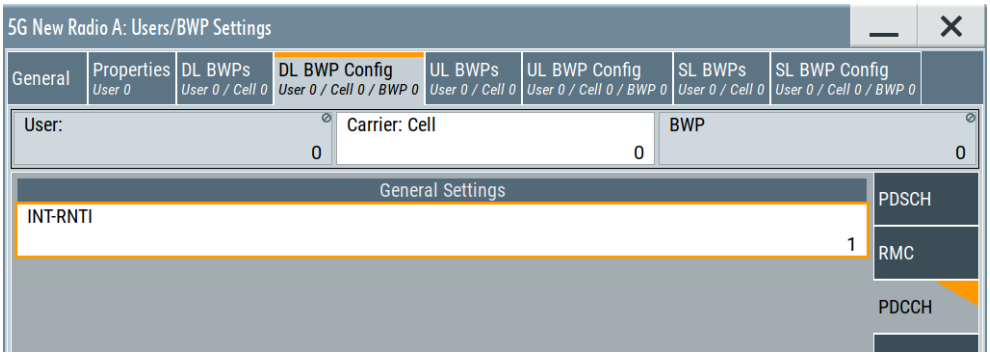
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:CQI` on page 716

5.3.6.4 PDCCH settings

Access:

1. Select "Simple Mode" = "Off".
2. Select "User/BWP Settings > DL BWP Config > PDCCH".

   The dialog comprises the RNTI and DCI-related settings.



Settings:

INT-RNTI
Sets the RNTI of the user.

See also "Usage" on page 254.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:INT` on page 719

5.3.6.5 Control settings (DCI)

Access:

1. Select "Simple Mode" = "Off".
2. Select "User/BWP Settings > DL BWP Config > Control".

   The dialog shows the uplink-related (control) settings that are transmitted in the downlink.
   The contents of the dialog are dynamic and depend on the DCI format you have selected from the "DCI Settings" menu. The following lists contain the control settings that are available for each DCI format. The control settings themselves are listed and described below in the corresponding chapters.
   For description of the remote-control commands, see Chapter 12.20.5, "DL control information commands", on page 721.

Control information for DCI format 0_1

Control settings for DCI format 0_1.

The following control settings are available with R&S SMW-K171:

- "Bits for PDCCH Monitoring Adaption Indication"
- "Bits for 2nd Precoding Information"
- "Bits for 2nd SRS Resource Indication"
- "Bits for 3rd Downlink Assignment Index"
- "Bits for SRS Offset Indicator"
- "Bits for SRS Resource Set Indication"
- "Max. Bits for 2nd Downlink Assignment Index"

Bits for PDCCH Monitoring Adaptation Indication
Turns the DCI field "Monitoring Adaption Indication" on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NMADaption` on page 726

Bits for 2nd Precoding Information
Turns the "2nd Precoding Information and Number of Layer" field on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PRC2` on page 724

Bits for 2nd SRS Resource Indication
Turns the "2nd SRS Resource Indicator" field on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:SRI2` on page 725

Bits for 3rd Downlink Assignment Index
Turns the "3rd Downlink Assignment Index" field on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:DAI3` on page 723

Bits for SRS Offset Indicator
Turns the "SRS Offset Indicator" field on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:SOIN` on page 725

Bits for SRS Resource Set Indication
Turns the "SRS Resource Set Indicator" field on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:SRINd` on page 725

Max. Bits for 2nd Downlink Assignment Index
Defines the bit length of the "2nd Downlink Assignment Index" field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:DAI2` on page 722

Report Trigger Size
Defines the trigger size of the CSI (channel state information) request field in DCI (bits).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSI:RTSize` on page 728

Control information for DCI format 0_2

Control settings for DCI format 0_2.

The control settings for DCI format 0_2 are the same as for DCI format 0_1.

Control information for DCI format 1_0

Control settings for DCI format 1_0.

Bits for TRS Availability Indication
Option: R&S SMW-K171

Selects the number of bits that you can use for the "TRS availability indication" DCI field. The parameter corresponds to higher layer parameter `TRS-ResourceSetConfig` as defined by 3GPP.

Availability depends on the payload size and the PO number per PEI. The value range also depends on the payload size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:TAINd` on page 726

Large Response Window
Turns the "LSBs of SFN" DCI field on and off. This field is available for MsgB-RNTI and RA-RNTI on and off.

Corresponds to higher layer parameter `msgB-responseWindow`, `ra-ResponseWindow` and `ra-ResponseWindow-v1610` as defined in 3GPP 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSI:LRESponse` on page 722

Control information for DCI format 1_2

Control settings for DCI format 1_2.

The control settings for DCI format 1_2 are the same as for DCI format 1_1.

The following control settings are available with R&S SMW-K171:

- "Bits for Enhanced Type 3 Codebook Indicator"

Control information for DCI format 1_1

Control settings for DCI format 1_1.

Control settings for DCI format 1_1 described elsewhere:

- Bits for PDCCH Monitoring Adaption Indication
- Bits for SRS Offset Indicator

The following control settings are available with R&S SMW-K171:

- "Bits for Enhanced Type 3 Codebook Indicator"

Bits for Enhanced Type 3 Codebook Indicator
Turns the "Enhanced Type 3 Codebook Indicator" field on and off and defines its size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NT3C` on page 726

Control information for DCI format 2_1

Control settings for DCI format 2_1.

Number of Pre-Emption Indications
Defines the number of "Pre-Emption Indicator" fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NUMPreempt` on page 719

Control information for DCI format 2_2

Control settings for DCI format 2_2.

Number of PUCCH Blocks
Defines the number of "Closed Loop Indicator" and "TPC Command" fields (RNTI type: TPC-PUCCH-RNTI).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:BD22` on page 722

Number of PUSCH Blocks
Defines the number of "Closed Loop Indicator" and "TPC Command" fields (RNTI type: TPC-PUSCH-RNTI).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:BD22` on page 722

TPC-PUCCH-RNTI
Selects the RNTI of the user (RNTI type: TPC-PUCCH-RNTI). It is a unique UE ID to control the PUCCH power.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PUCCh` on page 721

TPC-PUSCH-RNTI
Selects the RNTI of the user (RNTI type: TPC-PUSCH-RNTI). It is a unique UE ID to control the PUSCH power.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PUSCh` on page 721

TwoPUCCH-PC Adjustment
Turns the "Closed Loop Indicator" field on and off (RNTI type: TPC-PUCCH-RNTI).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:TPAS` on page 722

TwoPUSCH-PC Adjustment
Turns the "Closed Loop Indicator" field on and off (RNTI type: TPC-PUSCH-RNTI).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:TPAS` on page 722

Control information for DCI format 2_3

Control settings for DCI format 2_3.

Number of Blocks
Defines the number of "SRS Request" and "TPC Command" fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:BD23` on page 687

SRS-TPC-PDCCH-Group Type
Selects the SRS-TPC-PDCCH-Group type.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:GTYPe` on page 688

TPC-SRS-RNTI
Selects the RNTI of the user.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:SRS` on page 721

Control information for DCI format 2_4

Control settings for DCI format 2_4.

Requires: Option: R&S SMW-K148

Cancellation Indication Length
Defines the bit length of the "Cancellation Indication" fields.

The "Cancellation Indication Length" in combination with the "Number of Cancellation Indications" defines the size of the pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CILength` on page 685

CI-RNTI
Selects the RNTI of the user.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:CIRNti` on page 685

Number of Cancellation Indications
Defines the number of "Cancellation Indication" fields.

The "Cancellation Indication Length" in combination with the "Number of Cancellation Indications" defines the size of the pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NCINd` on page 685

Control information for DCI format 2_5

Control settings for DCI format 2_5.

Requires: Option: R&S SMW-K148

AI-RNTI
Selects the RNTI of the user.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:AIRNti` on page 686

Number of Availability Indications
Defines the number of "Availability Indication" fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NAINd` on page 686

Control information for DCI format 2_6

Control settings for DCI format 2_6.

Requires: Option: R&S SMW-K148

Number of Dormancy Indications
Defines the number of "Wakeup Indication" and "SCell Dormancy Indication" fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:NB26` on page 687

Number of SCell Groups Outside Active Time
Defines the number of bits for the "SCell Dormancy Indication" pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:NSCG` on page 687

PS-RNTI
Selects the RNTI of the user.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PSRNti` on page 686

Control information for DCI format 2_7

Control settings for DCI format 2_7.

Requires: Option: R&S SMW-K148

Control settings for DCI format 2_7 described elsewhere:

- Bits for TRS Availability Indication

Number of Subgroups per PO
Defines the higher layer parameter `subgroupConfig-r17` as defined in 3GPP 38.331. The parameter has an effect on the number of bits you can use for the "Early Indicator" DCI fields.

Availability depends on the payload size and the PO number per PEI. The value range also depends on the payload size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:SGPO` on page 725

Payload Size
Defines the payload size of DCI format 2_7. The parameter corresponds to higher layer parameter `payloadSizeDCI-2-7-r17` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PS27` on page 724

PO Number per PEI
Defines the number of "Paging Early Indicator" fields. The parameter corresponds to higher layer parameter `po-NumPerPEI-r17` as defined by 3GPP.

Available number of PEI fields depends on the payload size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PNPPei` on page 724

Control information for DCI format 3_0

Control settings for DCI format 3_0.

Requires: Option: R&S SMW-K148

Number of sl-PSFCH-ToPUCCH-Slots
Defines the value of the `sl-PSFCH-ToPUCCH` parameter as defined in 3GPP 38.213, table 16.5-2.

The value has an effect on the values and bit pattern of the "PSFCH-to-HARQ Feedback" field in DCI format 3_0, which depends on the number of slots set by `sl-PSFCH-ToPUCCH`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PTPSlots` on page 724

Control information for DCI format 3_1

Control settings for DCI format 3_1.

Requires: Option: R&S SMW-K148

Max LTE Subchannels
Sets the maximum number of LTE subchannels used in a V2X transmission.

The value has an effect on the values and bit pattern of the "First Subchannel" field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:LTEChan` on page 723

Control information for DCI format 4_2

Control settings for DCI format 4_2.

Requires: Option: R&S SMW-K171

HARQ-FeedbackEnabler
Turns the DCI field "HARQ-FeedbackEnabler" on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:HAENabler` on page 723

Minimum Size
Defines the number of bits in the DCI format 4_2.

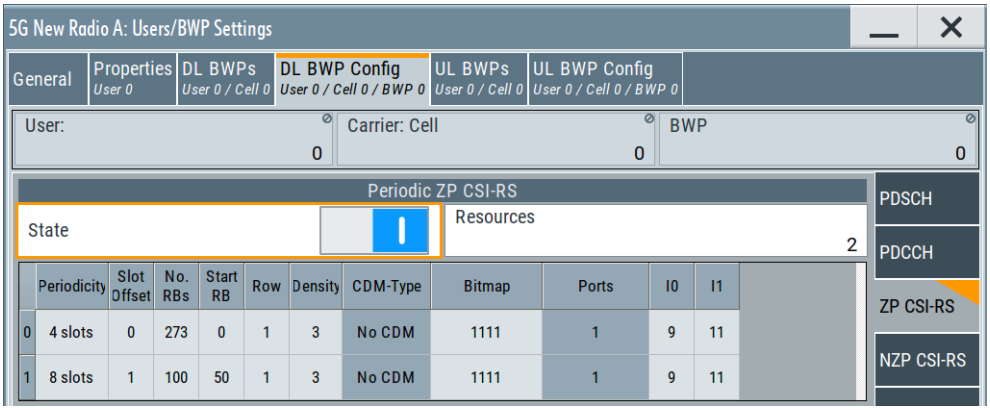
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:DS42` on page 723

5.3.6.6 ZP CSI-RS settings

Access:

► Select "User/BWP Settings > DL BWP Config > ZP CSI-RS".

The dialog comprises the zero-power (ZP) CSI-RS settings, as defined in TS 38.211.



For description of the remote-control commands, see Chapter 12.20.6, "ZP and NZP CSI-RS commands", on page 727.

State
Enables the ZP CSI-RS transmission.

The CSI-RS can be used among others for time or frequency tracking or CSI calculation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:STATe` on page 728

Resources
Sets the number of periodicCSI-RS resources.

There is one table row per resource.

See "Periodic ZP CSI-RS resource table" on page 152.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:NRESources` on page 729

Periodic ZP CSI-RS resource table
Each periodic ZP CSI-RS is configured individually; there is one table row per resource, where the number of rows is defined by the parameter Resources.

Periodicity ← Periodic ZP CSI-RS resource table
For periodic ZP CSI-RS:

Sets the periodicity $T_{CSI\text{-}RS}$ (in slots) transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Thus, this parameter defines how often the CSI-RS is transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:PER` on page 729

Slot Offset ← Periodic ZP CSI-RS resource table
For periodic ZP CSI-RS:

Sets the slot offset T_{offset} transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:OFFSet` on page 729

No. RBs ← Periodic ZP CSI-RS resource table
Sets the periodicity T_{CSI-RS} (in slots) transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Thus, this parameter defines how often the CSI-RS is transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:RBNumber` on page 729

Start RB ← Periodic ZP CSI-RS resource table
If the number of RB the CSI-RS spans ("No. RBs") is smaller than the available number of RB (i.e. the whole width of the BWP), set the first RB (`startingRB`) the CSI-RS allocates.

The value is set relative to the common resource block #0 on the common RB grid.

Only multiples of 4 are allowed.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:SRBNumber` on page 730

Row ← Periodic ZP CSI-RS resource table
The CSI-RS location in a slot is defined according to TS 38.211 as a function of the number of ports X, the "Density" and the "CDM-Type".

The possible combinations are listed in a table and the parameter "Row" indicates one of the combinations. It is not the consequent table row number in the CSI-RS resource table. The latter is defined with the suffix `RES<user0>` in the remote control command.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:ROW` on page 730

Density ← Periodic ZP CSI-RS resource table
Sets the value ρ that is the higher-layer parameter `density` in the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:DENSity` on page 731

CDM-Type ← Periodic ZP CSI-RS resource table
Indicates or sets value of the higher-layer parameter `cdm-Type` in the `CSI-RS-ResourceMapping`.

The value is selected automatically according to TS 38.211 and depending on the selected "Row".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:CDMType?` on page 731

Bitmap ← Periodic ZP CSI-RS resource table
Sets the location of the CSI-RS in the frequency domain. The starting position and number of the resource blocks in which the CSI-RS is transmitted are defined by the higher-layer parameters `freqBand`.

This parameter is transmitted by the higher-layer parameters `frequencyDomainAllocation` as part of the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:BITMap` on page 731

Ports ← Periodic ZP CSI-RS resource table
Sets the number of ports `X` that is given by the higher-layer parameter `nrofPorts`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:PORTs?` on page 730

l0/l1 ← Periodic ZP CSI-RS resource table
Sets the parameters l_0 and l_1 and define the CSI-RS location relative to the start of as slot. Thus, the l_0 and l_1 give the location of the CSI-RS in time.

These parameters are transmitted by the higher-layer parameters `firstOFDMSymbolInTimeDomain` and `firstOFDMSymbolInTimeDomain2` as part of the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

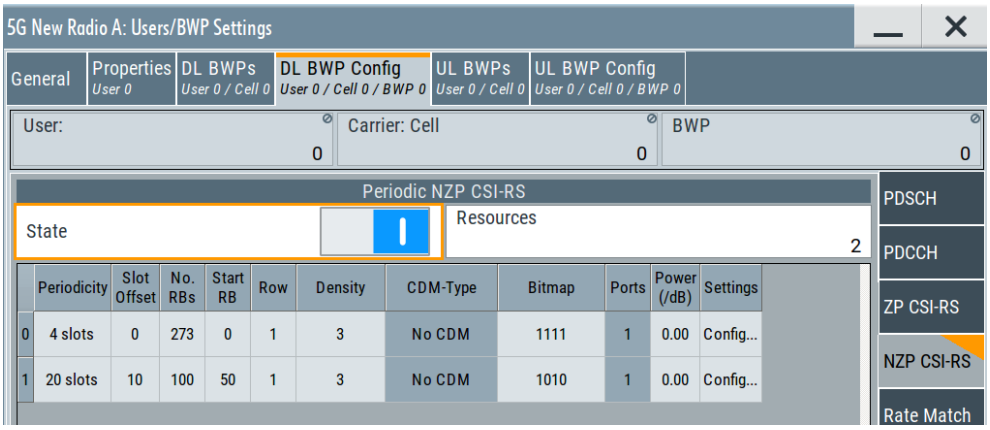
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:I0` on page 732
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:I1` on page 732

5.3.6.7 NZP CSI-RS settings

Access:

► Select "User/BWP Settings > DL BWP Config > NZP CSI-RS".

The dialog comprises the non-zero-power (NZP) CSI-RS settings, as defined in TS 38.211.



For description of the remote-control commands, see Chapter 12.20.6, "ZP and NZP CSI-RS commands", on page 727.

State

Enables the NZP CSI-RS transmission.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:STATe` on page 728

Resources

Sets the number of periodic CSI-RS resources.

There is one table row per resource.

See "Periodic ZP CSI-RS resource table" on page 152.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:NRESources` on page 729

Periodic NZP CSI-RS resource table
Each periodic NZP CSI-RS is configured individually; there is one table row per resource, where the number of rows is defined by the parameter Resources.

Periodicity ← Periodic NZP CSI-RS resource table
Sets the periodicity $T_{CSI\text{-}RS}$ (in slots) transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Thus, this parameter defines how often the CSI-RS is transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PER` on page 729

Offset ← Periodic NZP CSI-RS resource table
Sets the slot offset T_{offset} transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:OFFSet` on page 729

No. RBs ← Periodic NZP CSI-RS resource table
Sets the periodicity $T_{CSI\text{-}RS}$ (in slots) transmitted by the higher-layer parameter `CSI-ResourcePeriodicityAndOffset`.

Thus, this parameter defines how often the CSI-RS is transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:RBNumber` on page 729

Start RB ← Periodic NZP CSI-RS resource table
If the number of RB the CSI-RS spans ("No. RBs") is smaller than the available number of RB (i.e. the whole width of the BWP), set the first RB (`startingRB`) the CSI-RS allocates.

The value is set relative to the common resource block #0 on the common RB grid.

Only multiples of 4 are allowed.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:SRBNumber` on page 730

Row ← Periodic NZP CSI-RS resource table
The CSI-RS location in a slot is defined according to TS 38.211 as a function of the number of ports X, the "Density" and the "CDM-Type".

The possible combinations are listed in a table and the parameter "Row" indicates one of the combinations. It is not the consequent table row number in the CSI-RS resource table. The latter is defined with the suffix `RES<user0>` in the remote control command.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:ROW` on page 730

Density ← Periodic NZP CSI-RS resource table
Sets the value ρ that is the higher-layer parameter `density` in the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:DENSity` on page 731

CDM-Type ← Periodic NZP CSI-RS resource table
Indicates or sets value of the higher-layer parameter `cdm-Type` in the `CSI-RS-ResourceMapping`.

The value is selected automatically according to TS 38.211 and depending on the selected "Row".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:CDMType?` on page 731

Bitmap ← Periodic NZP CSI-RS resource table
Sets the location of the CSI-RS in the frequency domain. The starting position and number of the resource blocks in which the CSI-RS is transmitted are defined by the higher-layer parameters `freqBand`.

This parameter is transmitted by the higher-layer parameters `frequencyDomainAllocation` as part of the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:BITMap` on page 731

Ports ← Periodic NZP CSI-RS resource table
Sets the number of ports `X` that is given by the higher-layer parameter `nrofPorts`.

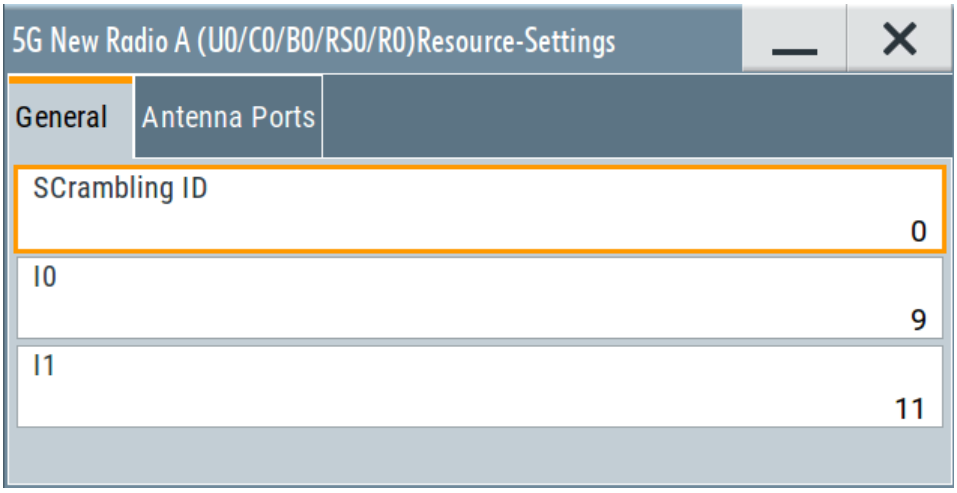
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PORTs?` on page 730

Power ← Periodic NZP CSI-RS resource table
Sets the power of the NZP resource relative to the PDSCH power.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PWR` on page 732

Settings ← Periodic NZP CSI-RS resource table
Opens the "Resource-Settings" dialog where you configure:
- Scrambling and I0/I1 values, see "Resource-Settings > General" on page 158.
- The antenna port mapping for the selected resource, see "Resource-Settings > Antenna Port Mapping" on page 159.

Resource-Settings > General ← Periodic NZP CSI-RS resource table
Access: "General > Users/BWPs > DL BWP Config > NZP CSI-RS" > "Resources = 1" and select "Settings > Config > General".



Scrambling ID ← Resource-Settings > General ← Periodic NZP CSI-RS resource table
Sets the parameter n_{ID} that is defined by the higher-layer parameter `ScramblingID` and used for the generation of the pseudo-random reference-signal generator.

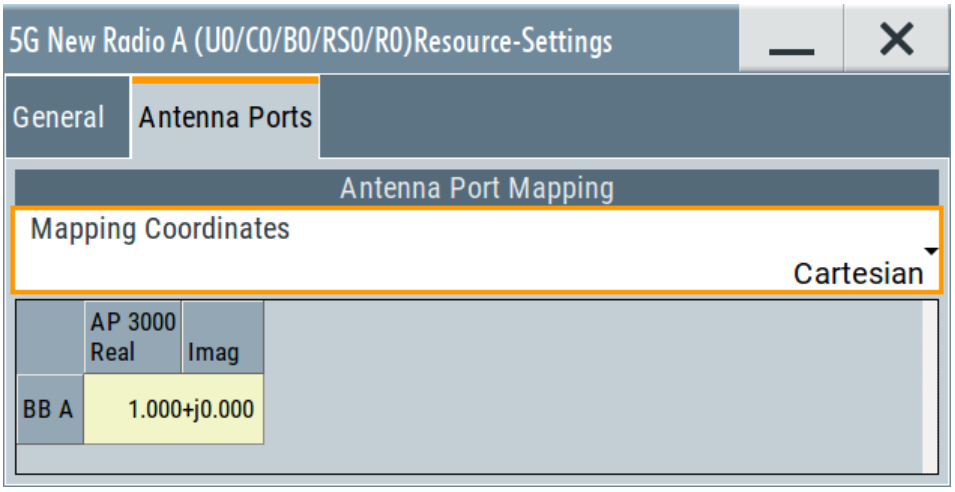
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:SCID` on page 732

I0/I1 ← Resource-Settings > General ← Periodic NZP CSI-RS resource table
Sets the parameters I_0 and I_1 and define the CSI-RS location relative to the start of as slot. Thus, the I_0 and I_1 give the location of the CSI-RS in time.

These parameters are transmitted by the higher-layer parameters `firstOFDMSymbolInTimeDomain` and `firstOFDMSymbolInTimeDomain2` as part of the `CSI-RS-ResourceMapping` or the `CSI-RS-CellMobility` messages.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:I0` on page 732
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:I1` on page 732

Resource-Settings > Antenna Port Mapping ← Periodic NZP CSI-RS resource table
Access: "General > Users/BWPs > DL BWP Config > NZP CSI-RS" > "Resources = 1" and select "Settings > Config > Antenna Ports".



For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Mapping Coordinates ← Resource-Settings > Antenna Port Mapping ← Periodic NZP CSI-RS resource table
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping table ← Resource-Settings > Antenna Port Mapping ← Periodic NZP CSI-RS resource table
The mapping table is a matrix with number of rows equal to the number of physical Tx antennas (basebands) and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration. The yellow matrix elements in the mapping table indicate the default antenna port to physical antenna (TX antenna/baseband) mapping.

The number of rows depends on the selected "System Configuration".

For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL` on page 733
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary` on page 733
"Mapping Coordinates = Cylindrical":

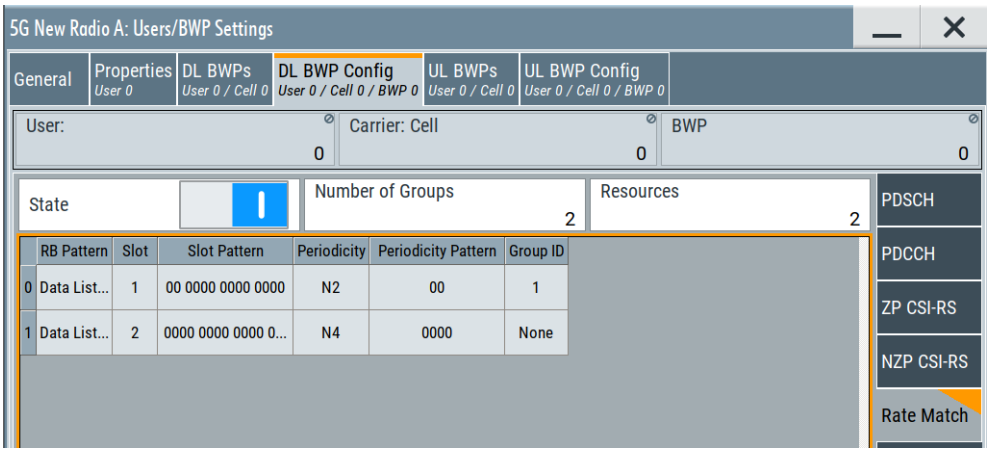
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude on page 733
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe on page 734

5.3.6.8 Rate match settings

Access:

► Select "User/BWP Settings > DL BWP Config > Rate Match".

The dialog comprises the PDSCH resources-mapping settings, required to configure the rate match patterns, as defined in TS 38.214.



For description of the remote-control commands, see Chapter 12.20.7, "Rate match commands", on page 734.

State
Enables the configuration of rate match groups.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:STATe on page 734

Number of Groups
Sets the number of rate match pattern groups (`rateMatchPatternGroup`).

The value limits the available group ID, the groups that can be selected for PDSCH ("Scheduling > PDSCH > Config > General" > Rate Match Pattern Group) and the bit length of the DCI format 1_1 parameter "Rate Matching Indicator".

Each rate match pattern group contains a list of RB and slot indices that build a resource set of resources. These resources are not available for the PDSCH allocations, if one of the following is true:

- The "Rate Matching Indicator" filed of the DCI format 1_1 used to schedule this PDSCH is set to value different than 0.
- A "Rate Match Group" is selected for a manually configured PDSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:GRPNumber` on page 735

Resources
Sets the number of rate match resources.

There is one table row per resource.

See "Rate match resource table" on page 161.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:NRESources` on page 735

Rate match resource table
Each rate match resource is configured individually; there is one table row per resource, where the number of rows is defined by the parameter Resources.

RB Pattern ← Rate match resource table
The resource block level bitmap is defined as a binary data from a data list, internally or externally generated.

The bitmap is 275 bits long. Longer patterns are truncated; shorter are zero-padded (i.e. the remaining bits are set to 0). If no data list is loaded, a pattern with all zeros is assumed.

A bit value of 1 in the RB level bitmaps indicates that the corresponding resource is not available for PDSCH.

To load a list:
- Select "Data List"
- In 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:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:RBDList` on page 735
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:RBPatt` on page 736

Slot ← Rate match resource table
Sets the number of slots and thus defines the "Slot Pattern" length.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:SLOT` on page 736

Slot Pattern ← Rate match resource table
Set the slots to be used as a pattern.

The pattern length is the 14 or 28 depending on whether "Slot = 1 or 2".

A bit value of 1 in the symbol level bitmaps indicates that the corresponding resource is not available for PDSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:SLTPatt` on page 736

Periodicity ← Rate match resource table
Sets the time-domain pattern and defines the "Periodicity Pattern" length.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:PER` on page 737

Periodicity Pattern ← Rate match resource table
Sets the periodicity in a pattern form, where the pattern length is set with the parameter "Periodicity".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:PERPatt` on page 737

Group ID ← Rate match resource table
Sets the group identifier for the selected rate match pattern, where the available values depend on the selected Number of GroupsIdPDbNr5gUserDlBwpRateMatchRsPeriodicity.

Up to four rate match patterns can use the same "Group ID".

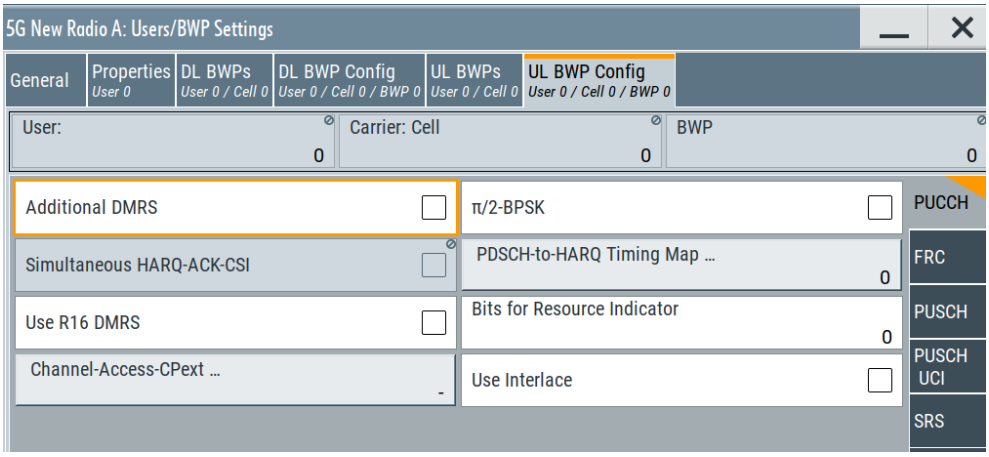
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:GRID` on page 737

5.3.7 UL BWP configuration settings

Access:

1. Select "5G New Radio > General > Link Direction" > **"Uplink"**.
2. Select "General > Users/BWPs" > **"UL BWP Config"**.

3. Select "PUCCH".



The dialog comprises the settings for the UL bandwidth parts (BWP) configuration.

Settings:

5.3.7.1 User, carrier, BWP settings

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

BWP
Select the bandwidth parts (BWP) whose settings are displayed for configuration.

There are one or more BWPs, as set with the parameter "User/BWP Settings > UL BWPs" > Number of DL/UL BWPs.

Remote command:
via suffix at `BWP<dir0>`

5.3.7.2 PUCCH settings

Access:

► Select "User/BWP Settings > UL BWP Config > PUCCH".

General settings

The general settings section of the PUCCH properties contain settings to configure general properties of the selected user.

Additional DMRS ☐	π/2-BPSK ☐
Use R16 DMRS ☐	Use Interlace ☐

Additional DMRS
Global parameter that defines if additional DMRS is used for PUCCH format 3 and 4. According to TS 38.211, the value is required to select the DMRS positions for the PUCCH format 3 and 4.

The value is ignored, if other PUCCH Format is configured.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:ADMRs:STATe` on page 738

π/2 - BPSK
If enabled, the π/2 - BPSK modulation order is used for PUCCH, instead of the default QPSK.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:BPSK:STATe` on page 738

Use R16 DMRS
Option: R&S SMW-K148.

Turns the higher layer parameter "dmrs-uplink-r16" on and off.

This parameter reduces the peak-to-average power ratio (PAPR) of the PUCCH DMRS as defined 3GPP, release 16. Using the low PAPR also results in a different calculation of the DMRS sequence.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UR16` on page 719

Use Interlace
Option: R&S SMW-K148

Configures the higher layer parameter `useInterlacePUCCH-PUSCH` as defined in 3GPP 38.331.

In addition, this parameter unlocks the use of interlaces.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UITL` on page 720

Control settings

The control settings section of the PUCCH properties contain settings related to DCI configuration.

Available when "Simple Mode" = "Off".

Control	
Simultaneous HARQ-ACK-CSI ☐	PDSCH-to-HARQ Timing Map ... 0
Bits for Resource Indicator 0	Channel-Access-CPext ... -
Use 2nd TPC Command ☐	ul-AccessConfigList DCI1_2 0

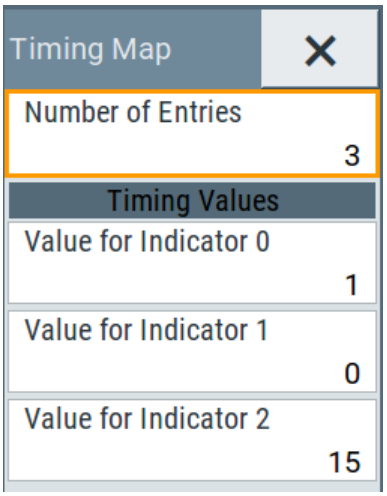
Simultaneous HARQ-ACK-CSI
Reserved for future use.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:HACK:STATe` on page 738

PDSCH to HARQ Timing Map
Select the parameter name to access a dialog where you configure the PDSCH-to-HARQ-timing-indicator field values map, as defined in TS 38.213.

The PDSCH to HARQ timing map is transmitted by the higher-layer parameter `dl-DataToUL-ACK` and affects the DCI field "PDSCH-to-HARQ_feedback Timing Indicator" in DCI formats 1_1 and 1_2.. It is a sequence of up to 8 entries, every four bits long, where the number of entries is set with the parameter Number of Entries.

The value of the individual timing indicators is defined by the parameter Value of Indicator x. Observe the resulting sequence in the overview indication together with the parameter name "PDSCH to HARQ Timing Map".



Number of Entries ← PDSCH to HARQ Timing Map
Sets the number of entries in the sequence of PDSCH to HARQ timing values.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:NTMentry` on page 739

Value of Indicator x ← PDSCH to HARQ Timing Map
Sets the individual timing values.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:TMIValue<gr0>` on page 739

Bits for Resource Indicator
Defines the bit length of the DCI field "PUCCH Resource Indicator" available in DCI format 1_2.

Corresponds to higher layer parameter `numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:BRINd` on page 719

Channel-Access-CPext
Option: R&S SMW-K148.

Opens a dialog to configure the higher layer parameter `UL-AccessConfigListDCI` as defined in 3GPP 38.331.

This parameter has an effect on the "Channel-Access-Cpext" DCI field in DCI format 0_1. This field is available when you turn on shared spectrum access.

Number of Entries ← Channel-Access-CPext
Defines the number of entries of the "Channel-Access-Cpext" DCI field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:CPEXt:NCPXt` on page 720

Value <x> ← Channel-Access-CPext
Defines the value for each "Channel-Access-Cpext" DCI field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:CPEXt:VAL<gr0>` on page 720

Use 2nd TPC Command
Turns the "2nd TPC Command for Scheduled PUCCH" DCI field on and off. This DCI field is supported by DCI formats 1_1 and 1_2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:U2TPc` on page 740

ul-AccessConfigList DCI1_2
Option: R&S SMW-K171.

Configures the higher layer parameter `ul-AccessConfigListDCI1-2` as defined in 3GPP 38.331.

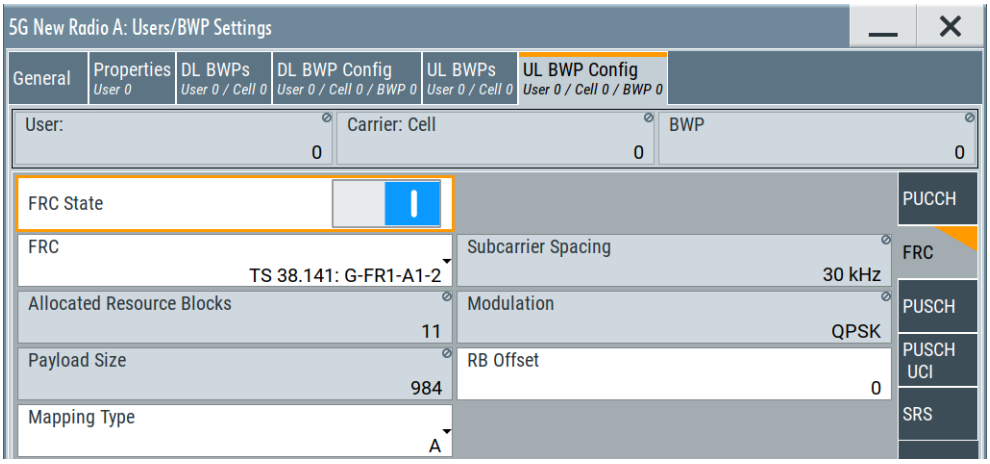
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:A12List` on page 738

5.3.7.3 FRC settings

Access:

1. Select "User/BWP Settings > Properties" > **DSCH/USCH Channel Coding** > **"On"**.

2. Select "User/BWP Settings > UL BWP Config > FRC".



The dialog allows you to select and enable fixed reference measurement channels (FRC), as defined in TS 38.141.
The available FRCs depend on the selected BWP SCS (SC Spacing/CP) and selected number of RBs (No. RBs).

FRC State

To enable the fixed reference measurement channels (FRC), set "User/BWP Settings > Properties" > **DSCH/USCH Channel Coding** > **"On"**.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:STATe` on page 740

FRC

The available FRCs depend on the selected BWP subcarrier spacing SC Spacing/CP) and selected number of resource blocks (No. RBs).

For each particular combination, you can select from the FRCs that have the same subcarrier spacing (SCS) as the BWP and the number of RBs allocated in the FRC is less than or equal to the "No. RB" of current BWP.

The FRCs are configured as defined in TS 38.141 (base station conformance testing) and TS 38.176 (IAB conformance testing). For details, refer to TS 38.141 and TS 38.176.

"TS 38.141: G-FR1"
Subset of FRCs defined for the FR1 in the annex of TS 38.141.

"TS 38.141: G-FR2"
Subset of FRCs defined for the FR2 in the annex of TS 38.141.

"TS 38.176: D-FR1"
Subset of FRCs defined for the FR1 in the annex of TS 38.176.

"TS 38.176: D-FR2"
Subset of FRCs defined for the FR2 in the annex of TS 38.176.

"Not Available" Indicates that there is no FRC defined for the current combination of "SC Spacing/CP" and "No. RB".

If FRC is selected, the following parameters are set automatically:

- DMRS for Mapping Type A parameters Config Type, Additional Position Index and Max Length.
- PUSCH allocations
- All FRC parameters in the "FRC" dialog.

Release 16 FRCs require R&S SMW-K148.

Release 17 FRCs require R&S SMW-K171.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:TYPE` on page 740

Channel Bandwidth
Indicates the channel bandwidth of the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:BW?` on page 743

Subcarrier Spacing
Indicates the SCS of the selected FRC. It is the same as the SCS of the selected BWP.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:SCS?` on page 743

Allocated Resource Blocks
Indicates the number of used RBs of the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:ALRB?` on page 743

Modulation
Indicates the modulation scheme used by the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:MODulation?` on page 744

Payload Size
Indicates the payload size of the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:PASize?` on page 744

RB Offset
Sets the RB offset for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:RBOFfset` on page 744

Mapping Type
Sets the PUSCH mapping type for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:MAPType` on page 745

PTRS
Enables PTRS for the selected FRC.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:PTRS:STATe` on page 745

5.3.7.4 PUSCH settings

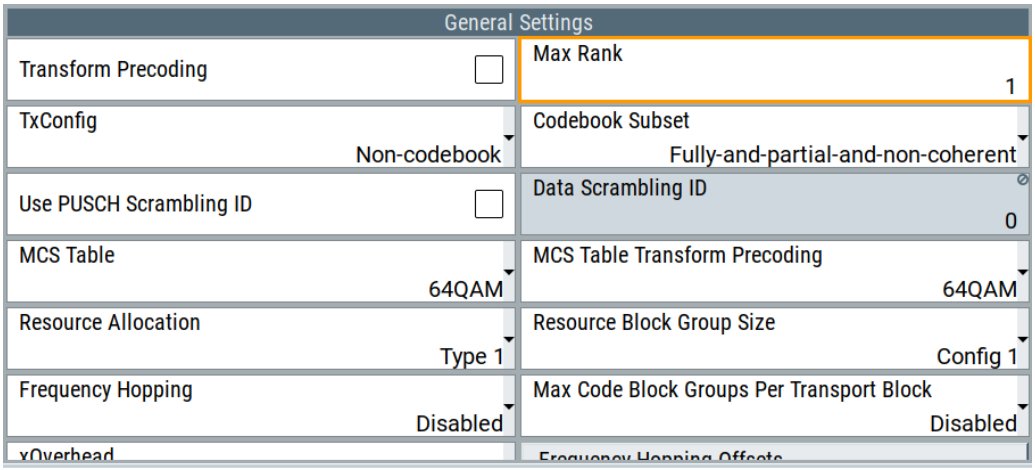
Access:

► Select "User/BWP Settings > UL BWP Config > PUSCH".

If FRC is used ("UL BWP Config > FRC > State > On"), the settings of the "DMRS for Mapping Type A" are configured automatically and cannot be changed.

General settings

The general settings section of the PUSCH properties contain settings to configure general properties of the selected user.



Transform Precoding

Sets the higher layer parameter `transformPrecoder` that defines which access method is used, the optional DFT-s-OFDM or the CP-OFDM.

See also Chapter 2.3, "Multiple accesses schemes", on page 23.

"On" Enables the precoding operation and thus enables the DFT-s-OFDM. See "PTRS Config (Transform Precoding) ..." on page 185.

"Off" Disables the DFT-s-OFDM precoding operation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:TPSTate` on page 752

Max Rank

Sets the higher layer parameter `maxRank` that defines the rank of the precoding matrix, as defined in TS 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MRANk` on page 752

TxConfig
Sets the higher layer parameter `txConfig`. It defines if codebook-based or non-codebook-based transmission is used and thus defines how and which precoding matrix is used, as defined in TS 38.212.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:TXConfig` on page 752

Codebook Subset
If codebook-based transmission ("TxConfig > Codebook") is used, this parameter sets the higher layer parameter `codebookSubset`, as defined in TS 38.212.

"Fully-and-partial-and-non-coherent" `codebookSubset = fullyAndPartialAndNonCoherent`

"Partial-non-coherent" `codebookSubset = partialAndNonCoherent`

"Non-coherent" `codebookSubset= nonCoherent`

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:CBSubset` on page 753

Use PUSCH Scrambling ID
Defines the value of the variable n_{ID} used for the initialization of the generator of the PUSCH scrambling sequence.

"Off" $n_{ID} = N_{ID}^{cell}$ (i.e. the physical layer cell identity)

"On" n_{ID} is the values set with the parameter Data Scrambling ID.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:SCRambling:STATe` on page 754

Data Scrambling ID
If Use PUSCH Scrambling ID > "On", sets the identifier `dataScramblingIdentityPDSCH` used to initialize data scrambling (c_init) for PUSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DSID` on page 754

MCS Table
Sets the MCS table and thus together with the parameter "MCS Table Transform Precoding" on page 173 defines the used modulation scheme.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MCSTable` on page 753

MCS Table Transform Precoding
Together with the selected "MCS Table", this parameter defines the used modulation scheme.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MTTPrecoding` on page 753

Resource Allocation
Sets the PxSCH resource allocation scheme and defines the allocation in the frequency domain.

Type 0 and dynamic switch are not available when transform precoding is on.

"Type 0", "Type 1"
Selects the downlink resource allocation scheme, according to TS 38.214.

"Dynamic Switch"
- If PDSCH Scheduling > "Auto/DCI":
  UE uses downlink resource allocation type 0 or type 1, as defined by the DCI field "Frequency domain resource assignment".
- If PDSCH Scheduling > "Manual":
  UE uses downlink resource allocation type 0 or type 1, as set with the parameter Resource Allocation.

This parameter defines the **PDSCH** allocation in the frequency domain globally and if you configure the allocations manually.

To configure the PDSCH based on the DCI:
- Set "Node > Scheduling > PDSCH Scheduling = Auto/DCI"
- Enable a DCI format 1_1 ("Scheduling > CORESET > Payload > DCI Format = 1_1") with "Config > Frequency Domain Resource Assignment = 262 143"
  Set "Create PDSCH > On"
- Observe the allocation information for PDSCH ("Scheduling > PDSCH > Info > Content > frequency domain allocation")

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RESalloc` on page 706
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:RESalloc` on page 754

Resource Block Group Size
For Resource Allocation = "Type 0/Dynamic Switch", the resource block assignment is defined in terms of resource block groups (RBG). An RBG is a set of consecutive virtual resource blocks and its size (`rbg-Size`) is defined as function of the BWP size and one of two possible configurations.

This parameter sets which of the two configurations defined in TS 38.214 is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RBGSize` on page 706
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:RBGSize` on page 754

Frequency Hopping
"Frequency Hopping" disables or enables inter- or intra-slot frequency hopping.

"Disabled"	Disable frequency hopping.
"Intra-Slot"	Enable intra slot frequency hopping. Both intra- and inter-subframe hopping are performed. The PUSCH position in terms of used resource blocks is changed each slot and each subframe.
"Inter-Slot"	Enable inter-slot frequency hopping. The PUSCH position in terms of used resource blocks is changed each subframe.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOP` on page 755

Max Code Block Groups Per Transport Block
Limits the number of code block groups per transport block.

In 5G NR a huge TB (transport block) is split into multiple code blocks (CB). Multiples CBs are grouped into one code block group (CBG). The number of code blocks grouped into the CBG can be limited by the "Max Code Block Groups Per Transport Block" setting.

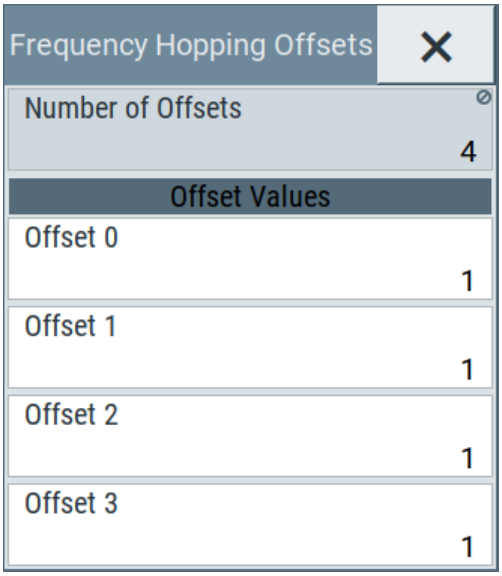
Disabled	Disabled the limitation of code block groups per transport block.
2, 4, 6, 8	Defines the max number of code block groups per TB.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MCBGroups` on page 750

xOverhead
Selects the size of the "xOverhead" parameter defined in 3GPP 38.214, chapter 5.1.3.2. The xOverhead parameter is used in RMCs for IAB-MT and determines the transport block size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:XOVerhead` on page 760

Frequency Hopping Offsets
Opens the "Frequency Hopping Offsets" dialog which displays the number of offsets and enables you to change the offset values.



Number of Offsets ← Frequency Hopping Offsets
Displays the number of frequency hopping offsets.

The number of offsets is set automatically to 2 or 4 depending on the size of the active BWP, as follows:

- If the size of the active BWP is fewer than 50 PRBs, one of two higher layer configured offsets is indicated in the UL grant.
- If the size of the active BWP is equal to or greater than 50 PRBs, one of four higher layer configured offsets is indicated in the UL grant.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOFfsets:NOFFsets` on page 755

Offset Values ← Frequency Hopping Offsets
Sets the value of the available offsets.

The number of offsets is set automatically to 2 or 4 depending on the size of the active BWP. See Number of Offsets for more information.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOFfsets:OFFSet<gr0>` on page 755

Full Power Transmission
Option: R&S SMW-K148.

For downlink transmission, the parameter controls the bit length of DCI fields. It corresponds to the higher layer parameter `ul-FullPowerTransmission` as defined in 3GPP 38.331.

For uplink transmission that uses codebook transmission, it defines the number of SRS resources and number of antenna ports used by the SRS resources. "Full power mode 2" allows to configure up to four SRS resources. Each SRS resource can use a different antenna ports. All other modes limit the SRS resources to two resources using the same antenna port.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FPTR` on page 758

Use Interlace
Option: R&S SMW-K148.

Shows the state of the higher layer parameter `useInterlacePUCCH-PUSCH` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:UITL?` on page 758

Control settings

The control settings section of the PUSCH properties contain settings related to DCI configuration.

Available when "Simple Mode" = "Off".

Control	
Minimum Scheduling Offset K2 0	Harq-ProcessNumberSizeDCI0_1 4 Bits
Priority Indicator DCI0_1 ☐	Priority Indicator DCI0_2 ☐
Invalid Symbol Indicator ☐	olpc-ParameterSet Not Configured
p0-PUSCH-SetList 0	ul-AccessConfigList DCI0_1 0
ul-AccessConfigList DCI0_2 0	Bits for Redundancy Version DCI0_2 0
Bits for HARQ DCI 0_2 0	Antenna Ports Present DCI0_2 ☐
	Type 1 Allocation Granularity DCI0_2

Minimum Scheduling Offset K2
Option: R&S SMW-K148.

Enables/disables the configuration of the minimum applicable scheduling offset indicator for the DCI format 0_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:OI01` on page 757

Harq-ProcessNumberSizeDCI0_1
Option: R&S SMW-K171.

Selects the size of the "HARQ Process Number" DCI field in DCI format 0_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:HP5Bits` on page 752

Priority Indicator DCI0_1 / DCI0_2
Option: R&S SMW-K148.

Turns the "Priority Indicator" DCI field in DCI formats 0_1 and 0_2 on and off.

Turn on this parameter if you want to define the bit length of the "Priority Indicator" DCI field.

Corresponds to higher layer parameter `priorityIndicatorDCI-0-1` / `priorityIndicatorDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PI01` on page 756
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PI02` on page 756

Invalid Symbol Indicator
Option: R&S SMW-K148.

Turns the "Invalid Symbol Pattern Indicator" DCI field in DCI formats 0_1 and 0_2 on and off.

Corresponds to higher layer parameter `invalidSymbolPatternIndicatorDCI-0-1` and `invalidSymbolPatternIndicatorDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:ISIN` on page 756

olpc-ParameterSet
Option: R&S SMW-K148.

Configures the open-loop power control parameter set indication as defined in 3GPP 38.212.

Corresponds to higher layer parameter `olpc-ParameterSetDCI-0-1` and `olpc-ParameterSetDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:OLPC` on page 757

p0-PUSCH-SetList
Option: R&S SMW-K148.

Configures the higher layer parameter `p0-PUSCH-SetList` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PPSL` on page 757

ul-AccessConfigList DCI0_1
Option: R&S SMW-K148.

Configures the higher layer parameter `ul-AccessConfigListDCI0-1` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:ACCList` on page 748

ul-AccessConfigList DCI0_2
Option: R&S SMW-K171.

Configures the higher layer parameter `ul-AccessConfigListDCI0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:A02List` on page 747

Bits For Redundancy Version DCI0_2
Option: R&S SMW-K148.

Defines the bit length of the DCI field "Redundancy Version" available in DCI format 0_2.

Corresponds to higher layer parameter `numberOfBitsForRV-DCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:BRV` on page 748

Bits For HARQ DCI 0_2
Defines the bit length of the DCI field "HARQ Process Number" available in DCI formats 0_2.

Corresponds to higher layer parameter `harq-ProcessNumberSizeDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:HA12` on page 702

Antenna Ports Present DCI0_2
Turns the "Antenna Ports" DCI field in DCI format 0_2 on and off.

Turn on this parameter if you want to define the bit length of the "Antenna Ports" DCI field.

Corresponds to higher layer parameter `antennaPortsFieldPresenceDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:APPResent` on page 748

DMRS Sequence Initialization DCI0_2
Turns the "DMRS Sequence Initialization" DCI field in DCI format 0_2 on and off.

Turn on this parameter if you want to define the bit length of the "DMRS Sequence Initialization" DCI field.

Corresponds to higher layer parameter `dmrs-SequenceInitializationDCI-0_2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DSINit` on page 751

Type 1 Allocation Granularity DCI 0_2
Option: R&S SMW-K148.

Configures the higher layer parameter `resourceAllocationType1GranularityDCI-0-2` as defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:T1GRan` on page 757

Use 2nd TPC Command
Turns the "2nd TPC Command for Scheduled PUSCH" DCI field on and off. This DCI field is supported by DCI formats 0_1 and 0_2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:U2TPc` on page 760

DMRS settings

The DMRS settings section of the PUSCH properties contain settings related to DMRS.

DMRS for Mapping Type A and Type B	
Same Settings for Type A and Type B ☑	
Config Type 1	Additional Position Index 0
Max Length 2	NPusch ID 0
Scrambling ID 0 0	Scrambling ID 1 0
Use R16 DMRS ☐	PTRS Config ...

Same Settings for Type A and Type B

Enables or disables the possibility to configure DMRS (demodulation reference signal) for mapping type A and B separately or identically. Per default, the same settings are applied for both DMRS mapping types.

Mapping type A and B define the DMRS position in the PUSCH, the starting symbol and length. The UE informs the BS about the mapping type supportability via the UE capability information message.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:BSAMe` on page 749

Config Type

Sets the configuration type (type 1 or type 2). It thus defines the mapping of the demodulation reference signal (DMRS) to the physical resource elements in the frequency domain, as defined in TS 38.211.

The configuration type is carried by the higher-layer parameter `dmrs-Type`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:CTYPe` on page 749
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:CTYPe` on page 749

Additional Position Index
Sets the parameter `dmrs-AdditionalPosition` that is required to select the positions of the DMRS symbols l˜, as defined in TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:APINdex` on page 750
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:APINdex` on page 750

Max Length
Sets the parameter `maxLength` and defines whether single- or double-symbol DMRS is used.

If "Max Length = 1", only single-symbol DMRS is allowed.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:MLENgth` on page 749
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:MLENgth` on page 749

NPusch ID
Sets the PUSCH ID value used for DMRS sequence generation.

Enabled if "Transform Precoding > On".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PUID` on page 750
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PUID` on page 750

Scrambling ID 0/Scrambling ID 1
Sets the higher-layer parameters `scramblingID0` and `scramblingID1` (N_{ID}^0,N_{ID}^1).

The values are used to calculate the initialization sequence of the pseudo-random sequence generator.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:SID0` on page 750
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:SID1` on page 750

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:SID0 on page 750
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:SID1 on page 750

Use R16 DMRS
Option: R&S SMW-K148.

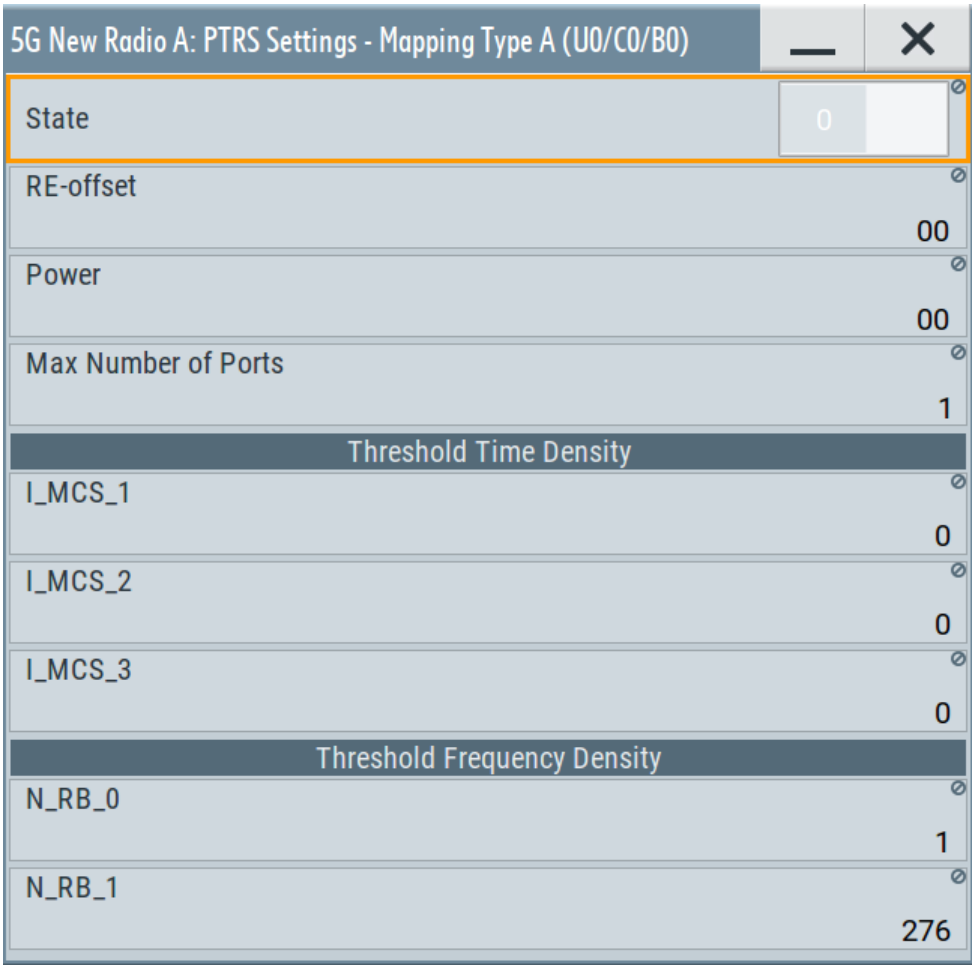
Turns the higher layer parameter "dmrs-uplink-r16" on and off.

This parameter reduces the peak-to-average power ratio (PAPR) of the PUSCH DMRS as defined 3GPP, release 16. Using the low PAPR also results in a different calculation of the DMRS sequence.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:UR16 on page 751
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:UR16 on page 751

PTRS Config ...
Enabled if Transform Precoding.

Comprises the settings of the phase-tracking reference signals (PTRS) for PxSCH, as defined in TS 38.214.



The phase tracking reference signal (PTRS) is a UE-specific reference signal that is used to compensate for the phase noise of the oscillator. Phase-tracking reference signals can be transmitted only in the resource blocks used for the PxSCH and if the transmission is enabled.

If the PTRS "State" is on, you can define its "Power" relative to the PxSCH and its location in the resource grid.

State ← PTRS Config ...

If DSCH/USCH Channel Coding > "On", enables the transmission of phase-tracking reference signals.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:STATe` on page 713

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:STATe` on page 713

RE-offset ← PTRS Config ...

Sets the parameter `resourceElementOffset` k_{ref}^{RE} required to define the precoding and mapping to the physical resources.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:REOF on page 713
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:REOF on page 713

Power ← PTRS Config ...
Sets the parameter `ptrs-Power` and thus defines the PUSCH to PTRS power ratio per layer per resource element.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:POWer on page 714
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:POWer on page 714

Max Number of Ports ← PTRS Config ...
Sets the maximum number of configured PTRS ports, given by the higher-level parameter `maxNrofPorts`.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:PORT on page 714
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:PORT on page 714

I_MCS_1/I_MCS_2/I_MCS_3 ← PTRS Config ...
Sets the threshold values ptrs-MCS_I with I = {1, 2, 3} transmitted by the higher-layer parameter `timeDensity` in `PTRS-DownlinkConfig` .

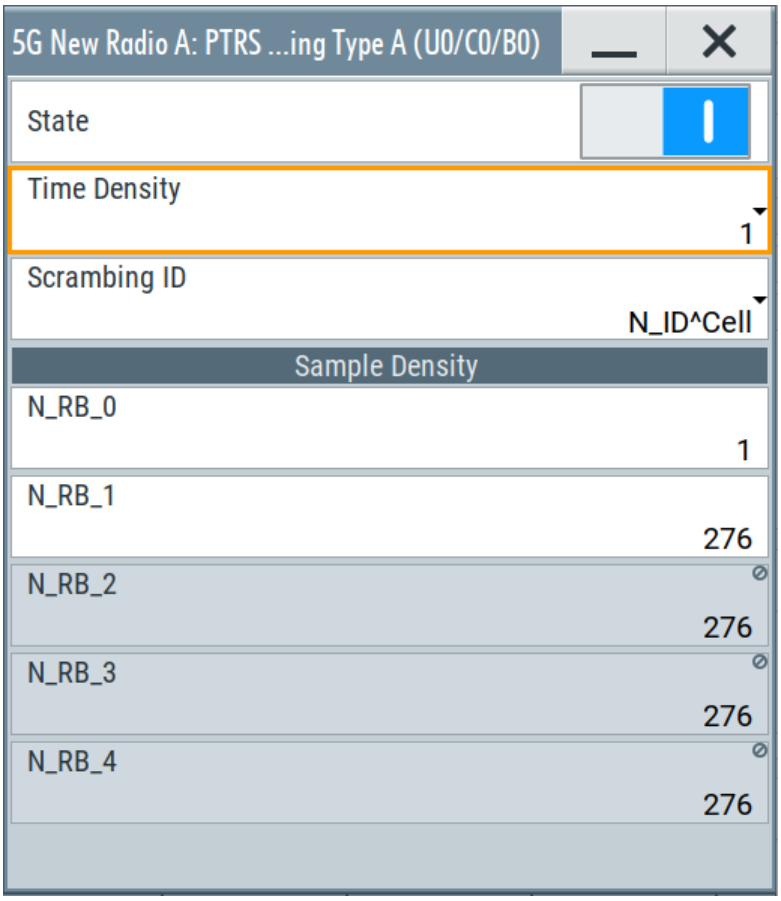
Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS1 on page 715
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS2 on page 715
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS3 on page 715
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS1 on page 715
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS2 on page 715
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS3 on page 715

N_RB_1/N_RB_2 ← PTRS Config ...
Sets the threshold values NRB_I with I = {0, 1} transmitted by the higher-layer parameter `frequencyDensity` in `PTRS-DownlinkConfig` .

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:RB0` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:RB1` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:RB0` on page 715
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:RB1` on page 715

PTRS Config (Transform Precoding) ...
Enabled if Transform Precoding > "On" and Link Direction > "Uplink".

Comprises the settings of the phase-tracking reference signals (PTRS) for PUSCH incl. transform precoding (TP), as defined in TS 38.214.



State ← PTRS Config (Transform Precoding) ...
Simulates the transmission of the higher-layer parameter `transformPrecoderEnabled`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:STATe` on page 758
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:STATe` on page 758

Time Density ← PTRS Config (Transform Precoding) ...
Per default, an UE is configured with time density L_{PTRS} = 1.

Set the value of this parameter to 2 to simulated an UE configured by the higher-layer parameter `timeDensityTransformPrecoding`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:TMDensity` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:TMDensity` on page 759

Scrambling ID ← PTRS Config (Transform Precoding) ...
Sets whether the PTRS Scrambling ID value used for PTRS sequence generation is configured by the NPusch ID (higher layer) or by the cell ID.

N_ID^Cell	Sets the cell ID as the scrambling ID for PTRS sequence generation.
N_ID^PUSCH	Sets the NPusch ID as the scrambling ID for PTRS sequence generation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:SCID` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:SCID` on page 759

N_RB_x ← PTRS Config (Transform Precoding) ...
Sets the higher-layer parameter `sampleDensity` that indicates the sample density thresholds $N_{RB,i}$.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB0` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB1` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB2` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB3` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB4` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB0` on page 759
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB1` on page 760

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB2 on page 760
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB3 on page 760
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB4 on page 760

Time domain allocation

The time domain allocation list section of the PUSCH properties contain settings related to PUSCH time domain scheduling.

Available when "Simple Mode" = "Off".

Time Domain Allocation List	
Time Domain Allocations DCI0_1 0	Time Domain Allocations DCI0_2 0
Time Domain Allocations Multi-PUSCH 0	Multi-PUSCH Length 1

Time Domain Allocations DCI0_1
Sets the number of time domain allocations used to calculate the bitwidth of the "Time Domain Resource Assignment" for the UL DCI format 0_1 as specified in TS 38.214.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:TDANum on page 760

Time Domain Allocations DCI0_2
Sets the number of time domain allocations used to calculate the bitwidth of the "Time Domain Resource Assignment" for the UL DCI format 0_2 as specified in TS 38.214.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:DC02:TDANum on page 761

Time Domain Allocations Multi-PUSCH
Defines the number of entries in the higher layer parameter `pusch-TimeDomainAllocationListForMultiPUSCH` (number of schedulable PUSCH) as defined in 3GPP 38.212.

Remote command:
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:MULTi:TDANum on page 761

Multi-PUSCH Length
Defines the maximum number of schedulable PUSCH among all entries in the higher layer parameter `pusch-TimeDomainAllocationListForMultiPUSCH`.

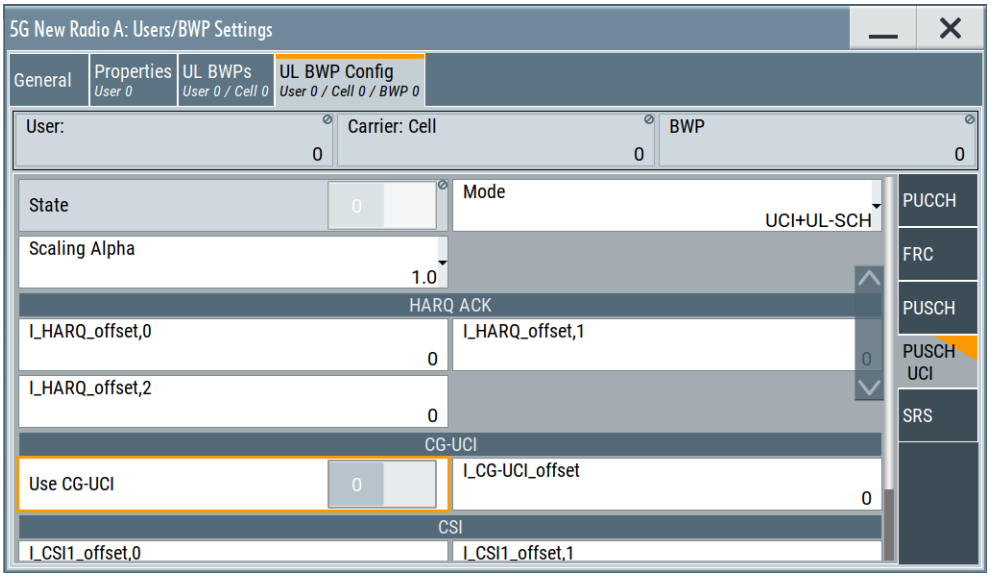
The multi-PUSCH length has effects on the length of various DCI fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:MULTi:PLEN` on page 761

5.3.7.5 PUSCH UCI settings

Access:

► Select "User/BWP Settings > UL BWP Config > PUSCH UCI".



Here you can define the PUSCH uplink control information (UCI) parameters, such as the settings of the uplink shared channel (UL-SCH), HARQ control information, and the channel state information (CSI).

State
Enables the transmission and the configuration of the uplink control information (UCI).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:STATe` on page 762

Mode
Defines the information transmitted on the PUSCH.

"UCI+UL-SCH" Control information and data are multiplexed into the PUSCH.

"UCI only" Only uplink control information is transmitted on PUSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:MODE` on page 762

Scaling Alpha
Sets the higher-layer parameter `scaling`. It defines the value of the parameter α required for the calculation of the number of coded modulation symbols per layer for HARQ-ACK and CSI transmissions.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:ALPHa` on page 763

I_HARQ_Offset,x
According to TS 38.213, the number of resources for multiplexing the HARQ-ACK information in a PUSCH is defined by the information offsets $\beta^{HARQ\text{-}ACK}_{offset}$.

The information offsets are defined by the indexes $I^{HARQ\text{-}ACK}_{offset,x}$, where :

- x = 0, 1, 2 and
- $I^{HARQ\text{-}ACK}_{offset,0}$ is used if up to 2 HARQ-ACK information bits are multiplexed
- $I^{HARQ\text{-}ACK}_{offset,1}$ is used for multiplexing of 2 to 11 HARQ-ACK information bits
- $I^{HARQ\text{-}ACK}_{offset,2}$ is used if more than 11 HARQ-ACK information bits are multiplexed

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF0` on page 763
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF1` on page 763
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF2` on page 763

Use CG-UCI
Option: R&S SMW-K148.

Turns transmission of configured grant uplink control information (CG-UCI) in the PUSCH on and off. The CG-UCI is defined in 3GPP release 16.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CGUCi:STATe` on page 763

I_CG-UCI_Offset
Defines an offset for the CG-UCI according to 3GPP TS 38.213, table 9.1.3. The offset is a value in terms of resource elements within the resource elements used by PUSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CGUCi:OFFSet` on page 763

I_CSI1_Offset,x, I_CSI2_Offset,x

According to TS 38.213, the number of resources for multiplexing the CSI information in a PUSCH is defined by the CSI part 1 and CSI part 2 information offsets β^{CSI-1}_{offset} and β^{CSI-2}_{offset}.

The information offsets are defined by the indexes $I^{CSI-1}_{soffset,x}$ and $I^{CSI-2}_{offset,x}$, where :

- x = 0, 1 and
- $I^{CSI-1}_{offset,0}$ and $I^{CSI-2}_{offset,0}$ is used if up to 11 CSI bits are multiplexed
- $I^{CSI-1}_{offset,1}$ and $I^{CSI-2}_{offset,2}$ is used for more than 11 CSI bits

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF10` on page 764

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF11` on page 764

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF20` on page 764

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF21` on page 764

5.3.7.6 SRS settings

Access:

1. Select "User/BWP Settings > UL BWP Config > SRS".
2. Select "User/BWP Settings > UL BWP Config > SRS > Resource Set = 1".
3. Select "Resource > Config".
4. To observe the SRS allocations on the time plan, proceed as follows:
   a) Select "5G NR > General > Link Direction > Uplink".
   b) Select "Scheduling > PUSCH > State > Off".

c) Select "General > Time Plan".

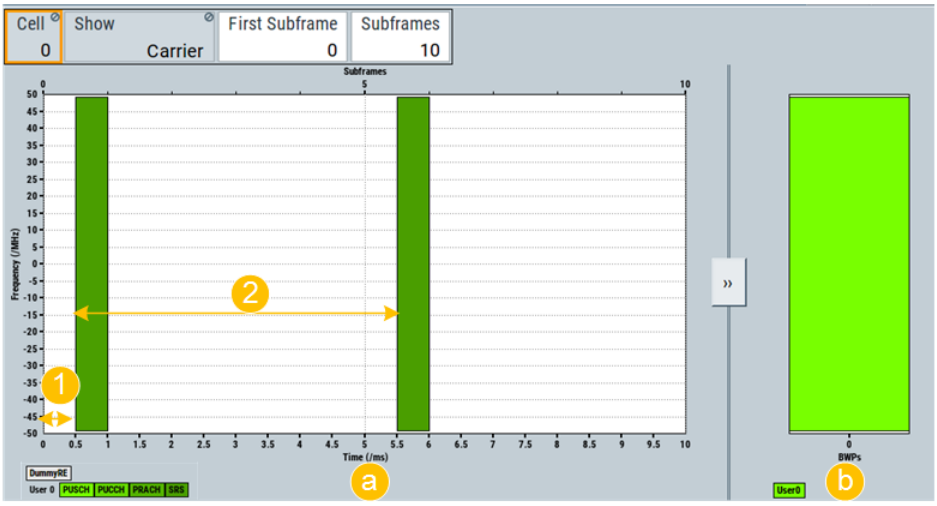


Figure 5-7: SRS representation on the Time Plan

a = SRS (PUSCH transmission is disabled)
b = Bandwidth part (273 RBs)
1 = Offset = 1 slot
2 = Periodicity = 10 slots

The sounding reference signal (SRS) is an UL reference signal transmitted by the UE. The BS uses the received SRS to estimate the UL channel quality for the particular user.
The SRS structure is defined in TS 38.211, TS 38.214 and TS 38.331.

SRS structure

The SRS 5G NR structure is similar to the SRS structure used in LTE. In 5G NR, SRS is transmitted within the BWP, based on a flexible scheduling and using only portions of the overall channel bandwidth. Among other, the SRS supports the frequency hopping and transmission comb techniques known from LTE.

In the **time domain**, the SRS resource is defined as:

- 1, 2 or 4 consecutive OFDM symbols (No. Sym. N_{symb}^{SRS})
- A starting position Start Pos. l_0 (i.e. the starting OFDM symbol), calculated as follows:
  $l_0 = N_{symb}^{slot} - 1 - l_{offset}$
  Where l_{offset} = {0 to 5} is an offset relative to the end of a slot.

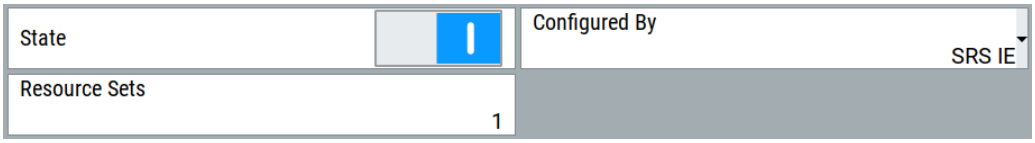
In the **frequency domain**, its starting position is defined by the parameter k_0 and the density indication is given by the parameter frequency shift.

The SRS can be mapped to 1, 2 or 4 antenna ports (No. Ports N_{ap}^{SRS}) and its transmit Power is controlled, too.

Settings

General settings

The general settings section of the SRS properties contain settings to configure general properties of the selected user.



State
Enables the SRS transmission.

Use this function to suppress the SRS indication on the "Time Plan".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:STATe` on page 765

Configured By
Option: R&S SMW-K148 and -K171

Selects the 3GPP release the SRS is based on.

As of 3GPP release 16, the SRS also can also be used for positioning purposes. Select "SRS Pos R16 IE" to generate signals in which the SRS carries positioning information.

Note that the value ranges for several SRS resources depend on which 3GPP release the SRS is based on.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:CONFig` on page 766

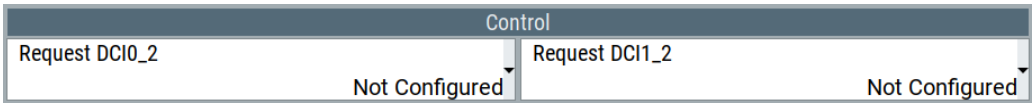
Resource Sets
Sets the number of SRS sets and thus defines the number of table rows in SRS resource set table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:NRSets` on page 766

Control settings

The control settings section of the SRS properties contain settings related to DCI configuration.

Available when "Simple Mode" = "Off".



Request DCI0_2
Configures the higher layer parameter `srs-RequestDCI0-2` available for DCI format 0_2 (number of bits of "SRS Request" DCI field).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RE02` on page 766

Request DCI1_2
Configures the higher layer parameter `srs-RequestDCI0-2` available for DCI format 1_2 (number of bits of "SRS Request" DCI field).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:REQuest` on page 767

SRS configuration table

The SRS table section of the SRS properties contain settings related to the SRS resource sets. The number of table rows depends on the number of resource sets.

Resource Type

Indicates that periodic SRS transmission is configured.

Periodic SRS means that the SRS occurs at regular time interval. "Aperiodic" and "Semi-Persistent" SRS will be supported in a future firmware version.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RSTYpe` on page 768

Usage

Indicates whether a codebook based or a non-codebook based transmission is used.

The value is set automatically and resembles the transmission method selected for PUSCH, see "UL BWP Config > PUSCH" > TxConfig.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:USAGe` on page 768

Resource > Config

Opens a dialog where you configure the SRS resources for the selected SRS resource set.

Resources ← Resource > Config

Sets the number of SRS resources in the SRS resource set.

Each SRS resource is configured in an individual row in the SRS resource table.

The maximum number of SRS resources depends on whether TxConfig = "Codebook" or not.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:NRESources` on page 768

Periodicity ← Resource > Config
If Usage = "Periodic", sets the SRS repetition factor T_{SRS}. The periodicity is a time interval defined as number of slots that indicates how often (i.e. after how many slots) the SRS is transmitted.

As smaller the periodicity value as frequent is the SRS transmission. To enable the SRS for example in each slot, set "Periodicity = 1 slot".

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:PER` on page 769

Offset ← Resource > Config
If Usage = "Periodic" and Periodicity ≥ "2 slots", sets time position of first SRS allocation within an SRS periodicity, given as an offset in number of slots (T_{offset}) from the start of the frame.

Logically, the maximum offset value is calculated as SRS Periodicity - 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:OFFSet` on page 769

Start Pos. ← Resource > Config
Sets the starting position of the SRS allocation l_0 within a slot. The value gives the OFDM symbol number counted backwards from the end of a slot, see "SRS structure" on page 191.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SPOS` on page 769

No. Sym. ← Resource > Config
Sets the number of consecutive OFDM symbols (N_{symb}^{SRS}) the SRS resource spans.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SYMNumber` on page 769

Freq. Pos. ← Resource > Config
Sets the parameter k_0 that defines the starting position of the SRS allocation in the frequency domain.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FPOS` on page 770

Freq. Shift ← Resource > Config
The frequency shift n_{shift} influence the SRS transmission density in the frequency domain.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FQSHift` on page 770

B SRS ← Resource > Config
Sets the filed b-SRS contained in the higher-layer parameter `freqHopping` and used to define the length of the SRS sequence, see TS 38.211, Table 6.4.1.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:BSRS` on page 770

C SRS ← Resource > Config
Sets the filed c-SRS contained in the higher-layer parameter `freqHopping` and used to define the length of the SRS sequence, see TS 38.211, Table 6.4.1.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:CSRS` on page 771

B Hop ← Resource > Config
Sets the parameter b_{Hop} that defines the frequency hopping of the SRS.

Set "B Hop" > "B SRS" to disable frequency hopping ("Rep. Factor" = 1).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:BHOP` on page 771

Rep. Factor ← Resource > Config
If B Hop < B SRS, defines how many times the SRS symbols are repeated.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:REFactor` on page 771

Trans. Comb ← Resource > Config
Transmission comb (k_{TC}) is a method for interleaving SRS symbols by using alternating subcarriers (only the even or odd subcarriers).

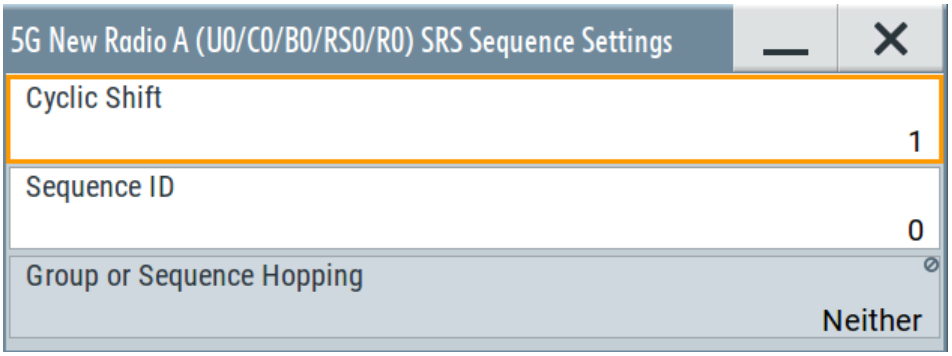
The value of k_{TC} defines the maximum number of cyclic shifts n_{SRS}^{cs} (Cyclic Shift).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:TRTComb` on page 771

Comb Offset ← Resource > Config
Sets the parameter transmission comb offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:COFFset` on page 772

Sequence Settings > Config ← Resource > Config
Access: "User/BWP Settings > UL BWP Config > SRS > Resource Set = 1", "Resource > Config" and select "Sequence > Config".



Cyclic Shift ← Sequence Settings > Config ← Resource > Config
Sets the number of cyclic shifts n_{SRS}^{cs}, required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:CYCShift` on page 772

Sequence ID ← Sequence Settings > Config ← Resource > Config
Sets the higher-layer parameter `sequenceId` (n_{ID}^{SRS}), required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:ID` on page 772

Group or Sequence Hopping ← Sequence Settings > Config ← Resource > Config
Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group, required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:HOPPing` on page 773

Frequency Scaling Factor ← Sequence Settings > Config ← Resource > Config
Option: R&S SMW-K171

Selects the frequency scaling factor defined in 3GPP 38.211, chapter 6.4.1.4.3.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FS:FSFactor` on page 767

Start RB Index ← Sequence Settings > Config ← Resource > Config
Option: R&S SMW-K171

Defines the start RB index defined in 3GPP 38.331. The parameter is defined through the RRC parameter `startRbIndexAndFreqScalingFactor`.

Values depend on the frequency scaling factor: possible values = scaling factor - 1.

Available if the frequency scaling factor > 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FS:SRIDx` on page 767

No. Ports ← Resource > Config
If TxConfig = "Codebook", sets how many antenna ports (AP) are used for every SRS transmission. The same number of antenna ports is used for all SRS resources.

If "Non-Codebook" transmission is used, the value of the parameter "No. Ports" is set automatically.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:NAPort` on page 773

PTRS Port Idx ← Resource > Config
Sets the PTRS antenna port index. The maximum number of configured PTRS ports is set with the parameter Max Number of Ports.

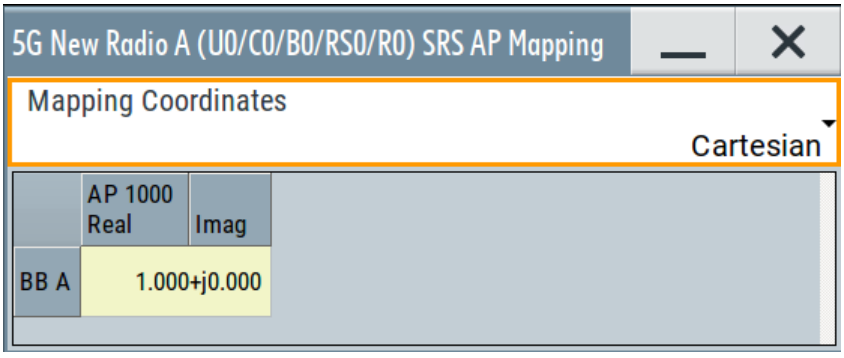
Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:PTRS` on page 774

Power ← Resource > Config
Sets the SRS power.

The value is set relative to the PUSCH power.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:POWer` on page 773

Antenna Ports > Config ← Resource > Config
Access: "User/BWP Settings > UL BWP Config > SRS > Resource Set = 1", "Resource > Config" and select "Antenna Ports > Config".



For details on the antenna ports-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Mapping Coordinates ← Antenna Ports > Config ← Resource > Config
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping table ← Antenna Ports > Config ← Resource > Config
Defines the mapping of the antenna ports (AP) to the physical antennas.

Set the number of antenna ports (AP) with the parameter No. Ports.

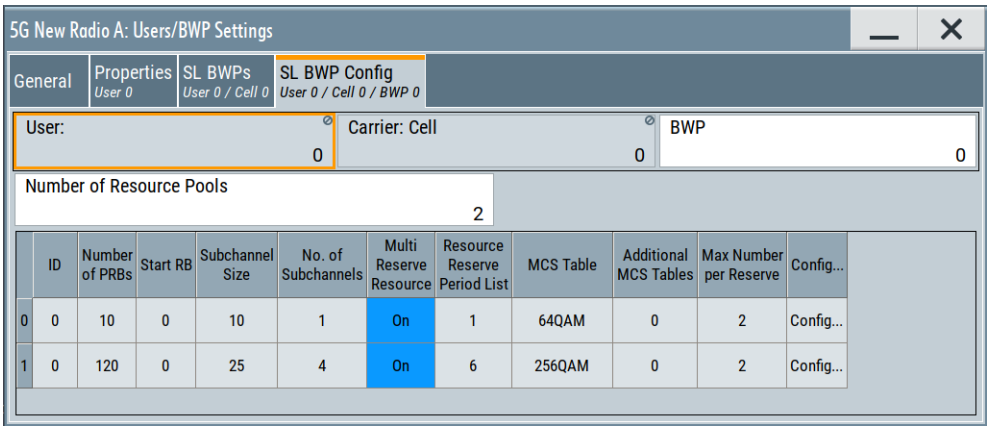
For details on the antenna ports-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL` on page 774
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary` on page 775
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude` on page 775
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe` on page 776

5.3.8 SL BWP configuration settings

Access:

1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "General > Users/BWPs" > "SL BWP Config".



The dialog includes settings to configure sidelink resource pools.

5.3.8.1 Basic resource pool management

Basic resource pool management settings allow you to select which signal part you want to configure.

User:
Selects the user to be configured.

Available if the number of users is greater than 1.

Remote command:
via suffix at `USER<ch>`

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

BWP
Select the bandwidth parts (BWP) whose settings are displayed for configuration.

There are one or more BWPs, as set with the parameter "User/BWP Settings > DL BWPs" > Number of SL BWPs.

Remote command:
via suffix at `BWP<dir0>`

Number of Resource Pools
Defines the number of resource pools used for sidelink transmissions.

A resource pool is a set of resource blocks that can span multiple subcarriers (subchannels) in the frequency domain and subframes in the time domain. Within a subframe, each slot is automatically assigned to certain channels (PSSCH, PSCCH or S-SS/PSBCH).

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:NRESpool` on page 777

5.3.8.2 Resource pool configuration table

The resource pool configuration table contains settings to configure each resource pool. Each row in the table represents on resource pool. The number of rows therefore depends on the number of resource pools you have defined.

ID

Shows the unique identifier for the resource pool in the range from 0 to 639.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:INDicator` on page 778

Number of PRBs

Defines the number of contiguous physical resource blocks (PRB) the resource pool uses and therefore its overall size in the resource grid.

The number of physical resource blocks has an effect on the available subchannel sizes and the supported number of subchannels.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NPRB` on page 779

Start RB

Defines the first resource block in the bandwidth part that the resource pool uses.

The value range depends on the number of physical resource blocks that the resource pool occupies.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:STRB` on page 781

Subchannel Size

Defines the size of a resource pool subchannel in terms of physical resource blocks. In the frequency domain, a resource pool can consist of one or more subchannels.

Subchannel sizes are a set of predefined values whose availability depends on the number of physical resource blocks that the resource pool occupies.

For example, if you assign 50 PRBs to the resource pool, you can define a subchannel size up to 50 resource blocks. In that case, the subchannel would occupy all PRBs.

Remote command:

`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:SCHSize` on page 781

Number of Subchannels

Selects the number of subchannels of the resource pool.

The number of subchannels you can define depends on the number of physical resource blocks that the resource pool occupies and the size of the subchannel.

For example, if you assign 50 PRBs to the resource pool and define a subchannel size of 25 resource blocks, you can create up to two subchannels.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NSUBchannels` on page 779

Multi Reserve Resource
Turns reservation of a sidelink resource for an initial transmission of a TB by an SCI associated with a different TB, based on sensing and resource selection procedure on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MREServe` on page 778

Reserve Resource Period List
Defines the possible resource reservation period allowed in the resource pool in the unit of ms.

This value corresponds to higher layer parameter `sl-ResourceReservePeriodList` defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:REPList` on page 780

MCS Table
Selects the modulation scheme of the resource pool.

Sidelink resource pools can have a 64QAM, 256QAM or 64QAMLowSE modulation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MSCTable` on page 779

Additional MCS Table
Selects the MCS table additionally used by the resource pool.

This value corresponds to higher layer parameter `sl-Additional-MCS-Table` defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:AMCS` on page 777

Max Number per Reserve
Defines the maximum number of reserved PSCCH/PSSCH resources that can be indicated by an SCI.

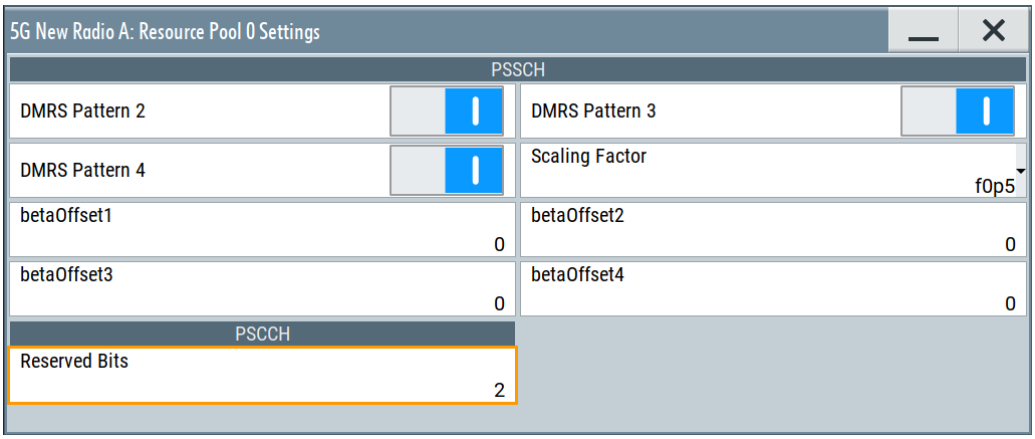
This value corresponds to higher layer parameter `sl-MaxNumPerReserve` defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MNPRes` on page 778

Config
Opens a dialog with enhanced settings for the resource pool.

5.3.8.3 Enhanced resource pool configuration

Contains settings to configure PSSCH and PSCCH properties in the corresponding resource pool.



DMRS Pattern 2 ... 4
Turns DMRS time domain patterns in the first stage SCI (SCI1A) on and off.

The number of DMRS pattern in SCI1A depends on the number of active DMRS patterns.

These values corresponds to higher layer parameter `sl-PSSCH-DMRS-TimePatternList` defined in 3GPP 38.331.

Remote command:
DMRS pattern 2: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT2` on page 780
DMRS pattern 3: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT3` on page 780
DMRS pattern 4: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT4` on page 780

Scaling Factor
Selects a scaling factor to limit the number of resource elements assigned to the second stage SCI on PSSCH.

This value corresponds to higher layer parameter `sl-Scaling` defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:SCALing` on page 781

betaOffset1 ... 4
Defines beta-offset values to determine the number of coded modulation symbols for second stage SCI (SCI2).

These values corresponds to higher layer parameter `sl-BetaOffsets2ndSCI` defined in 3GPP 38.331.

Remote command:
betaOffset1: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF1` on page 777
betaOffset2: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF2` on page 777
betaOffset3: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF3` on page 778
betaOffset4: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF4` on page 778

Reserved Bits
Defines the number of reserved bits in the first stage SCI pattern (SCI1A).

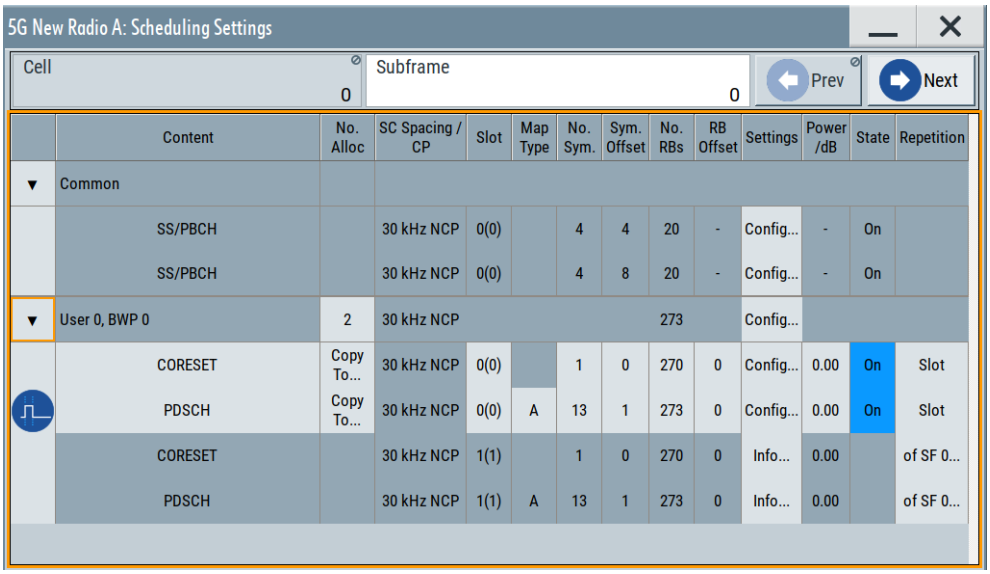
This value corresponds to higher layer parameter `sl-NumReservedBits` defined in 3GPP 38.331.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:RESBits` on page 780

5.4 Scheduling settings

Access:

► Select "Baseband > 5G NR > Scheduling".



	Content	No. Alloc	SC Spacing / CP	Slot	Map Type	No. Sym.	Sym. Offset	No. RBs	RB Offset	Settings	Power /dB	State	Repetition
▼	Common												
	SS/PBCH		30 kHz NCP	0(0)		4	4	20	-	Config...	-	On	
	SS/PBCH		30 kHz NCP	0(0)		4	8	20	-	Config...	-	On	
▼	User 0, BWP 0	2	30 kHz NCP					273		Config...			
	CORESET	Copy To...	30 kHz NCP	0(0)		1	0	270	0	Config...	0.00	On	Slot
	PDSCH	Copy To...	30 kHz NCP	0(0)	A	13	1	273	0	Config...	0.00	On	Slot
	CORESET		30 kHz NCP	1(1)		1	0	270	0	Info...	0.00		of SF 0...
	PDSCH		30 kHz NCP	1(1)	A	13	1	273	0	Info...	0.00		of SF 0...

This dialog displays an overview of distribution of the configured allocations in the time domain.
Because the slot is the basis time unit in 5G NR and the basis granularity in the numerologies, the **5G NR scheduling is performed on a per slot basis**. In comparison, the LTE scheduling is subframe-based. However, the scheduling dialog still shows the configuration of a complete subframe, as the subframe (besides the frame) is the common time boundary between the different numerologies.

Scheduling table: Understanding the displayed information

The allocation table lists the characteristics of all used allocations over all bandwidth parts and users for the corresponding link direction.

The table has two sections that distinguish the allocations between common and user-specific allocations.

- "Common" allocations:
  All allocations that are independent of a specific user. These allocations include SS/PBCH allocations (downlink only), puncturing allocations, dummy RE allocations or positioning reference signal allocations (downlink only). Most of these allocations are configured elsewhere in the user interface and are therefore read-only, with the exception of puncturing allocations.
- "User x BWP x" allocations:
  All allocations that are specific to a certain user. The table contains a group of allocations for each user throughout all bandwidth parts. The number of groups therefore depends on the number of users you have defined in each bandwidth part you have defined. User allocations include PDSCH and CORESET allocations (down-

link), PUSCH, PRACH and PUCCH allocations (uplink), LTE-CRS allocations or CSI-RS allocations.

You can collapse or expand each allocation group by selecting the arrow in the leftmost column of the table.

There are two types of allocations: configurable allocations and read-only allocations.

- *Configurable allocations*
  You can configure these allocations in the first 256 subframes. The configurable allocations are always the first allocations in each allocation group.
  To append or remove allocations of this type, set the number of allocations (No. of Allocations) for the corresponding group.
  Once configured, these allocations are repeated as defined in the Repetition/Repetition Type field.
- *Read-only allocations*
  These allocations are configured automatically, based on: scheduling mode, DCI, repetition of an allocation configured in previous/same subframe, ongoing allocations, aggregated PDSCH, or because they are configured elsewhere, like for example SS/PBCH, SRS, CSI-RS, dummy RE.
  You can observe the allocations in all available subframes, where the number of subframes depends on the ARB sequence length.

The icon at the beginning of a table row, indicates that this allocation is set as Burst Mode Ref Alloc Identifier for the "Burst" power mode.

To offer a better overview of the 5G NR frame structure in configurations including several slots, i.e. complicated TDD settings, the Slot column displays the slot number in the frame in parentheses next to the slot number in the subframe.

Allocating channels in the time and frequency domains

The following settings define the allocation position:

- SC Spacing/CP (defines the available resources)
- Time domain: Slot, No. Sym. and Sym. Offset
- Frequency domain: No. RB and RB Offset
- Repetition/Repetition Type

The allocation table shows information on the selected channel or signal. Additionally, for each "User x BWP x" summary information is also displayed, if this information affects the channel allocation within the BWP, e.g. SC Spacing/CP or No. RB.

If allocations are overlapping, a conflict is indicated in the most left column of the allocation table.

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

All Users
Selects the number of users shown in the scheduling table.

If on, the scheduling table shows all configurable users at the same time. Each row in the table corresponds to one user. The "Content" column shows the user ("User 0", "User 1" etc.).

If off, the scheduling table contains only one user (one row). You can select the displayed user in the "User(s)" field.

The table can display a maximum of 10 users. If you set up more than 10 configurable users, the table shows only one user at a time ("All Users" field is unavailable). Instead of displaying several users, the table only contains the currently selected user.

Remote command:
n/a

User(s)
Selects the user you can configure in the scheduling table. The selected user is represented as a single row in the scheduling table. The range of users depends on the number of users you have defined.

Available if all users is off.

Remote command:
n/a

Subframe
Sets the subframe to be configured.

The maximum number of available subframes N_{SF} is calculated as follows:

N_{SF} = 10 * "ARB Sequence Length" - 1

Remote command:
via suffix at `SUBF<st0>`

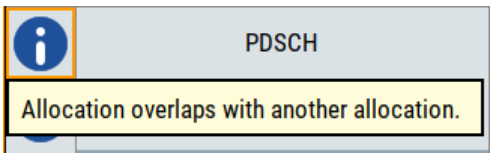
Next/Prev
Navigates through the subframes.

Remote command:
n.a.

Expand/Collapse
Shows/hides the group of settings.

Remote command:
n.a.

Conflict
A conflict is indicated if two allocations with the same priority overlap.



Observe also the Time Plan.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONFlict?` on page 786

Content
Selects the allocation type. The allocation type is the allocated channel or signal.

The allocation type also defines which cells / columns are available and editable in the scheduling table.

Common allocations:
- Dummy RE allocations
  Dummy RE information is read only and the number of used allocations depends its configuration. For more information about configuring dummy REs, see Chapter 5.2.10, "Dummy REs settings", on page 90.

- Puncturing allocations
  The number of used puncturing allocations is variable. You can configure these allocations directly in the scheduling table.
  Puncturing allocations are necessary for NB-IoT in-band testing according to 3GPP 38.141-1, chapter 4.9.2.2.9. Puncturing allocations always have zero power.
- SS/PBCH (downlink only)
  SS/PBCH information is read only and the number of used allocations depends its configuration. For more information about configuring the SS/PBCH, see Chapter 5.2.7, "SS/PBCH settings", on page 74.
- PRS (downlink only)
  PRS information is read only and the number of used allocations depends its configuration. For more information about configuring the PRS, see Chapter 5.2.9, "PRS settings", on page 84.
  If "Node > PRS" > State = "On", PRS allocations are configured automatically.
- S-SS/PSBCH (sidelink only)
  S-SS/PSBCH information is read only and the number of used allocations depends its configuration. For more information about configuring the S-SS/PSBCH, see Chapter 5.2.8, "S-SS/PSBCH settings", on page 81.
  Requires Option: R&S SMW-K170

User allocations:

- PDSCH and CORESET (downlink only)
  The number of used PDSCH and CORESET allocations is variable. You can configure the these allocations directly in the scheduling table. For additional information about enhanced PDSCH and CORESET settings, see Chapter 5.5, "PDSCH and PUSCH settings", on page 220 and Chapter 5.6, "CORESET settings", on page 245.
  If PDSCH Scheduling = "Auto/DCI", the "Content" = "CORESET".
  (PDSCH allocations are configured automatically)
- LTE-CRS (downlink only)
  LTE-CRS information is read only and the number of used allocations depends its configuration. For more information about configuring the LTE-CRS, see Chapter 5.2.6, "LTE-CRS coexistence settings", on page 71.
- CSI-RS (downlink only)
  Configuring CSI-RS allocations is possible in two ways that are independent from each other.
  - Directly via the "Scheduling" dialog.
    To configure CSI-RS allocations like this, select "Content" = "CSI-RS" for the corresponding allocation. This method allows you to edit various characteristics in the corresponding row of the scheduling table. More advanced settings become available when you select "Config" for the corresponding allocation. For more information, see Chapter 5.7, "CSI-RS settings (scheduling table)", on page 278.
  - Via the user / bandwidth part settings dialog.
    To configure CSI-RS allocations like this, select "Users/BWPs" > "DL BWP Config" > "ZP / NZP CSI-RS". This method adds read-only allocations to the scheduling table. The number of rows depends on the number of resource sets you have defined for the CSI-RS. For more information about configuring the CSI-RS, see Chapter 5.3.6.6, "ZP CSI-RS settings", on page 151 and Chapter 5.3.6.7, "NZP CSI-RS settings", on page 154.
- RIM-RS

The number of used RIM-RS allocations is variable. You can configure the these allocations directly in the scheduling table. For more information about the RIM-RS settings, see Chapter 5.8, "RIM-RS setting (scheduling table)", on page 281.

- PUSCH and PUCCH (uplink only)
  The number of used PUSCH and PUCCH allocations is variable. You can configure the these allocations directly in the scheduling table. For additional information about enhanced PUSCH and PUCCH settings, see Chapter 5.5, "PDSCH and PUSCH settings", on page 220 and Chapter 5.9, "PUCCH settings", on page 282.
- PRACH (uplink only)
  The number of used PRACH allocations is variable. You can configure the these allocations directly in the scheduling table. For additional information about enhanced PRACH settings, see Chapter 5.10, "PRACH settings", on page 289.
- SRS (uplink only)
  Configuring SRS allocations is possible in two ways that are independent from each other.
  – Directly via the "Scheduling" dialog.
    To configure SRS allocations like this, select "Content" = "SRS" for the corresponding allocation. This method allows you to edit various characteristics in the corresponding row of the scheduling table. More advanced settings become available when you select "Config" for the corresponding allocation. For more information, see Chapter 5.11, "SRS settings (scheduling table)", on page 291.
  – Via the user / bandwidth part settings dialog.
    To configure SRS allocations like this, select "Users/BWPs" > "UL BWP Config" > "SRS". This method adds read-only allocations to the scheduling table. The number of rows depends on the number of resource sets you have defined for the SRS. For more information about configuring the SRS, see Chapter 5.3.7.6, "SRS settings", on page 190.
- PSSCH and PSCCH (sidelink only)
  The number of used PSSCH and PSCCH allocations is variable. You can configure the these allocations directly in the scheduling table. For additional information about enhanced PSSCH and PSCCH settings, see Chapter 5.12, "PSSCH and PSCCH settings", on page 297.

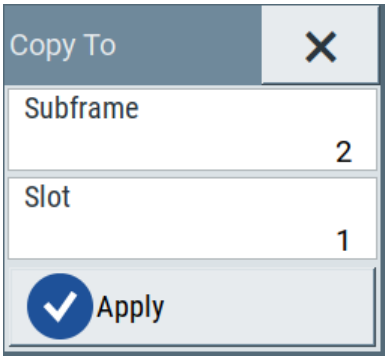
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONTent` on page 787

No. of Allocations
Defines the number of configurable allocations.

- For "Common" allocations, you can define the number of puncturing allocations.
- For each "User x BWP x" group, you can define the number of user allocations.

Remote command:
Common allocations: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:NALLoc` on page 796
User allocations: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:NALLoc` on page 796

Copy To...
Opens the "Copy To" dialog which enables you to copy the settings to another subframe and slot.



Remote command:
n.a.

Subframe
Sets the target subframe to copy the settings to.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:SUBF` on page 788

Slot
Sets the target slot to copy the settings to.

Remote command:
Copy To Slot: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:SLOT` on page 788

Apply
Starts the copying process.

Remote command:
Copy To Apply: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:APPLy` on page 787

SC Spacing/CP
Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

The provided values depend on the channel type.

The SCS of the selected BWP is also displayed, because the channel allocation in the frequency domain depends on this value.

Note that for most channel types, the subcarrier spacing in the scheduling table is read-only.

Remote command:
PRACH: [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:PRACh:SCSPacing? on page 793
RIM-RS: [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:RIMRs:SCSPacing on page 793

Slot
Sets the start slot in the subframe for the selected allocation. The available slots depend on the channel-specific SC Spacing/CP as follows:

Slot	SCS / CP (as selected for the specific channel)
0	15 kHz NCP
0 to 1	30 kHz NCP
0 to 3	60 kHz NCP 60 kHz ECP
0 to 7	120 kHz NCP
0 to 15	240 kHz NCP

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SLOT on page 794

Mapping Type
Defines to which symbols of the PDSCH/PUSCH allocation the demodulation reference signals (DMRS) are mapped.

Selection of the PDSCH-mapping type depends on the "Additional Position Index"dialog. If the "Addtional Position Index" ≤ 1 a selection of the mapping type B is possible.

The PUSCH-mapping type is in case of "FRC" read-only. Otherwise a selection between mapping type "A" and "B" is always allowed.

Release 16 increases the number and length of the symbols the DMRS can use for mapping type B (downlink only).

Unavailable in the sidelink application.

"A" Location relative to the start of the slot.

"B" Location relative to the start of the PDSCH resources.

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:MAPType on page 790

Format
In uplink, selects the PUCCH format.

3GPP defines several PUCCH formats. The PUCCH format affects several PUCCH characteristics, like the mapping to physical resource blocks.

You can select a different PUCCH format for each PUCCH allocation. Depending on the format, you can access different enhanced settings for the PUCCH.

For FR2-2 deployment frequency range, you can allocate up to 16 resource blocks to a PUCCH allocation, depending on the selected PUCCH format.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FMT` on page 789

Map Type / Format / Seq. Len.
Option: R&S SMW-K148.

Defines the PRACH sequence length for unlicensed spectrum.

The sequence length depends on the PRACH subcarrier spacing. Additional sequence lengths become available when you turn on shared spectrum access.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQLength` on page 794

No. Sym.
Indicates the time duration of the allocation inside the slot.

Notes on the available number of symbols.

- The number of symbols depend on the cyclic prefix (CP) and the Mapping Type. For details, see Table 5-2.
- The parameters "No. Sym." and "Sym. Offset" are interdepended; their sum must not exceed the maximum of 14 or 12 symbols, for normal and extended CP respectively.
- For SRS allocations, the value is set with "Users/BWP > UL BWP Config > SRS > SRS Resource Table > Resource > Config" > No. Sym..
- For PUSCH allocations, the number of symbols is limited If intra slot frequency hopping is enabled:
  – Mapping type A: minimum 8
  – Mapping type B: minimum 2
- On the sidelink, an allocation has a size between 7 and 14 symbols, because there is no extended cylic prefix and no mapping type.

Table 5-2: No. Sym. (L)

Mapping Type	Normal cyclic prefix	Extended cyclic prefix
Mapping type A	3, 14	3, 12
Mapping type B	2, 4, 7	2, 4, 6

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SYMNumber` on page 795

Sym. Offset
Sets the allocation's start (OFDM symbol) within the slot.

Notes on the symbol offset.

- The available values depend on the channel-specific SC Spacing/CP and the Mapping Type, see Table 5-3.
- For SRS allocations, the value is set with "Users/BWP > UL BWP Config > SRS > SRS Resource Table > Resource > Config" > Offset.
- For sidelink allocations, the mapping type is unavailable and therefore has no effects on the symbol offset.

Table 5-3: Sym. Offset

Mapping Type	Normal cyclic prefix	Extended cyclic prefix
Mapping type A	0, 1, 2, 3	0, 1, 2, 3
Mapping type B	0, 12	0, 10

If the value "Sym. Offset" is read-only or not, depends on:

- Number of symbols
- Content type (PDSCH / PUSCH / PRACH / ...)
- Mapping type
- DMRS Type A position
- Cyclic prefix / numerology

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SYMoffset` on page 795

No. RB

Sets the bandwidth (frequency size) of selected allocation in terms of resource blocks (RB).

The number of resource blocks generally depends on the SCS of the corresponding BWP, set with the parameter "Users/BWP > DL/UL BWPs" > SC Spacing/CP. Observe the number of *total* available RBs in the selected "User x, BWP x".

The number of *RB per channel* also depends on the channel type as follows:

- CORESET allocations always span a multiple of 6 resource blocks. Thus, only values that are multiple of 6 are allowed for these allocations.
- The number of resource blocks that are available for PUSCH depends on whether the transform precoding is enabled or not (that is if DFT-s-OFDM is applied), see "Transform Precoding" on page 215.
- The number of resource blocks of the PRACH allocation are set automatically, depending on the selected SC Spacing/CP.
- The number of resource blocks of the PUCCH allocation is limited when Transform Precoding is enabled. In this case setting the "No. of RB" to 7, 11 or 13 is prohibited.
  For PUCCH formats F0, F1 and F4 in FR2-2, you can use up to 16 resource blocks for each PUCCH allocation. This feature requires R&S SMW-K171.

Symbol "-" indicates that the CORESET or PxSCH allocations are defined as bitmaps:

- "Scheduling > CORESET > Config > General" > Frequency Domain Resources
- "Scheduling > PxSCH > Config > General" > Resource Allocation = "Type 0"

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RBNumber` on page 792
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RBNumber?` on page 892

RB Offset
Adds a frequency offset and sets the start resource block of the selected allocation.

The value range depends on the selected channel type and the parameters SC Spacing/CP and No. RB.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RBOFfset` on page 792

Transform Precoding
In UL, you can define which access method is used, the optional DFT-s-OFDM or the CP-OFDM.

See also Chapter 2.3, "Multiple accesses schemes", on page 23.

"On" Enables the precoding operation and thus enables the DFT-s-OFDM.

"Off" Disables the precoding operation and thus enables the CP-OFDM.

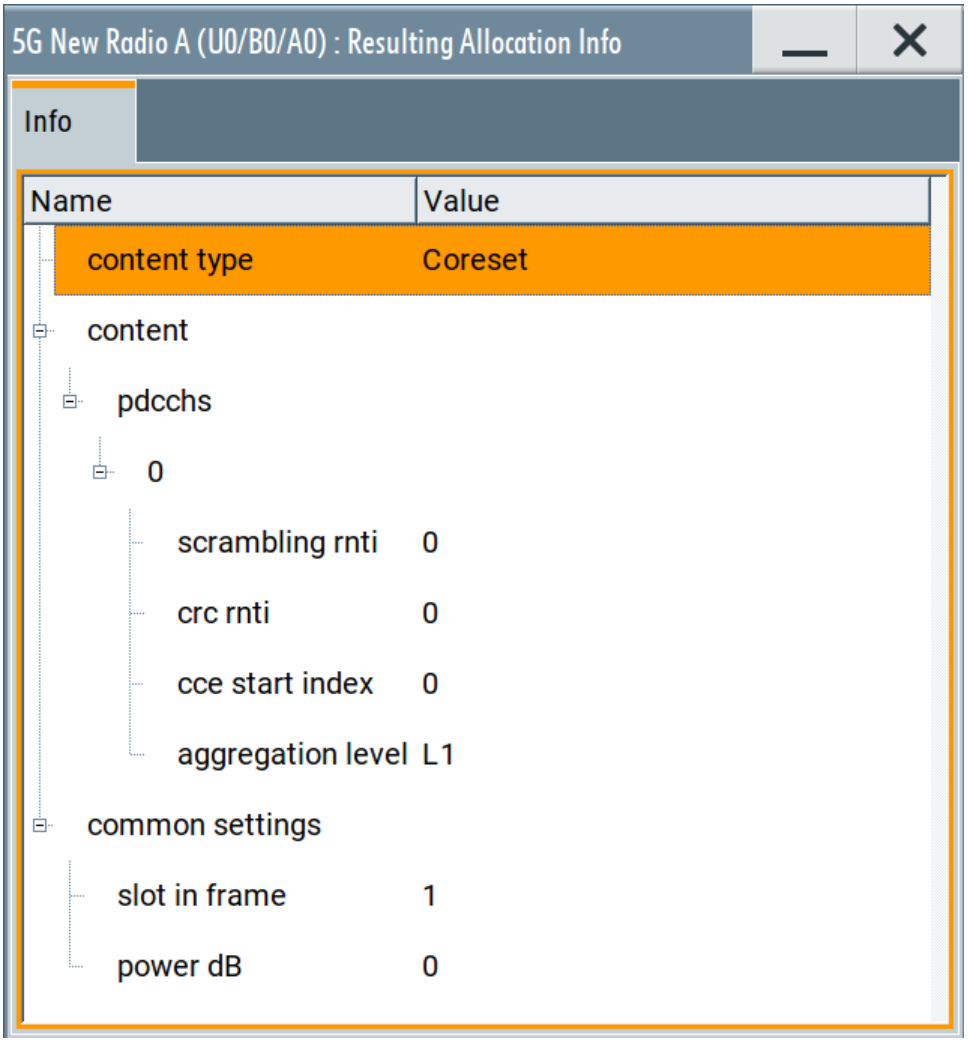
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TPSTate` on page 796

Settings
Opens dialogs with additional setting or information.

Config ← Settings
Opens the dialogs for configuration of the corresponding settings.

See:
- Chapter 5.2.7, "SS/PBCH settings", on page 74
- Chapter 5.2.10, "Dummy REs settings", on page 90
- Chapter 5.3.4, "DL/UL BWPs settings", on page 114
- Chapter 5.5, "PDSCH and PUSCH settings", on page 220
- Chapter 5.6, "CORESET settings", on page 245
- Chapter 5.9, "PUCCH settings", on page 282
- Chapter 5.12, "PSSCH and PSCCH settings", on page 297

Info ← Settings
Opens the "Resulting Allocation Info" dialog with details on the automatically allocated and repeated resources, like, for example, PDSCH created from DCIs or repeated PDSCH or CORESET.



Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

Power
Sets the power for the selected allocation relative to the power of the other allocations.

Allocations with "Power = 0 dB" use the same power level.

Unavailable for puncturing allocations.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:POWer` on page 791

State
Sets the allocation to active or inactive state.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:STATe` on page 795

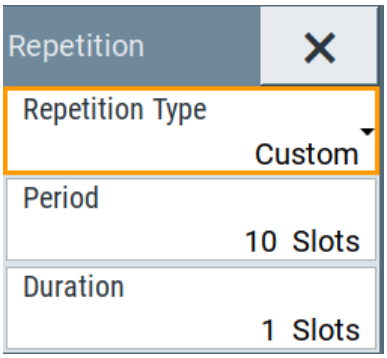
Repetition/Repetition Type

- Configurable allocations
  Displays if and how often the allocation is repeated.
  Select the field to open the Repetition Settings dialog where you can reconfigure the repetition.
- Read-only allocations
  Indicates the read-only reason, e.g. ongoing allocation, from SF#, etc.
  Select this indication to access the setting that causes the configuration.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions` on page 792

Repetition Settings

Access: "Baseband > 5G NR > Scheduling > Repetition".



Repetition Type ← Repetition Settings

Sets if and how the allocation is repeated, e.g. per slot, per subframe, on a per frame basis or at a user-defined period.

"Off"	The allocation is transmitted once.
"Slot", "Subframe", "Frame"	Available for "Content = PDSCH/PUSCH/PUCCH/CORESET". The allocation is transmitted every slot, subframe, or frame.
"Repetition Type A"	Repetition pattern based on redundancy versions defined in 3GPP 38.211, table 6.1.2.1-2. Available if "Closed Loop Feedback Mode" on page 559 is on.

"Custom" User-defined repetition pattern, set as Duration and Period.
Use the "Time Plan" to observe the current scheduling.

Example:

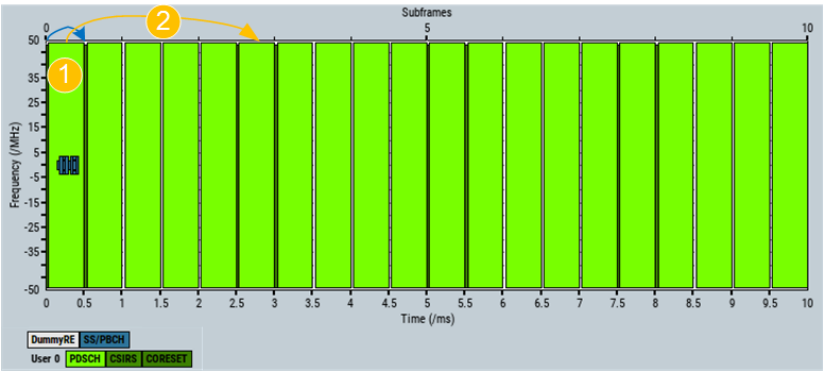


Figure 5-8: Repetition Type = Custom: Representation on the Time Plan

1 = Duration = "2 Slots"
2 = Period = "5 Slots"

If "Quick Setting" configuration with "Duplexing = TDD" is applied, the values set here resemble the slot configuration set in the "Quick Setting" > Frame format dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions` on page 792

Period ← Repetition Settings
Sets after how many slots the group of configurable allocation and its repetitions is repeated, see User-defined repetition.

The maximum repartition period is calculated as follows:

$RepPeriod_{max}$ = #SlotsPerFrame * "SequnceLength", where

- #SlotsPerFrame: is the number of available slots within a frame and depends on the used subcarrier spacing
- "SequnceLength": is the ARB sequence length as set with the parameter "Output/Power > Output" > Sequence Length.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PERiod` on page 791

Duration ← Repetition Settings
Sets in how many consecutive slots within a frame the allocation is repeated.

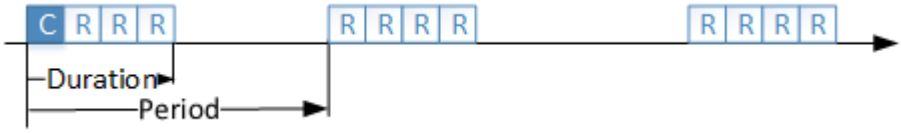


Figure 5-9: User-defined repetition

C = Configurable allocation
R = Repetition
Duration = Number of consecutive slots in that the allocation is transmitted
Period = Sets after how many slots the group of configurable allocation and its repetitions is repeated

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:DURation` on page 788

Aggregation Factor ← Repetition Settings
Option: R&S SMW-K145

The aggregation factor defines the number of PUSCH repetitions in terms of consecutive slots (2, 4 or 8). Select, for example, "4" to repeat the PUSCH in 4 consecutive slots.

Note that the aggregation factor also defines the redundancy version pattern within the slots. The logic for this is defined in 3GPP 38.211, table 6.1.2.1-2.

Selecting an aggregation factor is possible for repetition type A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:AGFT` on page 786

Offset in Aggregation ← Repetition Settings
Option: R&S SMW-K145

Defines an offset for the PUSCH repetitions in terms of slots.

Example:

Premise: Aggregation factor = 4; PUSCH in repeated over 4 consecutive slots.

An offset of "0" means that the repeated PUSCH allocations are transmitted in slot 0, 1, 2 and 3.

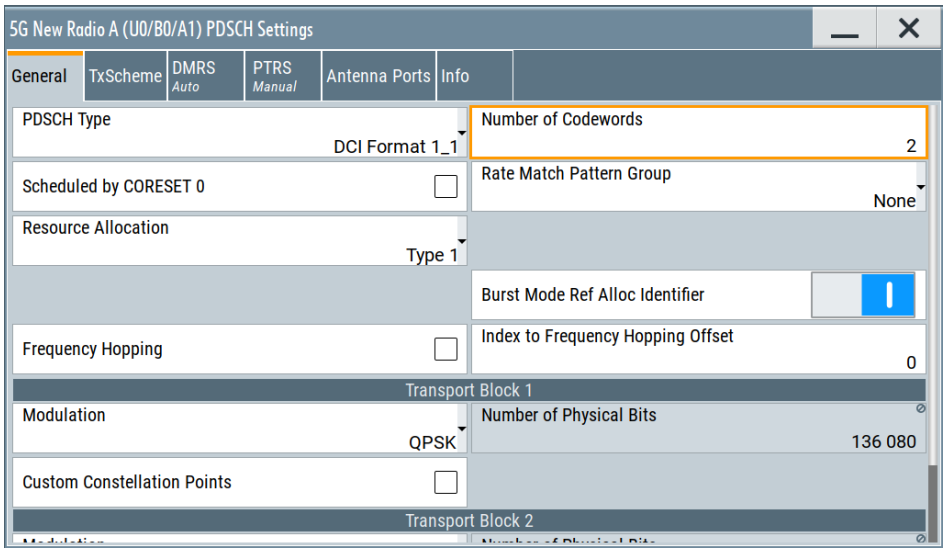
An offset of "1" means that the first PUSCH allocations are transmitted in slot 1,2,3 and 4.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:AGOFfset` on page 786

5.5 PDSCH and PUSCH settings

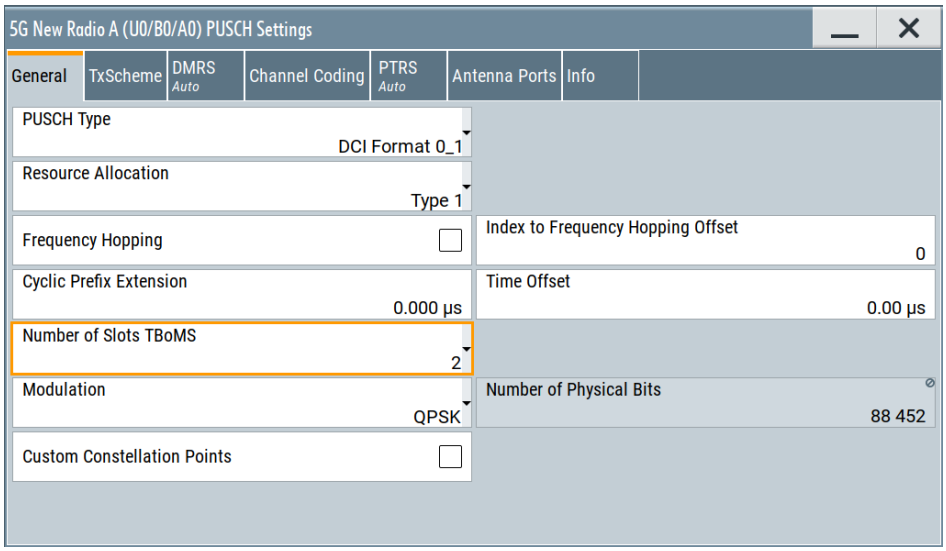
Access:

1. **PDSCH** settings:
   a) Select "5G New Radio > General > Link Direction > Downlink".
   b) Select "5G New Radio > Scheduling".
   c) Select "User x BWP x > Content > PDSCH".
   d) Select "PDSCH > Settings > Config".



2. **PUSCH** settings:
   a) Select "5G New Radio > General > Link Direction > Uplink".
   b) Select "5G New Radio > Scheduling".
   c) Select "User x BWP x > Content > PUSCH".

d) Select "PUSCH > Settings > Config".



This dialog comprises the settings of the physical downlink shared channel (PDSCH) or the physical uplink shared channel (PUSCH).
The PDSCH carries the general user data and is therefore the most prominent channel in a radio frame; it occupies the most resources.

Settings:

5.5.1 General settings

Access:

1. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".
2. Select "General".

Settings:

PDSCH Type/PUSCH Type

Defines the PDSCH/PUSCH type by selecting the DCI format by that the PDSCH/PUSCH content is defined.

The available settings depend on the current configuration. To select, for example, "PDSCH Type = DCI Format 1_0", select " Users/BWP > DL BWP Config > PDSCH > Additional Position Index = 2" and "Scheduling > PDSCH > Map Type = A".

For release 16 types: Option: R&S SMW-K148 is required.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:TYPE` on page 802

Number of Codewords

For PDSCH, sets if one or two codewords are used.

The combination of number of codewords and Number of Layers determines the layer mapping for the selected precoding scheme.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:NCW` on page 799

Scheduled by CORESET 0

For PDSCH allocations, defines if the PDSCH settings are scheduled by CORESET 0 or not.

You can enable several PDSCH allocations, also a combination of PDSCH scheduled by CORESET 0 and such that are not. To enable the CORESET 0 itself, set the parameter CORESET ID = "0".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:SBCZero:STATe` on page 801

Rate Match Pattern Group
For PDSCH allocations, selects one of the rate match patter groups, configured in the "Users/BWP Settings > DL BWP Config > Rate Match" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PATGrp` on page 800

Resource Allocation
If "Users/BWPs > DL BWP Config > PDSCH > Resource Allocation = Dynamic Switch", sets the resource allocation type 0 or type 1.

This parameter allows you to schedule PxSCH type 0 allocation if manual scheduling is used (PDSCH Scheduling > "Manual").

For PDSCH, the resource allocation for type 0 allocation is set with the parameter Resource Block Group Bitmap.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc` on page 801

Burst Mode Ref Alloc Identifier
If Power Mode > "Burst", sets whether the bandwidth of the current allocation is used as reference for the "Burst" power mode.

The icon in the Scheduling settings table indicates which allocation is set as burst reference.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:BMAid` on page 801

Interlaces...
Option: R&S SMW-K148

Opens a dialog box to configure interlaces.

Interlacing is a method to achieve a power spectral density of at least 80 % of the bandwidth in a shared spectrum (according to 3GPP).

Interlaces are bundles of allocated resource elements that are distributed over the complete bandwidth. In between those allocated resource elements are unused resource elements. For example, you can configure an interlace to only use every 5th allocation, or two interlaces that use every 1st and 3rd allocation.

This principle makes sure that the used allocations use a certain amount of the bandwidth to fulfill the 3GPP specifications for shared spectrum.

The interlace location is always relative to reference point A. For example, an interlace with a value = 4 would start 4 subcarriers above the reference point A.

The maximum number of supported interlaces depends on the subcarrier spacing.

Interlaces are supported under the following conditions:
- "Use Interlace" = On
- Resource Allocation = Type 2, which in turn is available for DCI format 0_0 and 0_1.

Number of Interlaces ← Interlaces...
Defines the number of interlaces. The maximum number depends on the current subcarrier spacing.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:NINT` on page 803

Value ← Interlaces...
Defines the distance between used resource elements. A value of 5, for example, would use every 5th resource element for the corresponding interlace.

Note that each interlace must have a different value. Otherwise interlaces would share the same allocation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:INT<il>:INTL` on page 803

Precoding Granularity
For PDSCH allocations, the precoding granularity can be adjusted. Sets the precoding granularity if "User/BWP Settings > DL BWP Config > PDSCH > General Settings > Precoding" in enabled.

"N2" Precoding granularity is set to N2.

"N4" Precoding granularity is set to N4.
This setting is not available if following values are set at " Users/BWPs > DL BWP Config > PDSCH > General Settings":

- "VRB-to-PRB Interleaver" equals 2 or
- "Resource Block Group Size" equals Config1 and BWP size ≤ 36 RBs

"Wideband" Precoding granularity is set to wideband.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PRECg` on page 800

Frequency Hopping
For PUSCH allocations, enable or disable the frequency hopping, configured in the "Users/BWP Settings > UL BWP Config > Frequency Hopping" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:FHOP:STATe` on page 802

Index to Frequency Hopping Offset
For PUSCH allocations, selects one of the frequency hopping offset index according to the entries, configured in the "Users/BWP Settings > UL BWP Config > Frequency Hopping Offsets" dialog.

"0, 1" If there are only 2 frequency hopping offsets configured.

"0, 1, 2, 3" If there are only 4 frequency hopping offsets configured.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:FHOI` on page 802

Cyclic Prefix Extension
Option: R&S SMW-K148

Defines the length of a cyclic prefix extension, which is added in front of the first PUSCH allocation in a slot. The other cyclic prefixes of the PUSCH allocations in the slot are not affected.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CPEXt` on page 798

Time Offset
Defines an offset for PUSCH allocations in the time domain.

Useful, for example, for 2-step RACH applications.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TOFFset` on page 805

Number of Slots TBoMS
Option: R&S SMW-K171

Selects the number of slots the PUSCH transport block is transmitted on.

Instead of transmitting the complete transport block in multiple slots, you can spread it over multiple slots. Spreading the PUSCH transport block over several slots increases the spectral power density, because fewer resource blocks are required.

Depending on your selection, the scheduling table is adjusted accordingly.

By default, the transmission of a transport block occurs on consecutive slots. However, TDD transmission also allows the transmission of a transport block on non-consecutive slots. In such scenarios, you can define the slots that carry the transport block in the table below the "Number of Slots TBoMS" parameter. The logic is as follows.

- The table only appears if "Number of Slots TBoMS" > 1.
- The number of columns depends on the number of slots the transport block uses. For example, if you spread the transport block over four slots, the table has three columns (the last slot the transmission uses is determined automatically).
- In each column, you can define a slot offset that the transport block transmission uses.
  If all entries in the table are "1", the tranmission occurs on consecutive slots.

To use non-consecutive slots, you can enter different values and thus skip specific slots.

Example:

The transport block over multiple slots table looks like this:

2	3	1

With this configuration, transport block transmission uses slots 0 - 3 - 7 - 9 (the first PUSCH slot is always configured in slot 0).

Spreading the PUSCH transport block over several slots is possible with the following settings.

- Restart Data and Control = "After Each Codeword and Allocation"
- Channel coding = on
- UCI mode = "UCI+UL-SCH"

Note that if you are transmitting transport blocks over multiple slots, HARQ feedback is always applied at the beginning of a transport block.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TBOMs` on page 804
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TBM<tbm>:SLOTs` on page 804

Resource Block Group Bitmap

For Resource Allocation > "Type 0", sets the PxSCH resource block groups allocation as bit pattern.

The bitmap is a 19-bits long pattern where value of 1 indicates that the resource element group is used for PxSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc:PATTern` on page 802

Modulation

Selects the modulation scheme.

- PDSCH: QPSK, 16QAM, 64QAM, 256QAM
  3GPP release 17 introduces 1024QAM modulation on the downlink. Release 17 features require R&S SMW-K171.
- PUSCH: QPSK, 16QAM, 64QAM, 256QAM, and if Transform Precoding > "Off" also pi/2-BPSK.
  1024QAM modulation on the uplink requires R&S SMW-K171.

Note:

Preconditions for 256QAM:

- "Users/BWP" > "DL/UL BWP Config" > "PDSCH" > "MCS Table" equals "256QAM"
- "Users/BWP" > "DL/UL BWP Config" > "PUSCH" > "MCS Table" equals "256QAM"

Preconditions for 1024QAM (downlink only):

- "Users/BWP" > "DL/UL BWP Config" > "PDSCH" > "MCS Table" equals "1024QAM"

Preconditions for BPSK :

- BPSK is not available for PxSCH
- π/2-BPSK:

Preconditions for π/2-BPSK:

- π/2-BPSK: "Users/BWP" > "DL/UL BWP Config" > "PUSCH" > "Transform Precoding" equals "Enabled"

See also Table 2-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:MOD` on page 799

Phys. Bits
Indicates the size of the selected allocation in bits.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PHYSbits?` on page 799

HARQ Process Number
Sets the HARQ process number for the relevant DCI.

The value can be set between 0 and 31.

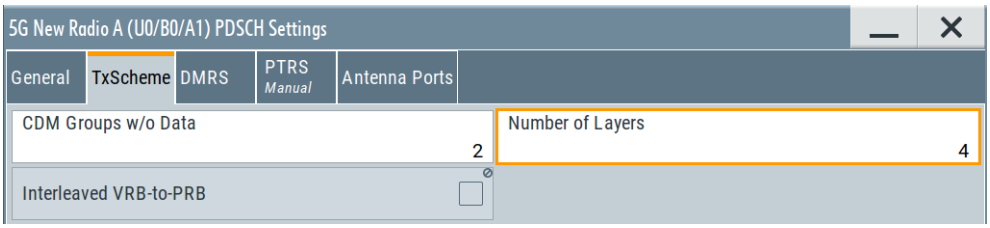
Note: Only visible when the "HPN Mode" is enabled in the "Node Settings > Feedback" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:HPRNumber` on page 803

5.5.2 TxScheme settings

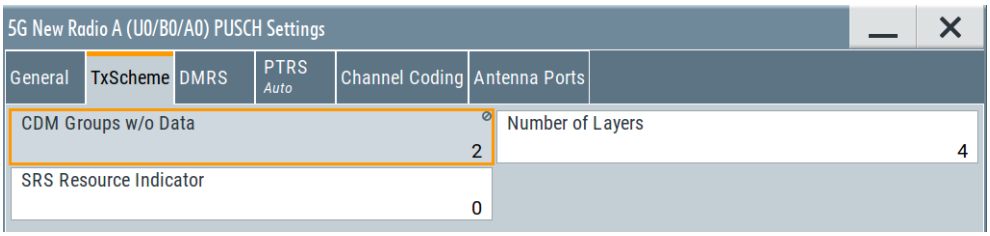
Access:

1. Select "5G New Radio > General > Link Direction" > **"Downlink"**.
2. Select "Scheduling > User x BWP x > Content > PDSCH > Settings > Config".
3. Select "TxScheme".



4. Select "5G New Radio > General > Link Direction" > **"Uplink"**.
5. Select "Scheduling > User x BWP x > Content > PUSCH > Settings > Config".
6. Select "General > PUSCH Type = DCI Format 0_1".

7. Select "TxScheme".



Settings:

CDM Groups w/o Data

Selects the number of CDM groups that are reserved and contain no data. They are therefore not used by the PDSCH/PUSCH for data transmission. In the resource grid, the resource elements for CDM (between PDSCH/PUSCH DMRS resource elements) remain empty.

The value is required to select the number of DMRS ports and hence the number of antenna ports. For details, see TS 38.212.

If "User/BWPs > UL BWP Config > PUSCH" > Transform Precoding = "On", this parameter is set automatically.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:TXSCheme:CDMData` on page 807

Number of Layers

Sets the number of precoding layers.

The combination of number of codewords and number of layers determines the layer mapping. Each layer is transmitted on a separate antenna port. The minimum number of layers corresponds to the selected Number of Codewords.

If "User/BWPs > UL BWP Config > PUSCH" > TxConfig = "Codebook", this parameter is set automatically; a number of layers > 1 is possible if the number of antenna ports for an SRS resource is > 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh|PSSCh:TXSCheme:NLAYers` on page 908

TPMI

Access: "User/BWPs > UL BWP Config > PUSCH" > TxConfig = "Codebook".

Sets the TPMI index, required to select the precoding matrix, as defined in TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:TXSCheme:TPMidx` on page 811

SRS Resource Indicator
Access: "User/BWPs > UL BWP Config > SRS > Resource > Config" > Resources ≥ 1.

Selects the SRS resource to be used. SRS resources are defined in the SRS resource table and the resource indicator refers to a table row number.

See "Resource > Config" on page 194.

If only one SRS resource is defined, the "SRS Resource Indicator = 0".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:TXSCheme:SRI` on page 810

Interleaved VRB-to-PRB
If "User/BWP Settings > DL BWP Config > PDSCH" > VRB-to-PRB Interleaver = "2 or 4", the VRB-to-PRB interleaving is enabled for all PDSCH allocation.

With this parameter, you can disable the VRB-to-PRB interleaving for the particular PDSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:INTervp` on page 807

Number of CSI-RS Antenna Ports
Selects the number of antenna ports the CSI-RS is transmitted on.

The setting becomes available when you select the precoding based on a 3GPP codebook. The number of selected antenna ports in turn has an effect on the availability on the codebook parameters that define the precoding matrix.

Note that increasing the number of layers automatically adjusts the number of antenna ports.

Currently, the R&S SMW supports up to four antenna ports.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs` on page 806

Codebook Type
Shows the codebook type (higher layer parameter `codebookType`).

Currently, the R&S SMW supports type I single panel codebook.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:CBTYpe?` on page 807

Precoding configuration
The precoding configuration parameters define which precoding matrix from the codebook is applied.

The following precoding parameters are available:
- "N1"
- "N2"
- "Codebook Mode"
- "Codebook Index 1_1" ($i_{1,1}$)
- "Codebook Index 1_2" ($i_{1,2}$)
- "Codebook Index 1_3" ($i_{1,3}$)
- "Codebook Index 2" (i_2)

Depending on the antenna port and layer configuration, some precoding parameters are automatically set and read only.

The number and type of precoding parameters depend on the number of antenna ports and the number of layers you have selected.

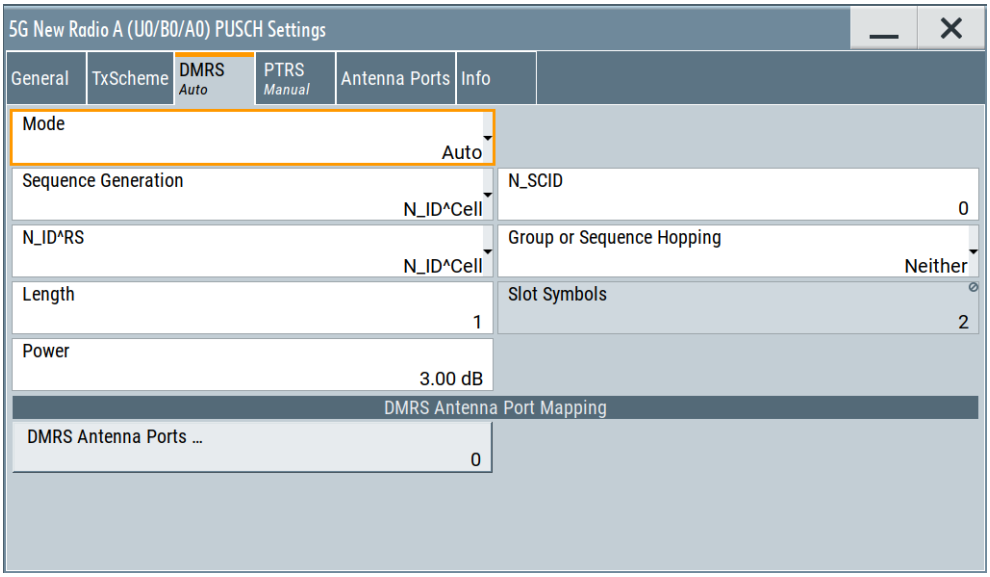
The effects on precoding matrix selection, dependencies and ranges of the precoding parameters are described by the tables in 38.214, chapter 5.2.2.2.

Remote command:
N1: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:PCN1` on page 808
N2: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:PCN2?` on page 808
Codebook Index 1_1: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I11` on page 809
Codebook Index 1_2: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I12` on page 809
Codebook Index 1_3: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I13` on page 810
Codebook Index 2: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I2` on page 810
Codebook Mode: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:CBMD` on page 806

5.5.3 DMRS settings

Access:

1. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".
2. Select "DMRS".



Settings:

Mode

Selects the configuration mode for the DMRS.

"Auto" Apply the same settings to all allocations.

"Manual" Define DMRS settings for each allocation separately.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE` on page 814

Sequence Generation

The initialization sequence of the pseudo-random sequence generator is generated based among others depending on a parameter called scrambling ID ($N_{ID}^{n\_SCID}$).

This parameter defines how the scrambling ID is derived:

"N_ID^Cell" Scrambling ID (i.e. $N_{ID}^{n\_SCID}$) = cell ID (i.e. N_{ID}^{Cell})

"N_ID^DMRS" Scrambling ID (i.e. $N_{ID}^{n\_SCID}$) = DMRS scrambling ID (i.e. N_{ID}^{DMRS})

See also "About PDSCH and DMRS sequence generation" on page 122.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SEQGen` on page 815

N_SCID
Sets which variable, N_{ID}^0 or N_{ID}^1, is used by the generation of the initialization sequence of the pseudo-random sequence generator. The value of the parameters N_{ID}^0 or N_{ID}^1 is set per DMRS type with the parameters "User/BWP > DL BWP > PDSCH" > 134.

See also "About PDSCH and DMRS sequence generation" on page 122.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:NSID` on page 814

N_ID^RS
Sets whether the variable n_{ID}^{CELL} or n_{ID}^{PUSCH} is used by the generation of the DMRS sequence.

Enabled if "User/BWP > PUSCH Config > PUSCH > Transform Precoding > On".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:DMR:NIDSel` on page 813

Group or Sequence Hopping
Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group for the DMRS sequence generation according to TS 38.211.

Enabled if "User/BWP > PUSCH Config > PUSCH > Transform Precoding > On".

Neither	Disables the group and sequence hopping for the DMRS sequence generation.
Group Hopping	Enables the group hopping for the DMRS sequence generation.
Sequence Hopping	Enables the sequence hopping for the DMRS sequence generation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SEQHopping` on page 815

TypeA Position
Defines the position of the DMRS.

For details see "DMRS Type A Position" on page 63.

Unavailable for individual allocations if configuration mode = "Auto".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:TAPos` on page 816

Config Type
Selects the DMRS configuration type.

For details see "Config Type" on page 133.

Unavailable for individual allocations if configuration mode = "Auto".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:CTYPe` on page 812

Additional Position Index
Defines the position of the DMRS.

For details, see "Additional Position Index" on page 134.

Unavailable for individual allocations if configuration mode = "Auto".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:APINdex` on page 812

Length
Defines whether single- or double-symbol DMRS is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:LENGth` on page 813

Slot Symbols
Indicates the number of DMRS slot symbols. The value is set automatically, depending on the selected "Length".

Unavailable if configuration mode = "Manual".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SLTSymbols?` on page 815

Power
Sets the power of the PDSCH/PUSCH, relative to the power of the other channels.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:POWer` on page 814

DMRS Antenna Ports ...
Sets the antenna ports.

The number of allocated antenna ports mut be equal to the number of layers and must not be equal to the number of mapped antenna ports.

Note: When the codebook is used, the antenna ports in "Antenna Port" tab are numbered consecutively from 1000 to 1000 + number of mapped antenna ports. When the codebook is not used, the antenna ports configured for DMRS + 1000 are used.

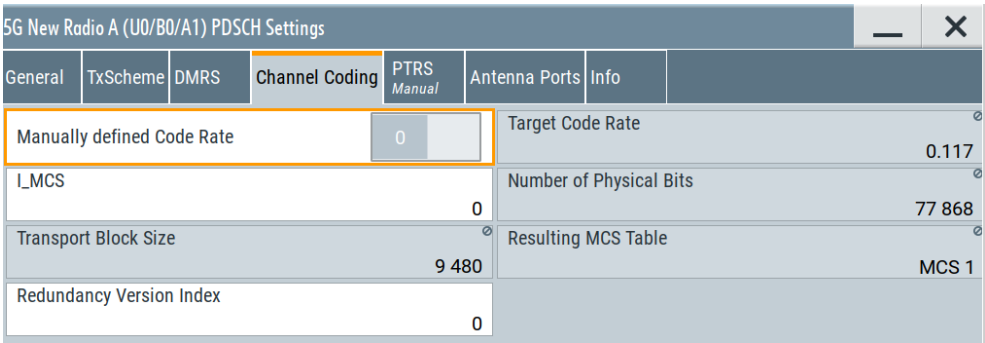
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh[:DMRS]:APSelect<s2us0>` on page 695
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh[:DMRS]:APSelect<s2us0>` on page 816

5.5.4 Channel coding settings

Access:

1. Select "5G New Radio > General > Users/BWPs > Properties > DSCH/USCH Channel Coding > On".
2. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".
3. Select "Channel Coding".

   The dialog comprises the settings for the LDPC channel coding for PDSCH and PUSCH.



Channel coding parameters determine the code rate of the PDSCH/PUSCH, which is the ratio between transmitted bits and maximum bits in a subframe (or 1 ms transport block). Because the number of bits in a subframe is variable, the target code rate has to be derived from the modulation order in combination with an index I_{MCS}.
You can select the modulation order for the PDSCH/PUSCH (one of several tables, one for each modulation type) by setting the corresponding index value "I_MCS". The target code rates for modulation order and index are defined in TS 38.214.
In addition to the modulation order and I_{MCS}, the number of transmitted bits depends on the "Redundancy Version Index". Depending on the redundancy version index, the PDSCH/PUSCH contains a different number of parity bits for error detection: Index 0 adds 1 sequence of parity bits, index 1 adds two sequences of parity bits etc.

Settings:

Manually Defined Coderate
Turns custom coderate definition on and off.

Effects of automatic coderate definition:
- The target code rate, number of physical bits, transport block size and MCS table are automatically calculated based on the modulation and I_MCS.

Effects of manual coderate definition:
- You can define a custom target code rate.
- The number of physical bits and transport block size are calculated based on the modulation and target code rate.
- Selecting an I_MCS and calculation of MCS table becomes unavailable.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:FRCR`
on page 817

I_MCS
Sets the modulation and coding scheme index.

The available values depend on the selected Modulation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:IMCS`
on page 817

Target Code Rate
Shows or defines the target code rate.

- For automatic code rate selection, the target code rate is automatically calculated depending on the modulation and coding scheme ("I_MCS)".
- For manual code rate definition, you can define a custom target code rate. Selecting an I_MCS is not possible in that case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TCRate`
on page 818

Phys. Bits
Indicates the size of the selected allocation in bits.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PHYSbits?` on page 799

Transport Block Size
Indicates the resulting transport block size (TBS), calculated for the selected modulation and coding scheme ("I_MSC").

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TBSize?` on page 818

Resulting MCS Table
Shows the MCS table the configuration corresponds to. The MCS tables are defined in 3GPP 38.214.

Automatic calculation of the MCS table is possible when manual coderate definition is off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:RMCStable?` on page 819

Redundancy Version Index
Sets the redundancy version index.

Depending on the redundancy version index, the PDSCH/PUSCH contains a different number of parity bits for error detection: Index 0 adds 1 sequence of parity bits, index 1 adds two sequences of parity bits etc.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:RVINdex` on page 818

TBS Scaling Factor
Selects the size of the TB scaling factor S. The TB scaling factor S has an effect on the size of a transport block (TB), which in turn affects the code rate.

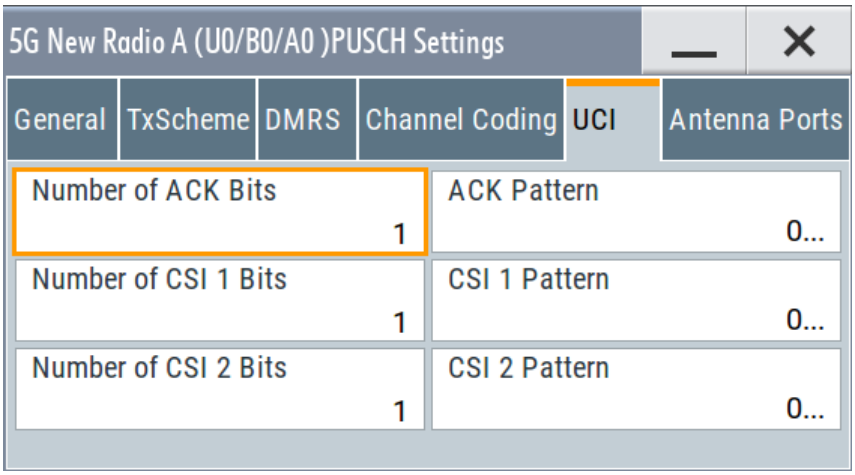
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TBSFactor` on page 818

5.5.5 UCI settings

Access:

1. Select "Users/BWPs > Properties > USCH Channel Coding > On".
2. Select "Users/BWPs > UL BWP Config > PUSCH UCI > State > On".

3. Select "Scheduling > User x BWP x > Content > PUSCH > Settings > Config".
4. Select "UCI".



Settings:

Number of ACK Bits

Sets the number of ACK bits and defines the length of the "ACK Pattern" field.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:ACK:BITS` on page 820

ACK Pattern

Sets the ACK bits in pattern form, where the pattern length is set with the parameter "Number of ACK Bits".

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out once.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:ACK:PATTern` on page 820

Number of CG-UCI Bits

Sets the number of CG-UCI bits and defines the length of the "CG-UCI Pattern" field.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CGUCi:BITS` on page 821

CG-UCI Pattern
Sets the ACK bits in pattern form, where the pattern length is set with the parameter "Number of CG-UCI Bits".

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out once.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CGUCi:PATTern` on page 821

Number of CSI x Bits
Sets the number of CSI 1/CSI 2 bits and defines the length of the "CSI Pattern" fields.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI1:BITS` on page 820
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI2:BITS` on page 820

CSI x Pattern
Sets the CSI bits in pattern form, where the pattern length is set with the parameter "Number of CSI x Bits".

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out once.

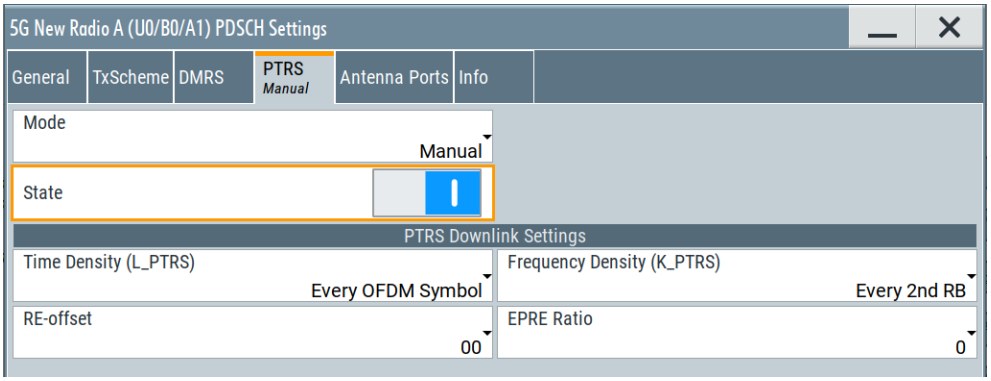
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI1:PATTern` on page 820
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI2:PATTern` on page 820

5.5.6 PTRS settings

Access:

1. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".

2. Select "PTRS".



The dialog comprises the settings of the phase-tracking reference signal (PTRS). The phase tracking reference signal (PTRS) is a UE-specific reference signal that is used to compensate for the phase noise of the oscillator. Phase-tracking reference signals can be transmitted only in the resource blocks used for the PxSCH and if the transmission is enabled.
If the PTRS "State" is on, you can define its "Power" relative to the PxSCH and its location in the resource grid.

The power of the PTRS is only defined for up to 6 layers (3GPP 38.214, table 4.1-2). Therefore, you can no longer define the characteristics of the PTRS when you select more than 6 layers.

Settings:

Mode
Sets how the PTRS configuration is defined:

"Auto" If DSCH/USCH Channel Coding > "On" and "PTRS" > State > "On", the PTRS configuration is derived from the current PDSCH DMRS settings.

"Manual" You configure PTRS manually, with the settings provided in the "PxSCH Settlings > PTRS" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:MODE` on page 823

PTRS-DMRS Association
If "Scheduling > User x BWP x > Content = PUSCH", indicates the PTRS-DMRS association.

The association between UL PTRS ports and DMRS ports is signaled by PTRS-DMRS association field in DCI format 0_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:PTDMrs` on page 824

State
Enables the transmission of phase-tracking reference signals.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:STATe` on page 823

Time Density (L_PTRS)
Sets the higher-layer parameter `timeDensity`.

The "L_PTRS" defines distance between the PTRS in terms of OFDM symbols (transmission every 1, 2 or 4 OFDM symbols). If the subcarrier used by the PTRS also contains a DMRS, the distance can be larger.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:TMDen` on page 824

Frequency Density (K_PTRS)
Sets the higher-layer parameter `frequencyDensity`.

The "K_PTRS" and "RE-offset" define the location of the PTRS in the frequency domain. K_{PTRS} defines the distances between the PTRS in terms of subcarrier. You can also define an additional frequency offset for the PTRS relative to the first subcarrier.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:FRQDen` on page 822

RE-offset
Sets the parameter `resourceElementOffset` k_{ref}^{RE} required to define the precoding and mapping to the physical resources.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:REOF` on page 823

EPRE Ratio
If "Scheduling > User x BWP x > Content = PDSCH", sets the higher layer parameter `epre-Ratio`. It is needed to define the ratio of PTRS EPRE to PDSCH EPRE per layer per RE for PTRS port.

The abbreviation EPRE stands for energy per resource element.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PTRS:EPRE` on page 822

Power
If "Scheduling > User x BWP x > Content = PUSCH", sets the parameter `ptrs-Power` and thus defines the PUSCH to PTRS power ratio per layer per resource element.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:POWer` on page 824

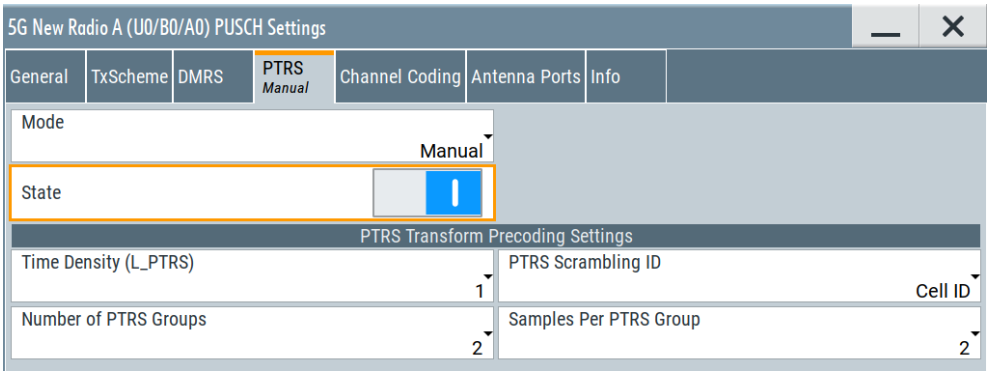
Max Number of Ports
If "Scheduling > User x BWP x > Content = PUSCH", sets the maximum number of configured PTRS ports, given by the higher-level parameter `maxNrofPorts`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:PORT` on page 824

5.5.7 PTRS settings with enabled transform precoding

Access:

1. Select "Users/BWPs > Properties > USCH Channel Coding > On".
2. Select "General > Users/BWPs > UL BWP Config > PUSCH > Transform Precoding > On"
3. Select "Scheduling > User x BWP x > Content > PUSCH > Settings > Config".
4. Select "PTRS".



The dialog comprises the settings of the phase-tracking reference signal (PTRS) if transform precoding is enabled.

Settings:

Mode

Sets how the PTRS configuration is defined:

"Auto" If DSCH/USCH Channel Coding > "On" and "PRTS (Transform Precoding)" > State > "On", the PTRS configuration is derived from the current PUSCH DMRS settings.

"Manual" You configure PTRS manually, with the settings provided in the "PUSCH Settlings > PTRS" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:MODE` on page 825

State

Enables the transmission of phase-tracking reference signals.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:STATe` on page 826

Time Density (L_PTRS)

Sets the higher-layer parameter `timeDensity`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:TMDensity` on page 826

Number of PTRS Groups

Sets the number of PTRS groups according to TS 38.214, required to define the PTRS group pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:NGRPs` on page 825

PTRS Scrambling ID

Sets whether the PTRS Scrambling ID value used for PTRS sequence generation is configured by the NPusch ID (higher layer) or by the cell ID.

Cell ID Sets the cell ID as the scrambling ID for PTRS sequence generation. This is the value by default.

N_ID^PUSCH Sets the NPusch ID as the scrambling ID for PTRS sequence generation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:SCID` on page 825

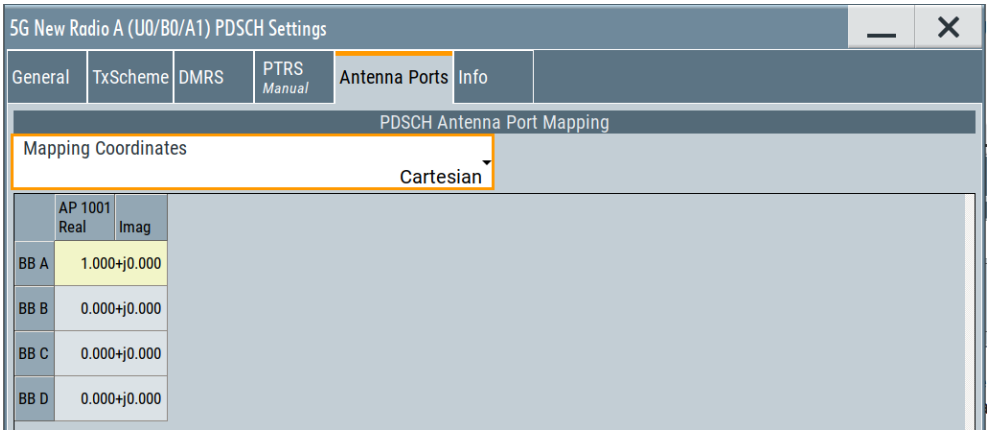
Samples Per PTRS Group
Sets the number of samples per PTRS group according to TS 38.214, required to define the PTRS group pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:SPPG` on page 826

5.5.8 Antenna ports

Access:

1. If necessary, enable MIMO scenario.
   a) For example, select "System Config > Fading/Baseband Config > Mode = Advanced".
   b) Select a 2x4x4 configuration with "BB Source Config = Coupled per Entity".
   c) Confirm with "Apply".
2. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".
3. Select "Antenna Ports".



With the provided settings, you can map the antenna ports arbitrarily to the baseband outputs. The available antenna ports depend on the current configuration. For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Settings:

Mapping Coordinates
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping Table
Defines the mapping of the antenna ports (AP) to the physical antennas.

The available antenna ports depend on the current configuration. For details on the antenna port-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

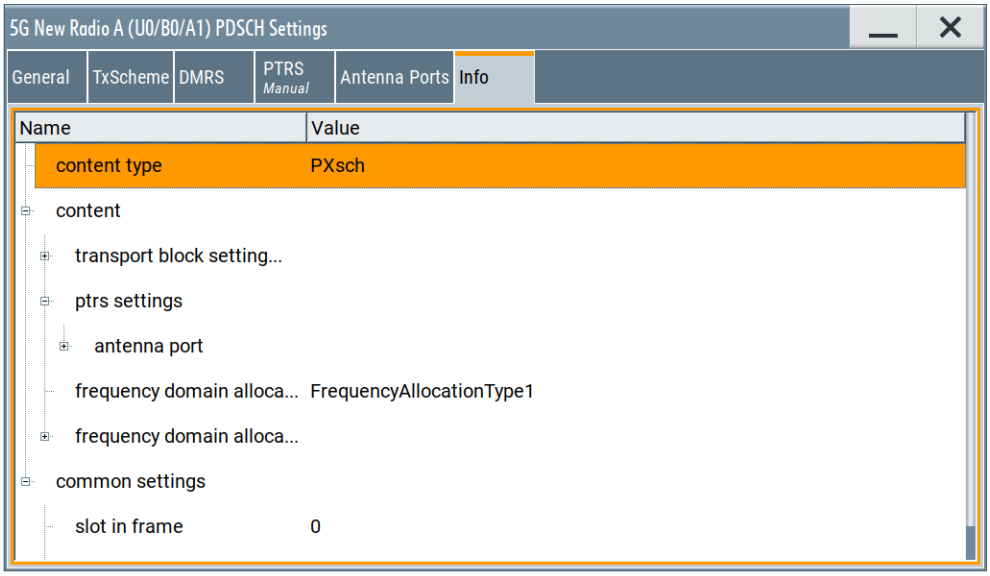
Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:REAL` on page 828
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:IMAGinary` on page 828
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:MAGNitude` on page 827
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:PHASe` on page 827

5.5.9 Info

Access:

1. Select "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config".

2. Select "Info".



The dialog displays details on the PDSCH/PUSCH configuration.

Info

The dialog displays details on the configuration.

There are two information lists:

- "Stable": Naming and structure of the information in this list are stable in future firmware releases.
- "Mutable": Naming and structure of the information in this list can change in future firmware releases.

Remote command:

`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

5.6 CORESET settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > CORESET".
4. Select "CORESET > Settings > Config".

CORESET

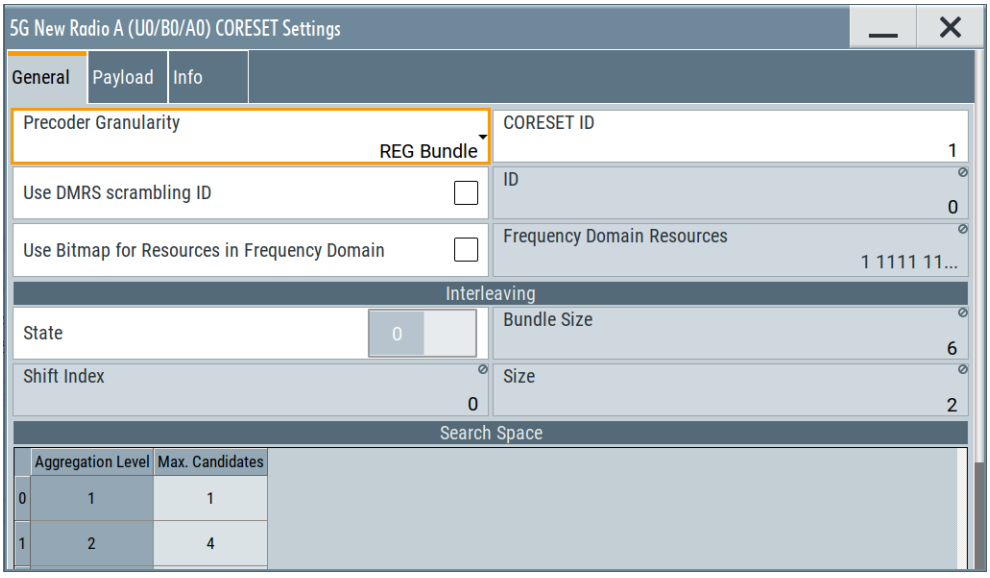
The CORESET settings are defined per user and per BWP. The CORESET size in the frequency domain is given by number of resource blocks N_{RB}^{COREST} is spans; in the time - it can occupy 1, 2 or 3 symbols.

A CCE consists of 6 resource-element groups (REGs). The mapping between the CEE and the REGs is unique per CORESET. It can be interleaved or non-interleaved and is described by the so called REG bundles with different sizes (L).

5.6.1 General settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > CORESET".
4. Select "CORESET > Settings > Config" > "General".



This dialog comprises the settings of the Control Resource Set (CORESET). Each CORESET is assigned to a specific user and comprises of a set of one or more PDCCH channels.
The PDCCH channel carries the downlink control information.

Precoder Granularity

Sets the value of the higher-layer parameter `precoderGranularity`, as defined in TS 38.211.

"REG Bundle" The same precoding is used within a REG bundle; corresponds to `precoderGranularity = sameAsREG-bundle`.

"All Contiguous RBs" The same precoding is used across all REG within the set of contiguous resource blocks in the CORESET; corresponds to `precoderGranularity = allContiguousRBs`.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:PREGran` on page 832

CORESET ID

Sets the CORESET ID.

Set "CORESET ID = 0" to simulate CORESET 0 (`controlResourceSetZero`). If CORESET 0 is used, the reference point changes and is according to TS 38.211 the subcarrier 0 of the lowest-numbered resource block in the CORESET.

For "CORESET ID ≥ 1", the reference point is subcarrier 0 in common resource block 0.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:ID` on page 831

Use DMRS Scrambling ID

Defines the parameter used to calculate the PUCCH scrambling sequence:

- If disabled, the Cell ID is used.
- If enabled, the demodulation reference signal DMRS ID is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SCRam:STATe` on page 830

ID

For Use DMRS Scrambling ID > "On", sets the value of the higher-level parameter `PDCCH-DMRS-Scrambling-ID`, according to TS 38.211.

This DMRS scrambling ID is used to calculate the PDCCH scrambling sequence instead of Cell ID.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SCRam:ID` on page 830

Use Bitmap for Resources in Frequency Domain
If enabled, the CORESET frequency allocation is set as a bitmap, defined with the parameter Frequency Domain Resources.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:STATe` on page 833

Frequency Domain Resources
Sets the value of the higher-level parameter `frequencyDomainResources` according to TS 38.331 and thus defines the CORESET frequency allocation.

The frequency domain resources is a 45 bits long pattern, where value of 1 indicates a resource element group that is used for the CORESET.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:BITMap` on page 833

DMRS Reference Point
Selects the reference point for the DMRS.

"Point A"	Reference point is the reference point A.
"CORESET Start"	Reference point ist the first resource used by the CORESET.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:REFDmrs` on page 831

Interleaving State
If enabled, the CCE-to-REG mapping is interleaved.

This parameter corresponds to the higher-level parameter `CORESET-CCE-REG-mapping-type` (TS 38.211).

See "CORESET" on page 246.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:STATe` on page 832

Bundle Size
For Interleaving State > "On", sets the higher-level parameter bundle size L (`CORESET-REG-bundle-size`).

The value is used to calculate the CCE-to-REG mapping, according to TS 38.211.

See also "CORESET" on page 246.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:BUNSize` on page 831

Shift Index
For Interleaving State > "On", sets the higher-level parameter shift index n_{shift} (`CORESET-shift-index`).

The value is used to calculate the CCE-to-REG mapping, according to TS 38.211.

See also "CORESET" on page 246.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:SHIDx` on page 832

Size
For Interleaving State > "On", sets higher-level parameter interleaver size R (`CORESET-interleaver-size`).

The value is used to calculate the CCE-to-REG mapping, according to TS 38.211.

See also "CORESET" on page 246.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:SIZE` on page 832

Search Space
The term search space describes a set of CCEs that a UE monitors. The UE can decode only the control information on a PDCCH/CORESET that is transmitted over CCEs within the search space this UE monitors.

A physical downlink control channel PDCCH consists of one or more control-channel elements (CCEs), where their number is defined by the "Aggregation level".

The following parameters influence the way the search space is defined:

- If **Restrict to Search Space > "On"**, you define the search space by selecting the **aggregation level** and the **number of a particular candidate**. The available candidates are defined as a combination aggregation level and maximum number of candidates per aggregation level.
  See:
  – "Scheduling > CORESET > Payload" > Aggregation Level
  – "Scheduling > CORESET > Payload" > Candidate
  – "Scheduling > CORESET > General" > Aggregation Level and Max Candidates

  The **CCE start index** CCE Index is selected automatically so that the CCE is within the search space.
- If **Restrict to Search Space > "Off"**, you define the search space manually, by setting the CCE start index, see CCE Index.

Example:

Select:

- Restrict to Search Space > "On".
- For "Scheduling > CORESET > General" > Aggregation Level = "1", select Max Candidates = "2".
- Select "Scheduling > CORESET > Payload" > Aggregation Level = "1" and Candidate = "1"

Observe the CCE index ("Scheduling > CORESET > Payload" > CCE Index). The value is set automatically.

Aggregation Level ← Search Space
Displays the possible aggregation levels, as defined in TS 38.213.

For each aggregation level, you can set the maximum number of candidates that are monitored, see Max Candidates.

"Aggregation level"	Number of CCEs
1	1
2	2
4	4
8	8
16	16

For more information, see "Search Space" on page 249.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SPACe<s2us0>:AGGLevel?` on page 830

Max Candidates ← Search Space
Sets the maximum number of candidates allowed for the selected aggregation level, as specified in TS 38.213.

For more information, see "Search Space" on page 249.

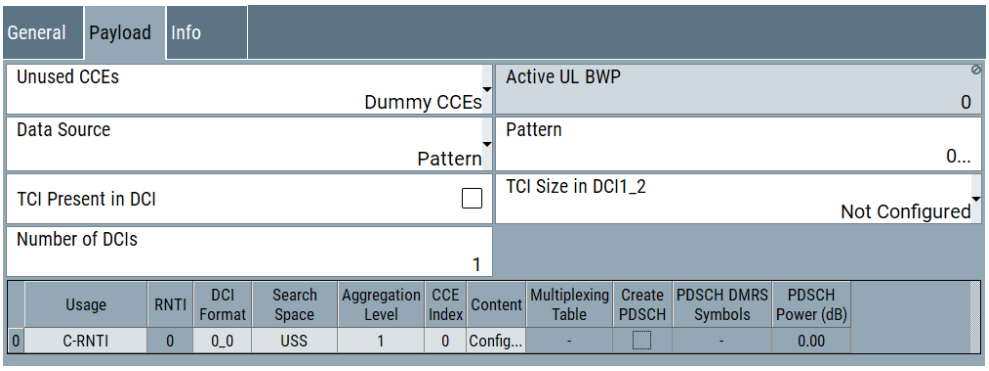
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SPACe<s2us0>:MAXCandidate` on page 831

5.6.2 Payload settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > CORESET".

4. Select "CORESET > Settings > Config" > "Payload".



Unused CCEs

Defines if unused CORSET resources (CCEs) are used for data transmission or not.

"No Data"	No data is transmitted in the unused CCEs.
"Dummy CCEs"	Unused CCEs are filled in with dummy data.
"Allow PDSCH"	PDSCH transmission is allowed in the unused CCEs.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:STATe` on page 836

Dummy CCEs Data Source

Selects the data source for the dummy CCEs.

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:

- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:DATA` on page 835
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:DLISt` on page 835
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:PATTern` on page 835

Active UL BWP
If more than one UL BWPs are configured ("Users/BWP Settings > UL BWPs" > Number of UL BWPs ≥ 2), this parameter sets the index of the UL BWP to be used by the calculation of the bit size of the DCI formats.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:AULBwp` on page 834

TCI Present In DCI
Sets the higher-layer parameter `tci-PresentInDCI` according to TS 38.212.

Available when simple mode = off.

"On" Transmission configuration indication (TCI) field in DCI format 1_1 is 3 bits long.

"Off" Transmission configuration indication field in DCI format 1_1 is not transmitted; field is disabled in the DCI format 1_1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:TCI` on page 839

TCI Size in DCI1_2
Defines the bit length of the DCI field "Transmission Configuration Indication" available in DCI format 1_2.

Corresponds to higher layer parameter `tci-PresentDCI-1-2` as defined in 3GPP 38.212.

Available when simple mode = off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:TS12` on page 841

Number of DCIs
Sets the number of DCIs and thus defines the number of rows in the DCI table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:NDCI` on page 841

DCI Table
Comprises the DCI settings. There is one row per DCI. The number of rows depends on the selected Number of DCIs.

Usage ← DCI Table
Sets the RNTI type to scramble the CRC, see Table 5-5.

In addition to the RNTIs defined by 3GPP, you can select a "Custom RNTI" for which you can define custom DCIs. When you select a custom RNTI, the only available DCI format is the custom DCI format.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:USAGe` on page 840

RNTI ← DCI Table
Displays the current applicable RNTI of the associated user.

When simple mode = on, you can only select a custom RNTI.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RNTI` on page 839

DCI Format ← DCI Table
Sets the DCI format.

The downlink control information (DCI) is a message used to control the physical layer resource allocations. It carries scheduling information and power control commands.

The DCI formats available in a particular situation depend on the selected Usage and Search Space. For an overview of the available DCI formats, see Table 5-4. Additionally, the "Custom" format with user-defined content is available.

Note that when you select a custom RNTI, the only available DCI format is the custom DCI format.

When simple mode = on, you can only configure a custom DCI format.

To configure the parameters per DCI format, select "Content > Config".

Table 5-4: DCI formats overview [TS 38.212]

DCI format	Usage
0_0	Scheduling of PUSCH in one UL cell See "DCI Format 0_0" on page 258.
0_1	Scheduling of one or multiple PUSCH in one cell, or indicating downlink feedback information for configured grant PUSCH (CG-DFI). See "DCI Format 0_1" on page 259.
0_2	Option: R&S SMW-K148. Scheduling of PUSCH in one cell. See "DCI Format 0_2" on page 261.
1_0	Scheduling of PDSCH in one DL cell (allocation type 1) See "DCI Format 1_0" on page 263.
1_1	Scheduling of PDSCH in one DL cell See "DCI Format 1_1" on page 264.

DCI format	Usage
1_2	Option: R&S SMW-K148. Scheduling of PDSCH in one cell. See "DCI Format 1_2" on page 266.
2_0	Notifying a group of UEs of the slot format See "DCI Format 2_0" on page 268.
2_1	Notifying a group of UEs of the PRBs and OFDM symbols where UE can assume that no transmission is intended for the UE See "DCI Format 2_1" on page 268.
2_2	Transmission of TPC commands for PUCCH and PUSCH See "DCI Format 2_2" on page 269.
2_3	Transmission of a group of TPC commands for SRS transmissions by one or more UEs See "DCI Format 2_3" on page 269.
2_4	Option: R&S SMW-K148. Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE. See "DCI Format 2_4" on page 270.
2_5	Option: R&S SMW-K148. Notifying the availability of soft resources. See "DCI Format 2_5" on page 270.
2_6	Option: R&S SMW-K148. Notifying the power saving information outside DRX Active Time for one or more UEs. See "DCI Format 2_6" on page 271.
2_7	Option: R&S SMW-K171. Notifying paging early indication and TRS availability indication for one or more UEs. See "DCI Format 2_7" on page 271.
3_0	Option: R&S SMW-K148. Scheduling of NR PSCCH and NR PSSCH in one cell. See "DCI Format 3_0" on page 272.
3_1	Option: R&S SMW-K148. Scheduling of LTE PSCCH and LTE PSSCH in one cell. See "DCI Format 3_1" on page 273.
4_0	Option: R&S SMW-K171. Scheduling of PDSCH with CRC scrambled by MCCH-RNTI or G-RNTI for broadcast. See "DCI Format 4_0" on page 273.

DCI format	Usage
4_1	Option: R&S SMW-K171. Scheduling of PDSCH with CRC scrambled by G-RNTI or G-CS-RNTI for multicast. See "DCI Format 4_1" on page 274.
4_2	Option: R&S SMW-K171. Scheduling of PDSCH with CRC scrambled by G-RNTI or G-CS-RNTI for multicast. See "DCI Format 4_2" on page 275.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FMT` on page 837

Search Space ← DCI Table

Defines the search space for the selected DCI.

The search space defines the set of PDCCH candidates that a UE has to monitor. Search spaces can be common search space (CSS) and UE-specific search space (USS), where the non-common DCIs are mapped to the USS. The UE can decode only the control information that is transmitted within one or more search spaces this UE monitors.

TS 38.213 defines the search spaces listed in "Search Space" on page 256.

Table 5-5: Search space sets

Search space	Designation	Parameter	CRC scrambled with
CSS (Common search space)	Type0-PDCCH Type0A-PDCCH	"Type0 CSS"	SI-RNTI RA-RNTI, TC-RNTI
	Type1-PDCCH	"Type1 CSS"	P-RNTI
	Type2-PDCCH	"Type2 CSS"	C-RNTI, CS-RNTI, P-RNTI, MCS-C-RNTI, SP-CSI-RNTI, INT-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, RPC-SRS-RNTI
	Type3-PDCCH	"Type3 CSS"	INT-RNTI, SFI-RNTI, TPC-PUSCH/PUCCH/SRS-RNTI, C-RNTI, CS-RNTI, MCS-C-RNTI, P-RNTI, RA-RNTI, TC-RNTI, SP-CSI-RNTI, SI-RNTI, CI-RNTI, PS-RNTI
UE-specific search space	USS	"USS"	C-RNTI, CS-RNTI, MCS-C-RNTI, SP-CSI-RNTI

The available search spaces depend on the selected Usage.

Inside the user BWPs, the common search space types Type0A, Type1 and Type2 are supported.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SSP` on page 839

Aggregation Level ← DCI Table
Sets the aggregation level for the selected DCI.

A physical downlink control channel PDCCH consists of one or more control-channel elements (CCEs), where their number is defined by the "Aggregation level".

This and several other parameters influence the way the search space is defined. For details, see "Search Space" on page 249.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:AGGLevel` on page 836

Candidate ← DCI Table
Selects one of the candidates configured for the selected Aggregation Level, where the number of candidates per aggregation level is set by the parameter "CORESET > General" > Max Candidates.

This and several other parameters influence the way the search space is defined. For details, see "Search Space" on page 249.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CANDidate` on page 836

CCE Index ← DCI Table
Sets or displays the CCE start index and thus the position of the first CCE of the PDCCH.

This and several other parameters influence the way the search space is defined. For details, see "Search Space" on page 249.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INDex` on page 838

Content ← DCI Table
Access a dialog for configuring the parameters per DCI format, see "DCI content configuration" on page 258.

Multiplexing Table ← DCI Table
Selects the time domain resource allocation table for the PDSCH.

Selecting one of the tables is possible for DCI formats 1_0 and 1_1. The tables you can select depend on the selected RNTI and search space as defined in 3GPP 38.214, chapter 5.1.2.1.1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:MULTable` on page 838

Create PDSCH ← DCI Table
If enabled, the content and scheduling of the PDSCH is created automatically, as configured with the DCI format 1_0, 1_1 and 1_2 parameters.

If PDSCH Scheduling = "Auto/DCI", the "Create PDSCH" = "On".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CPDSch` on page 837

PDSCH DMRS Symbols ← DCI Table
Shows the PDSCH DMRS symbols that the corresponding DCI uses.

This information is displayed if the PDSCH content was created automatically. Otherwise the cell remains empty.

If the DMRS symbols could not be created for any reason, a warning sign appears instead of the symbol numbers. Check the time domain allocations.

This information is read only.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSS?` on page 837

PDSCH Power /dB ← DCI Table
Defines the power of PDSCH allocations according to the CORESET DCI.

Available for PDSCH scheduling DCI formats (for example 1_0, 1_1 and 1_2) and if the PDSCH scheduling mode is "Auto / DCI".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:POWer` on page 838

DCI content configuration
Comprises the parameters of the selected DCI format.

The fields defined in the DCI format are mapped to the information bits according to TS 38.212. The resulting Bit Data > Pattern is displayed.

The following parameters have an impact on the DCI bit data length and the DCI fields:
- Number of RB No. RBs of the first UL BWP
- Number of RB of the DL BWP, in that the DCI is configured
- SUL indicator of the selected cell
- DCI Search Space

Bit Data > Pattern ← DCI content configuration
Displays the resulting bit data as selected with the DCI format parameters.

Mapping of the information bits is according to TS 38.212.

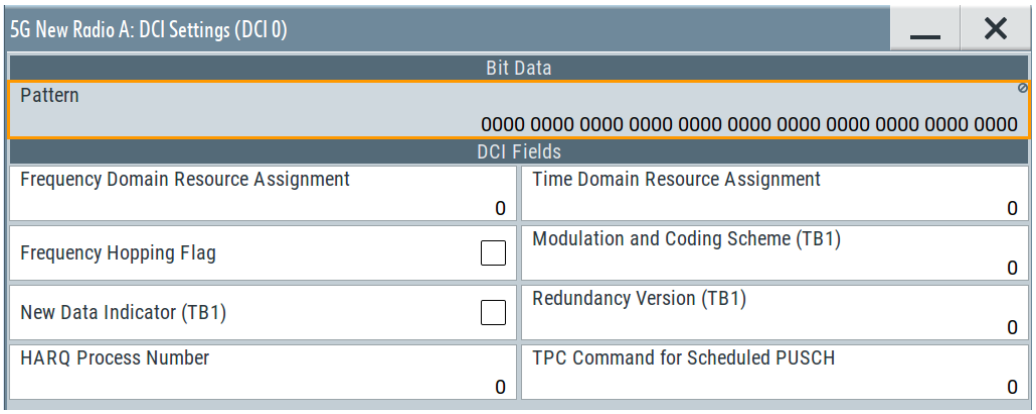
Padding bits are added in certain cases, that is zeros are append to the DCI format until the payload size is equal to a specified size.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HBTS?` on page 837

DCI Format 0_0 ← DCI content configuration
The DCI format 0_0 is used for scheduling of PUSCH in one UL cell.

DCI format 0_0 is available for:
- C-RNTI

- CS-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.1, "DCI format 0_0", on page 842.

The following DCI fields are available for DCI format 0_0.

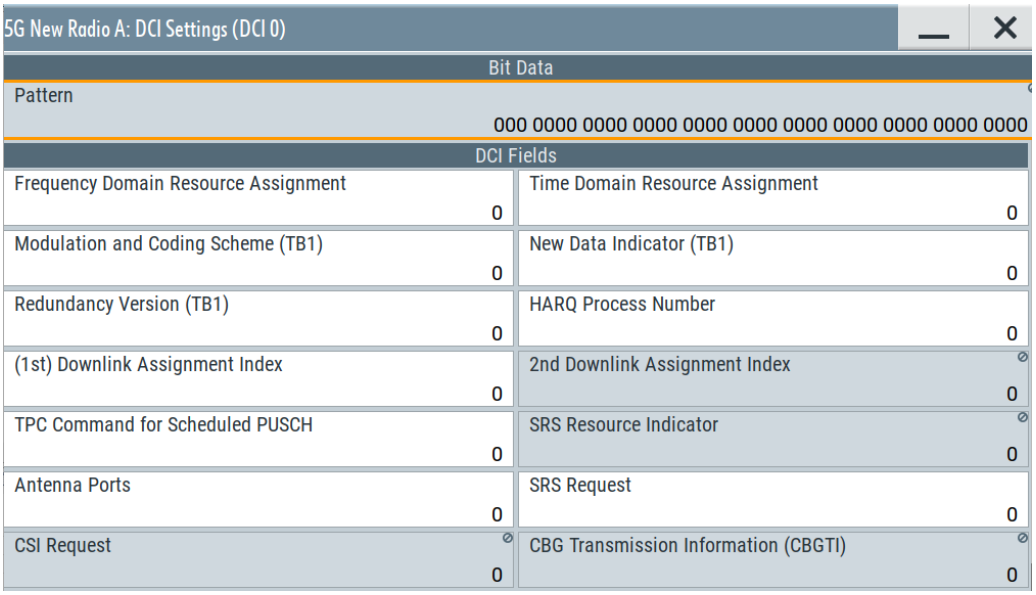
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "Frequency hopping flag"
  Requires: resource allocation = type 1 and PUSCH frequency hopping = intra-slot
- "Modulation and coding scheme (TB1)"
  "Modulation and coding scheme (TB2)"
- "New data indicator (TB1)"
  "New data indicator (TB2)"
- "Redundancy version (TB1)"
  "Redundancy version (TB2)"
- "HARQ process number"
- "TPC command for scheduling PUSCH"
- "Channel Access Cpext"
  Requires: shared spectrum access = on
- "UL/SUL Indicator"
  Requires: SUL = on

DCI Format 0_1 ← DCI content configuration

The DCI format 0_1 is used for scheduling one or more PUSCH in one UL cell or for indicating downlink feedback information for configured grant PUSCH (CG-DFI).

DCI format 0_1 is available for:

- C-RNTI
- CS-RNTI
- MCS-C-RNTI
- SP-CSI-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.2, "DCI format 0_1", on page 845.

The following DCI fields are available for DCI format 0_1.

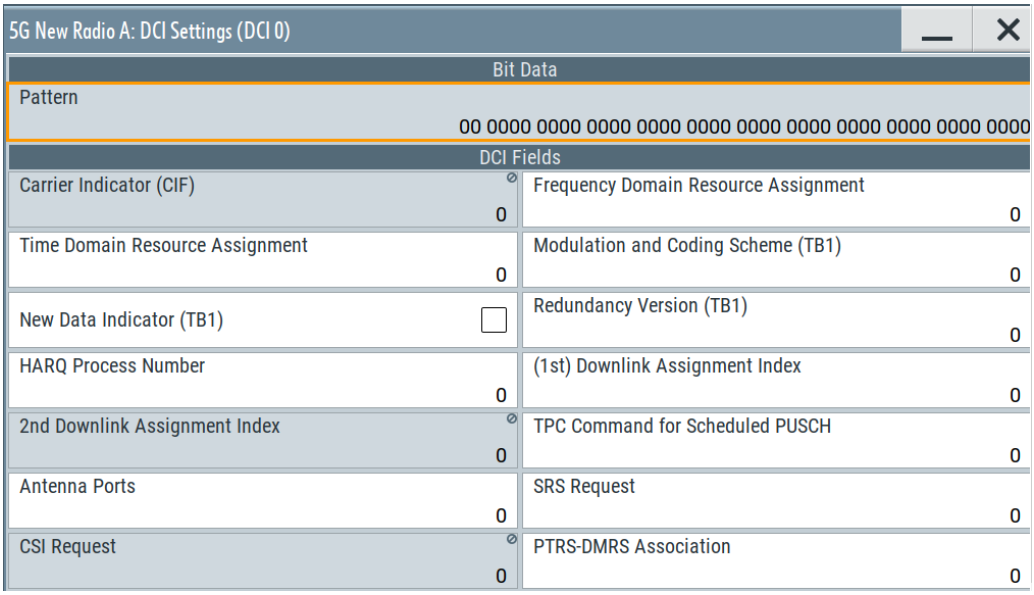
- "Downlink Feedback Information"
  Requires: CS-RNTI and shared spectrum access = on
- "UL/SUL Indicator"
  Requires: SUL = on
- "Carrier indicator"
  Requires: CIF = on
- "Bandwidth part indicator"
  Requires: number of bandwidth parts > 1
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "Frequency hopping flag"
  Requires: resource allocation = type 1 and PUSCH frequency hopping = intra-slot
- "Modulation and coding scheme (TB1)"
- "New data indicator (TB1)"
- "Redundancy version (TB1)"
- "HARQ process number"
- "(1st) downlink assignment index"
  "2nd downlink assignment index"
  Depends on: PDSCH HARQ ACK codebook
- "3rd downlink assignment index" (requires release 17 option)
  Requires: Bits for 3rd downlink assignment index > 0
- "TPC command for scheduling PUSCH"
  "2nd TPC command for scheduling PUSCH" (requires release 17 option)
  Requires: Use 2nd TPC command = on
- "SRS resource set indicator" (requires release 17 option)
  Requires: Bits for SRS resource set indication = on
- "SRS resource indicator"
  "2nd SRS resource indicator" (requires release 17 option)

Requires: Bits for 2nd SRS resource indication > 0
- "Precoding information and number of layers"
  Requires: "TxConfig" on page 172 = codebook, SRS resource sets = 1, SRS no. of ports = 4
  "2nd Precoding information and number of layers" (requires release 17 option)
  Requires: Bits for 2nd precoding information > 0
- "Antenna ports"
- "SRS request"
- "SRS Offset Indicator" (requires release 17 option)
  Requires: Bits for SRS offset indicator > 0
- "CSI request"
- "CBG transmission information (CBGTI)"
- "PTRS-DMRS association"
  Requires: Max rank ≥2
- "Beta_offset indicator"
- "DMRS sequence initialization"
- "SCell dormancy indication 1" (requires release 16 option)
  Requires: Number of SCell Groups Outside Active Time > 0
- "UL-SCH indicator" (requires release 16 option)
  Requires: Shared spectrum access = on
- "Channel Access Cpext" (requires release 16 option)
  Requires: Shared spectrum access = on
- "Open-loop power control parameter indication" (requires release 16 option)
- "Priority indicator" (requires release 16 option)
  Requires: Priority Indicator = on
- "Invalid symbol pattern indicator" (requires release 16 option)
  Requires: Invalid symbol indicator = on
- "Minimum applicable scheduling offset indicator" (requires release 16 option)
  Requires: Minimum scheduling offset = on
- "PDCCH Monitoring Adaption Indication" (requires release 16 option)
  Requires: Bits for monitoring adaption indication > 0

DCI Format 0_2 ← DCI content configuration
Option: R&S SMW-K148.

The DCI format 0_2 is used for scheduling of PUSCH in one UL cell.

DCI format 0_1 is available for:
- C-RNTI
- CS-RNTI
- MCS-C-RNTI
- SP-CSI-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.3, "DCI format 0_2", on page 853.

The following DCI fields are available for DCI format 0_2.

- "UL/SUL Indicator"
  Requires: SUL = on
- "Bandwidth part indicator"
  Requires: number of bandwidth parts > 1
- "Carrier indicator"
  Requires: CIF = on
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "Frequency hopping flag"
  Requires: resource allocation = type 1 and PUSCH frequency hopping = intra-slot
- "Modulation and coding scheme (TB1)"
- "New data indicator (TB1)"
- "Redundancy version (TB1)"
- "HARQ process number"
- "(1st) downlink assignment index"
  "2nd downlink assignment index"
  Requires: Downlink assignment index for DCI 0_2 = on
  Depends on: PDSCH HARQ ACK codebook
- "3rd downlink assignment index" (requires release 17 option)
  Requires: Bits for 3rd downlink assignment index > 0
- "TPC command for scheduling PUSCH"
  "2nd TPC command for scheduling PUSCH" (requires release 17 option)
  Requires: Use 2nd TPC command = on
- "SRS resource set indicator" (requires release 17 option)
  Requires: Bits for SRS resource set indication = on
- "SRS resource indicator"
  "2nd SRS resource indicator" (requires release 17 option)
  Requires: Bits for 2nd SRS resource indication > 0

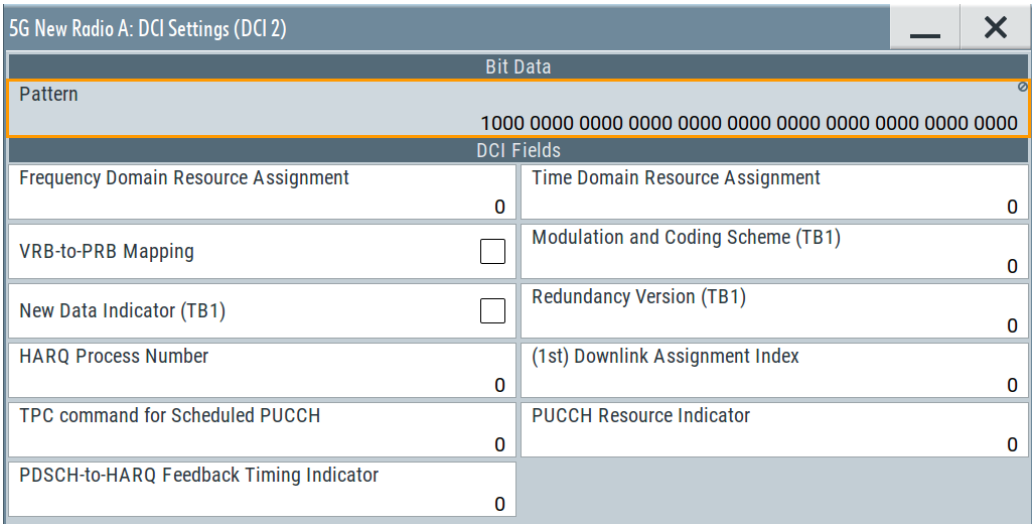
- "Precoding information and number of layers"
  Requires: "TxConfig" on page 172 = codebook, SRS resource sets = 1, SRS no. of ports = 4
  "2nd Precoding information and number of layers" (requires release 17 option)
  Requires: Bits for 2nd precoding information > 0
- "Antenna ports"
- "SRS request"
- "SRS Offset Indicator" (requires release 17 option)
  Requires: Bits for SRS offset indicator > 0
- "CSI request"
- "PTRS-DMRS association"
  Requires: Max rank ≥2
- "Beta_offset indicator"
- "DMRS sequence initialization"
- "UL-SCH indicator"
  Requires: Shared spectrum access = on
- "Open-loop power control parameter indication"
- "Priority indicator"
  Requires: Priority Indicator = on
- "Invalid symbol pattern indicator"
  Requires: Invalid symbol indicator = on
- "Monitoring Adaption Indication" (requires release 17 option)
  Requires: Bits for monitoring adaption indication > 0

DCI Format 1_0 ← DCI content configuration

The DCI format 1_0 is used for scheduling of PDSCH in one DL cell and / or triggering one shot HARQ-ACK codebook feedback.

DCI format 1_0 is available for:

- C-RNTI
- P-RNTI
- CS-RNTI
- RA-RNTI
- SI-RNTI
- MsgB-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.4, "DCI format 1_0", on page 854.

The following DCI fields are available for DCI format 1_0.

- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "Modulation and coding scheme (TB1)"
- "New data indicator (TB1)"
- "Redundancy version (TB1)"
- "HARQ process number"
- "(1st) downlink assignment index"
  Depends on: PDSCH HARQ ACK codebook
- "TPC command for scheduling PUSCH"
- "PUCCH resource indicator"
  Requires: C-RNTI or CS-RNTI
- "PDSCH-to-HARQ feedback timing indicator"
  Requires: C-RNTI
- "Short message indicator"
  Requires: P-RNTI
- "Short messages"
  Requires: P-RNTI
- "System information indicator"
  Requires: SI-RNTI
- "TB scaling"
- "TRS Availability Indication" (requires release 17 option)
  Requires: Bits for TSR Availability Indication > 0 and usage type = P-RNTI
- "Padding bits, reserved bits"
  Requires: SI-RNTI
- "Channel access CPext" (requires release 16 option)
  Requires: Shared spectrum access = on
- "LSBs of SFN"
  Requires: RA-RNTI

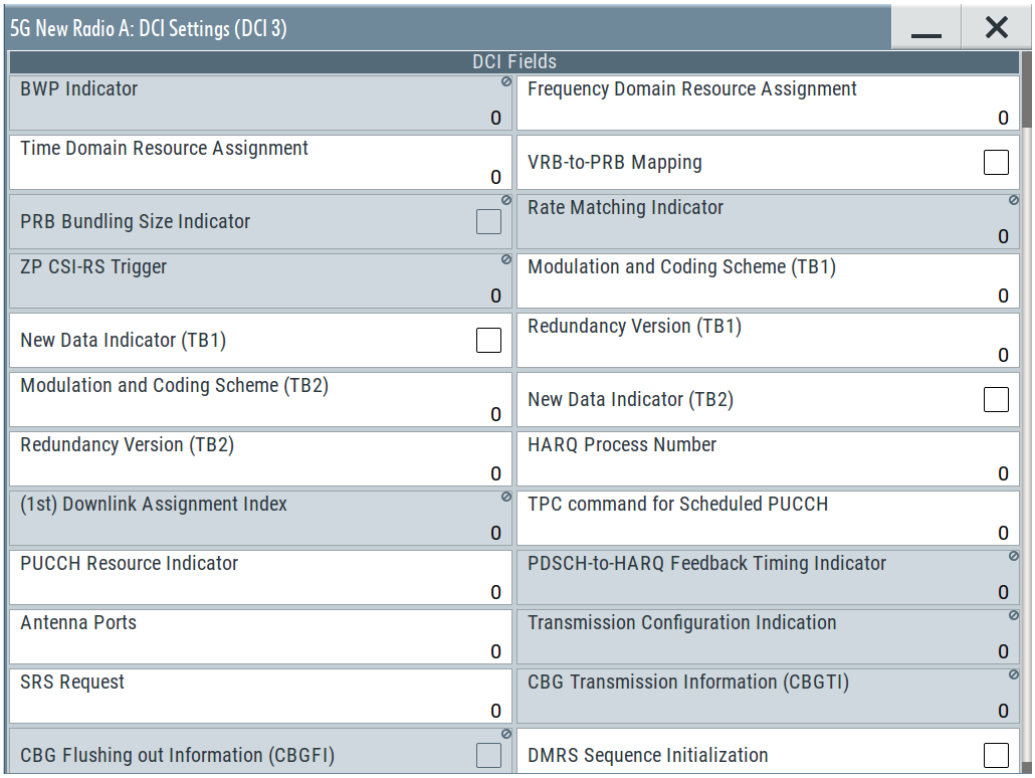
DCI Format 1_1 ← DCI content configuration

The DCI format 1_1 is used for scheduling of PDSCH in one DL cell.

The DCI resource allocator for DCI1_1 C-RNTI - CA is needed for cross-carrier scheduling.

DCI format 1_1 is available for:

- C-RNTI
- CS-RNTI
- MCS-C-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.5, "DCI format 1_1", on page 857.

The following DCI fields are available for DCI format 1_1.

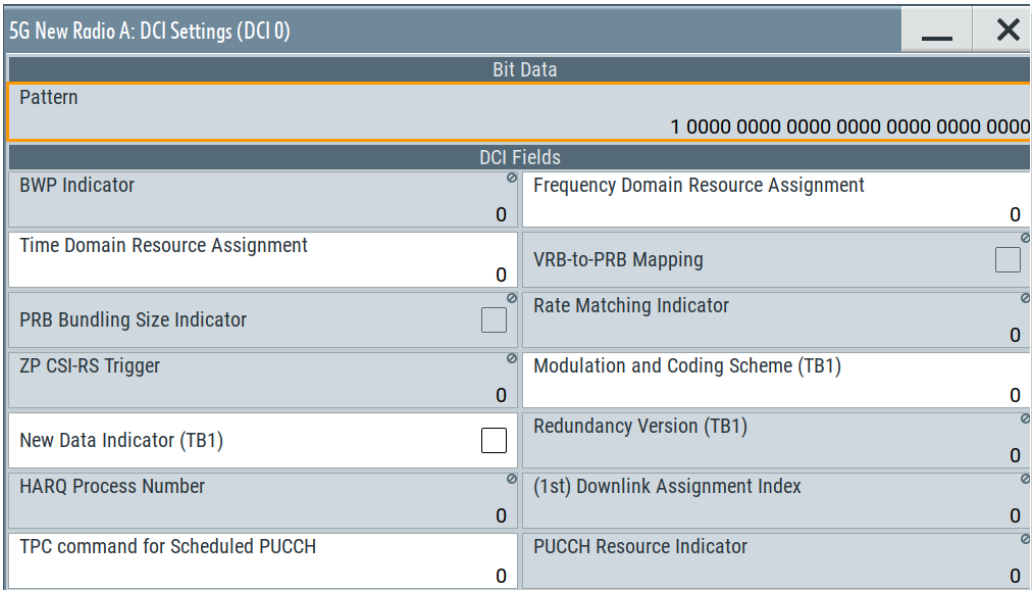
- "Carrier indicator"
  Requires: CIF = on
- "Bandwidth part indicator"
  Requires: number of bandwidth parts > 1
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "PRB bundling size indicator"
- "Rate matching indicator"
- "ZP CSI-RS trigger"
- "Modulation and coding scheme (TB1)"
  "Modulation and coding scheme (TB2)"
- "New data indicator (TB1)"
  "New data indicator (TB2)"
- "Redundancy version (TB1)"
  "Redundancy version (TB2)"
- "HARQ process number"
- "(1st) downlink assignment index"
  Depends on: PDSCH HARQ ACK codebook
- "TPC command for scheduling PUCCH"
  "2nd TPC command for scheduling PUCCH" (requires release 17 option)
  Requires: Use 2nd TPC command = on
- "PUCCH resource indicator"

- "PDSCH-to-HARQ feedback timing indicator"
- "HARQ-ACK Retransmission Indicator" (requires release 17 option)
  Requires: HARQ-ACK retransmission indicator = on
- "Enhanced Type 3 Codebook Indicator" (requires release 17 option)
  Requires: Bits for enhanced type 3 indicator > 0
- "Antenna ports"
- "Transmission configuration indication"
  Requires: TCI present in DCI = on
- "SRS request"
- "CBG transmission information (CBGTI)"
- "CBG flushing out information (CBGFI)"
- "DMRS sequence initialization"
- "SCell dormancy indication 1" (requires release 16 option)
  Requires: Number of SCell Groups Outside Active Time > 0
- "Minimum applicable scheduling offset indicator" (requires release 16 option)
  Requires: Minimum scheduling offset indicator = on
- "One-shot HARQ-ACK request" (requires release 16 option)
- "PDSCH group index" (requires release 16 option)
- "New feedback indicator" (requires release 16 option)
- "Number of requested PDSCH groups" (requires release 16 option)
- "Priority indicator" (requires release 16 option)
  Requires: Priority Indicator = on
- "Channel Access Cpext" (requires release 16 option)
  Requires: Shared spectrum access = on
- "Monitoring Adaption Indication" (requires release 17 option)
  Requires: Bits for monitoring adaption indication > 0
- "PUCCH Cell Indicator" (requires release 17 option)
  Requires: PUCCH-sSCellDyn DCI1_1 = on

DCI Format 1_2 ← DCI content configuration
Option: R&S SMW-K148.

The DCI format 1_2 is used for scheduling of PDSCH in one DL cell.

DCI format 1_2 is available for:
- C-RNTI
- CS-RNTI
- MCS-C-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.6, "DCI format 1_2", on page 862.

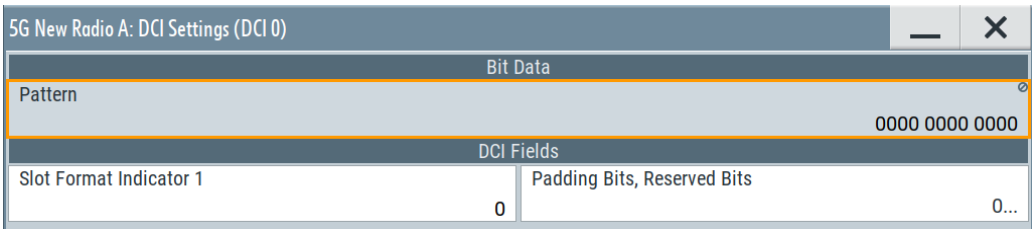
The following DCI fields are available for DCI format 1_1.

- "Carrier indicator"
  Requires: CIF = on
- "Bandwidth part indicator"
  Requires: number of bandwidth parts > 1
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "PRB bundling size indicator"
- "Rate matching indicator"
- "ZP CSI-RS trigger"
- "Modulation and coding scheme (TB1)"
- "New data indicator (TB1)"
- "Redundancy version (TB1)"
- "HARQ process number"
- "(1st) downlink assignment index"
  Depends on: PDSCH HARQ ACK codebook
- "TPC command for scheduling PUCCH"
  "2nd TPC command for scheduling PUCCH" (requires release 17 option)
  Requires: Use 2nd TPC command = on
- "PUCCH resource indicator"
- "PDSCH-to-HARQ feedback timing indicator"
- "HARQ-ACK Retransmission Indicator" (requires release 17 option)
  Requires: HARQ-ACK retransmission indicator = on
- "Enhanced Type 3 Codebook Indicator" (requires release 17 option)
  Requires: Bits for enhanced type 3 indicator > 0
- "Antenna ports"
- "Transmission configuration indication"
  Requires: TCI present in DCI = on

- "SRS request"
- "DMRS sequence initialization"
- "Priority indicator"
  Requires: Priority Indicator = on
  Option: R&S SMW-K148
- "Monitoring Adaption Indication" (requires release 17 option)
  Requires: Bits for monitoring adaption indication > 0
- "PUCCH Cell Indicator" (requires release 17 option)
  Requires: PUCCH-sSCellDyn DCI1_1 = on

DCI Format 2_0 ← DCI content configuration
The DCI format 2_0 is used for notifying a group of UEs of the slot format.

DCI format 2_0 is available for:
- SFI-RNTI

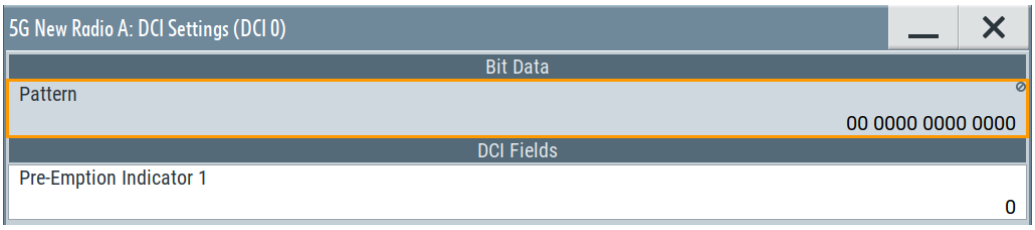


For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.7, "DCI format 2_0", on page 863.

The following DCI fields are available for DCI format 2_0.
- "Slot format indicator 1 ... 16"
  Depends on the number of SFIs in DCI2_0.
- "Available RB set indicator 1 ... 16"
  Depends on the number of available RB set indicators.
- "COT duration indicator 1 ... 16"
  Depends on the number of available COT duration indicators.
- "Search space set group switching flag 1 ... 4"
  Depends on the number of search space set group switching flags.
- "Padding bits, reserved bits"

DCI Format 2_1 ← DCI content configuration
The DCI format 2_1 is used for notifying a group of UEs of the PRBs and OFDM symbols where UE can assume that no transmission is intended for the UE.

DCI format 2_1 is available for:
- INT-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.7, "DCI format 2_0", on page 863.

The following DCI fields are available for DCI format 2_1.

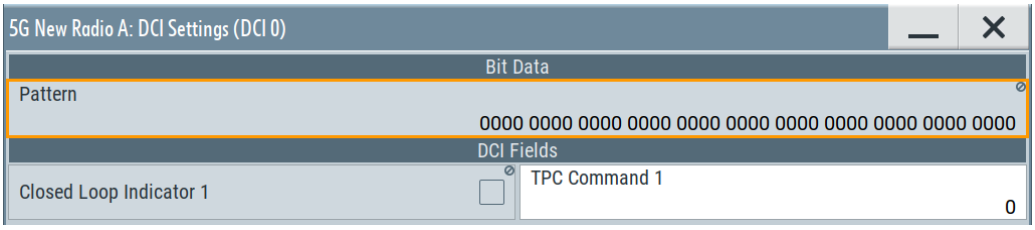
- "Pre-emption indication 1 ... 9"
  Depends on the number of pre-emption indicators in DCI2_1.

DCI Format 2_2 ← DCI content configuration

The DCI format 2_2 is used for transmission of TPC commands for PUCCH and PUSCH.

DCI format 2_2 is available for:

- TPC-PUSCH-RNTI
- TPC-PUCCH-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.9, "DCI format 2_2", on page 866.

The following DCI fields are available for DCI format 2_2.

- "Closed loop indicator 1 ... 14"
- "TPC command 1 ... 14"

The fields become available if TPC-PUCCH-RNTI (TPC-PUSCH-RNTI) or TPC-PUCCH-RNTI (TPC-PUCCH-RNTI) = on.

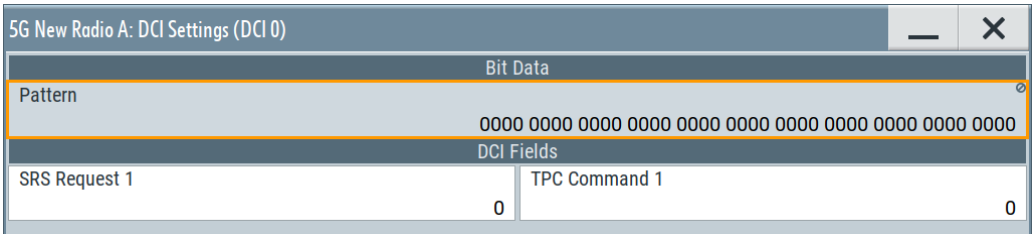
The number of fields depend on Number of PUSCH Blocks and Number of PUCCH Blocks.

DCI Format 2_3 ← DCI content configuration

The DCI format 2_3 is used for transmission of a group of TPC commands for SRS transmissions by one or more UEs.

DCI format 2_3 is available for:

- TPC-SRS-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.10, "DCI format 2_3", on page 868.

The following DCI fields are available for DCI format 2_3.

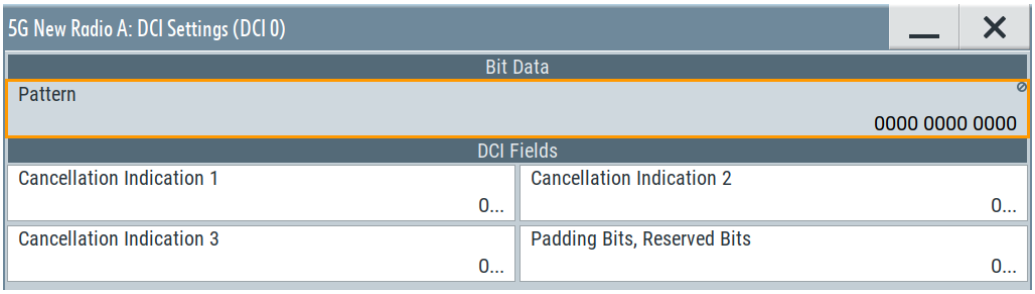
- "SRS request 1 ... 22"
- "TPC command 1 ... 22"

The number of fields depend on the number of blocks.

DCI Format 2_4 ← DCI content configuration
Option: R&S SMW-K148.

The DCI format 2_4 is used for notifying the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE.

DCI format 2_4 is available for:
- CI-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.11, "DCI format 2_4", on page 868.

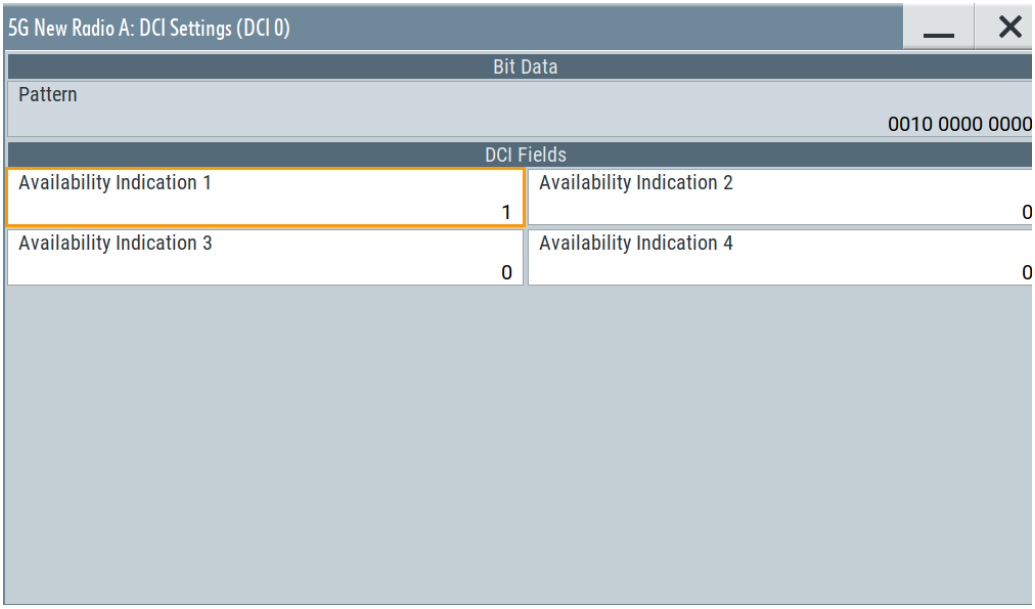
The following DCI fields are available for DCI format 2_4.
- "Cancellation indication 1 ... 16"
- "Padding bits, reserved bits"

The number of fields depend on the number of cancellation indications.

DCI Format 2_5 ← DCI content configuration
Option: R&S SMW-K148.

The DCI format 2_5 is used for notifying the availability of soft resources.

DCI format 2_5 is available for:
- AI-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.12, "DCI format 2_5", on page 869.

The following DCI fields are available for DCI format 2_5.

- "Availability indication 1 ... 10"
- "Padding bits, reserved bits"

The number of fields depend on the number of availability indications.

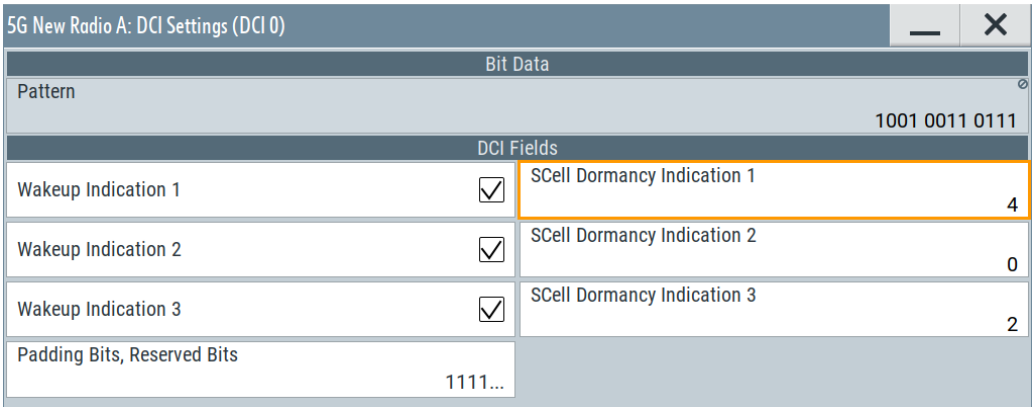
DCI Format 2_6 ← DCI content configuration

Option: R&S SMW-K148.

The DCI format 2_6 is used for notifying the power saving information outside DRX Active Time for one or more UEs.

DCI format 2_6 is available for:

- PS-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.13, "DCI format 2_6", on page 870.

The following DCI fields are available for DCI format 2_6.

- "Wakeup indication 1 ... 10"
  The number of fields depend on the number of dormancy indications.
- "SCell dormancy indication 1 ... 10"
  The number of fields depend on the number of SCell groups.
- "Padding bits, reserved bits"

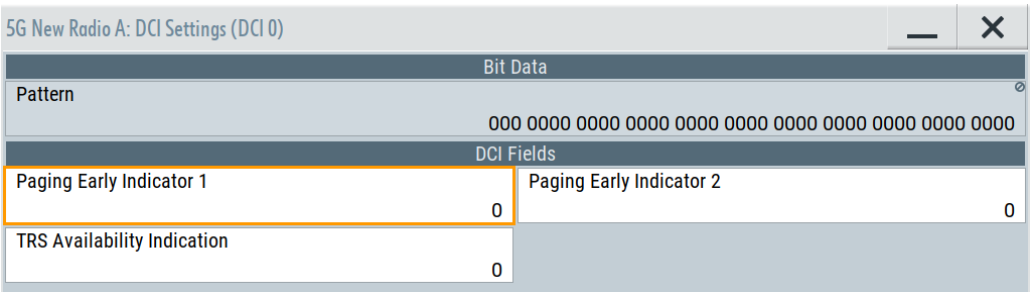
DCI Format 2_7 ← DCI content configuration

Option: R&S SMW-K171.

The DCI format 2_7 is used for notifying the paging early indication and TRS availability indication for one or more UEs.

DCI format 2_7 is available for:

- PEI-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.14, "DCI format 2_7", on page 871.

The following DCI fields are available for DCI format 2_7.

- "Paging early indicator 1...8"
  The number of fields depend on the PO number per PEI.
- "TRS availability indication"
  Available when the bits for TRS availability indication > 1.

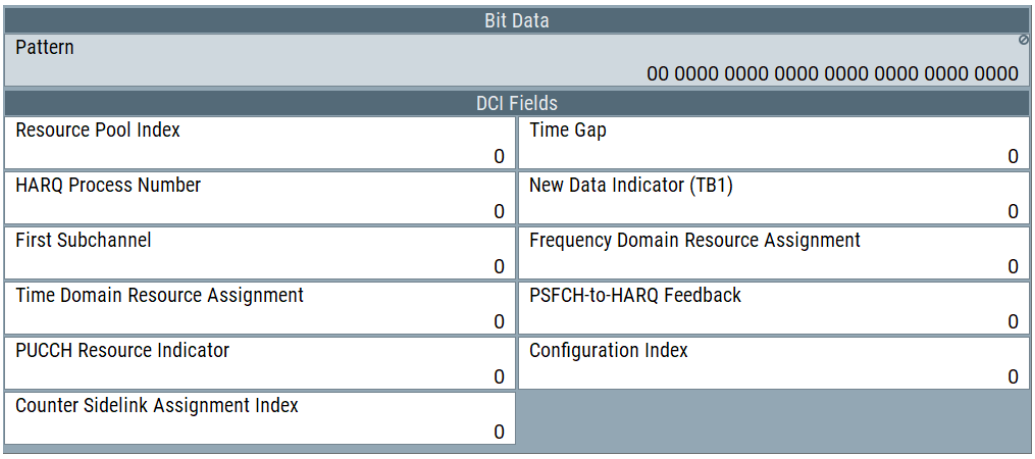
DCI Format 3_0 ← DCI content configuration

Option: R&S SMW-K148.

The DCI format 3_0 is used for scheduling of NR PSCCH and NR PSSCH in one cell.

DCI format 3_0 is available for:

- SL-RNTI
- SL-CS-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.15, "DCI format 3_0", on page 872.

The following DCI fields are available for DCI format 3_0.

- "Resource pool index"
  Requires: number of resource pools > 1
- "Time gap"
- "HARQ process number"
- "New data indicator (TB1)"
  "New data indicator (TB2)"
- "First subchannel"
  Requires: number of subchannels > 1

- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "PSFCH-to-HARQ feedback"
- "PUCCH resource indicator"
- "Configuration index"
  Requires: SL-CS-RNTI
- "Counter sidelink assignment index"
- "Sidelink Assignment Index"
  Requires: Bits for sidelink assignment index > 0

DCI Format 3_1 ← DCI content configuration
Option: R&S SMW-K148.

The DCI format 3_0 is used for scheduling of LTE PSCCH and LTE PSSCH in one cell.

DCI format 3_1 is available for:
- V-RNTI

Bit Data	
Pattern	000 0000 0000 0000 0000 0000 0000
DCI Fields	
Timing Offset 0	Carrier Indicator (CIF) 0
First Subchannel 0	Frequency Resource Location 0
Time Gap 0	SL Index 0
SL SPS Configuration Index 0	Activation/Release Indication ☐

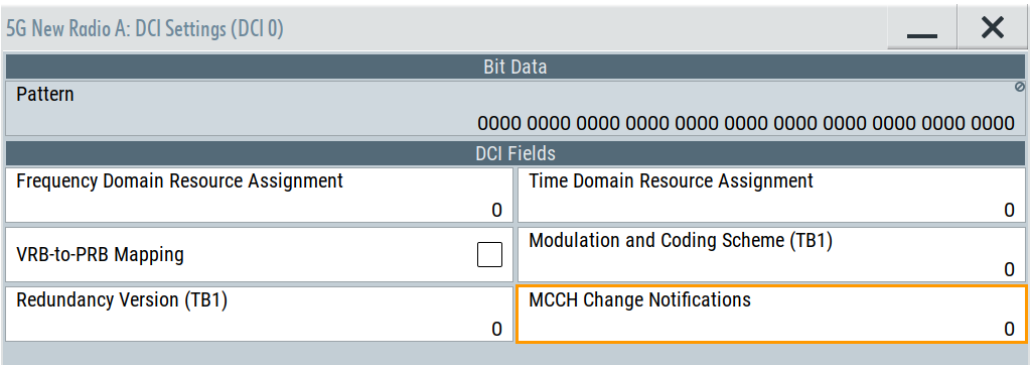
For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.16, "DCI format 3_1", on page 874.

The following DCI fields are available for DCI format 3_1.
- "Timing offset"
- "Carrier indicator (CIF)"
- "First subchannel"
  Requires: number of subchannels > 1
- "Frequency resource allocation"
- "Time gap"
- "SL index"
- "SL SPS configuration index"
- "Activation / release indication"

DCI Format 4_0 ← DCI content configuration
Option: R&S SMW-K171.

The DCI format 4_0 is used for schedulng of PDSCH with CRC scrambled by MCCH-RNTI or G-RNTI for broadcast.

DCI format 4_0 is available for:
- MCCH-RNTI
- G-RNTI



For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.17, "DCI format 4_0", on page 876.

The following DCI fields are available for DCI format 4_0.

- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "Modulation and coding scheme (TB1)"
- "Redundancy version (TB1)"
- "MCCH change notifications"

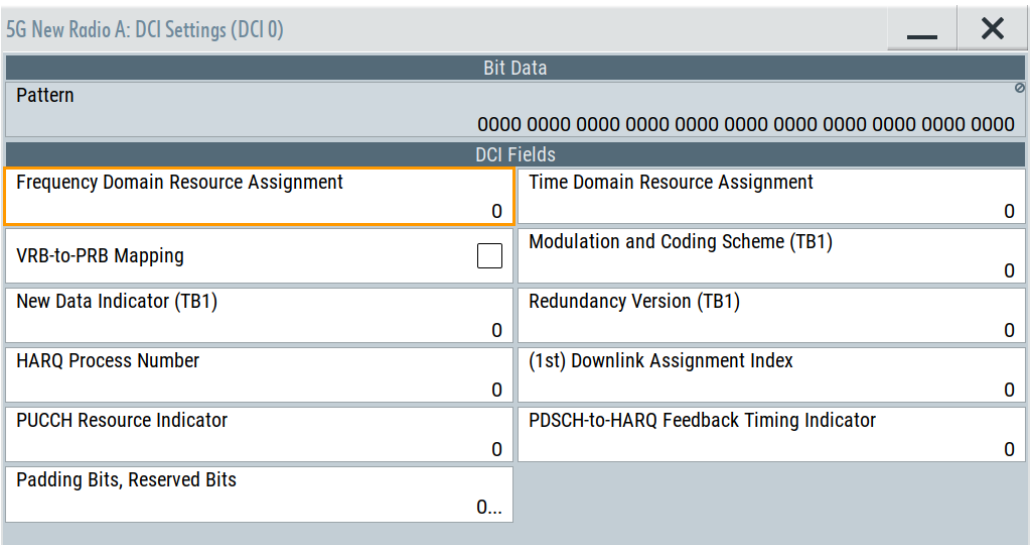
DCI Format 4_1 ← DCI content configuration

Option: R&S SMW-K171.

The DCI format 4_1 is used for schedulng of PDSCH with CRC scrambled by G-RNTI or G-CS-RNTI for broadcast.

DCI format 4_1 is available for:

- G-RNTI
- G-CS-RNTI



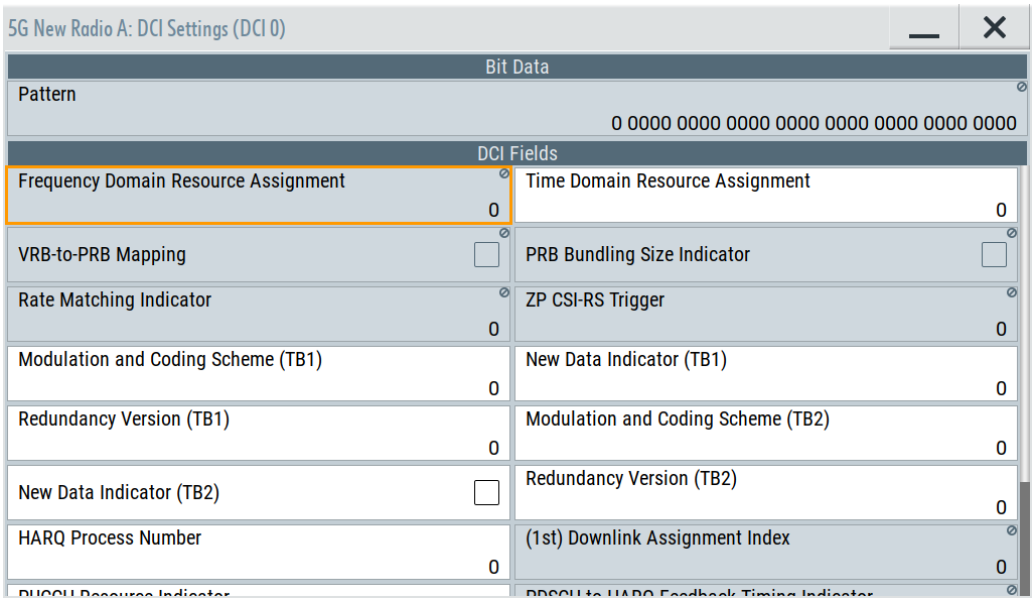
For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.18, "DCI format 4_1", on page 876.

The following DCI fields are available for DCI format 4_1.
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "Modulation and coding scheme (TB1)"
- "New data indicator (TB1)"
- "Redundancy version (TB1)"
- "HARQ process number"
- "(1st) downlink assignment index"
- "PUCCH resource indicator"
- "PDSCH-to-HARQ feedback timing indicator"
- "Padding bits, reserved bits"

DCI Format 4_2 ← DCI content configuration
Option: R&S SMW-K171.

The DCI format 4_2 is used for schedulng of PDSCH with CRC scrambled by G-RNTI or G-CS-RNTI for broadcast.

DCI format 4_2 is available for:
- G-RNTI
- G-CS-RNTI

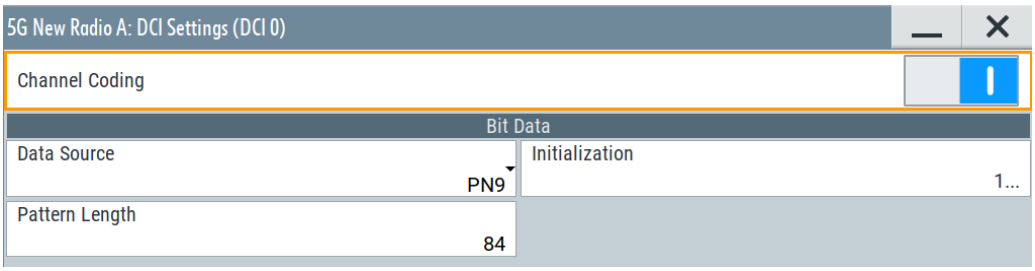


For a list of remote commands required to configure the DCI fields, see Chapter 12.23.3.19, "DCI format 4_2", on page 877.

The following DCI fields are available for DCI format 4_2.
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "VRB-to-PRB mapping"
- "PRB bundling size indicator"
- "Rate matching indicator"
- "ZP CSI-RS trigger"
- "Modulation and coding scheme (TB1)"

"Modulation and coding scheme (TB2)"
- "New data indicator (TB1)"
  "New data indicator (TB2)"
- "Redundancy version (TB1)"
  "Redundancy version (TB2)"
- "HARQ process number"
- "(1st) downlink assignment index"
- "PUCCH resource indicator"
- "PDSCH-to-HARQ feedback timing indicator"
- "Antenna ports"
- "Transmission configuration indication"
- "DMRS sequence initialization"
- "Enabling HARQ-ACK feedback indication"
  Requires: HARQ_ACK feedback indication = on.
- "Padding bits, reserved bits"
  Requires: Minimum size > 34.

Custom ← DCI content configuration
This setting is a DCI without predefined DCI fields. The DCI content is user-definable.



Channel Coding ← Custom ← DCI content configuration
Enables channel coding.

If PDSCH Scheduling = "Auto/DCI", the "Channel Coding" = "On".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:STATe` on page 880

Data Source ← Custom ← DCI content configuration
Selects the data source for the custom DCI.

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:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DATA` on page 879
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DLISt` on page 879
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PATTern` on page 880

Initialization ← Custom ← DCI content configuration
Sets an initialization value for the second m-sequence in the PN sequence of the custom DCI.

Enabled if "Data Source > PNxx".

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INITpattern` on page 879

Pattern Length ← Custom ← DCI content configuration
If Channel Coding > "On", sets the number of DCI bits, i.e. the number of bits in the "Pattern" field.

If Channel Coding > "Off", the number of DCI bits is calculated based on the selected Aggregation Level for the corresponding DCI.

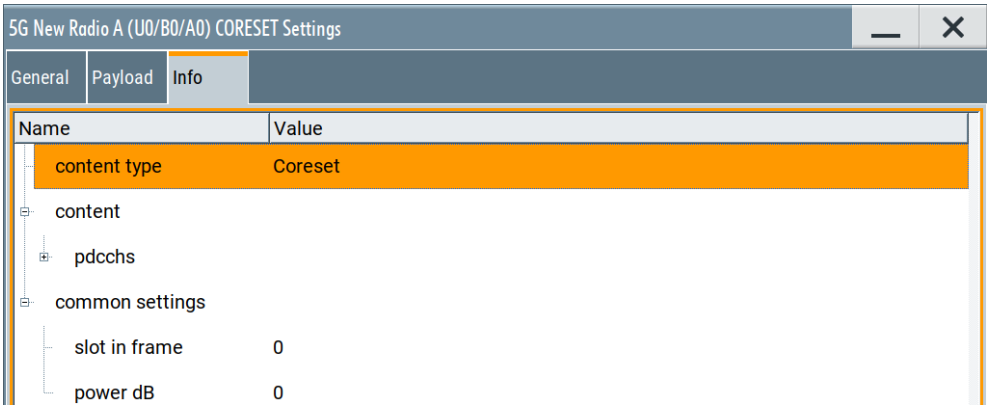
Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BITLength` on page 879

5.6.3 Info

Access:

1. Select "Scheduling > User x BWP x > Content > CORESET > Settings > Config".

2. Select "Info".



The dialog displays details on the CORESET configuration.

Info
The dialog displays details on the configuration.

There are two information lists:

- "Stable": Naming and structure of the information in this list are stable in future firmware releases.
- "Mutable": Naming and structure of the information in this list can change in future firmware releases.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

5.7 CSI-RS settings (scheduling table)

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. For any configurable allocation, select "Content" = "CSI-RS".
4. For any CSI-RS allocation, select "Config" to configure the corresponding CSI-RS allocation.

   This dialog comprises the settings of the CSI reference signal.

Note that the settings available in this dialog are a subset of the settings available for the CSI-RS in the "DL BWP Config" dialog. However, when you change a setting for the CSI-RS in one place, it has no effect on the other - both ways to configure a CSI-RS allocation are independent of each other.

5.7.1 General CSI-RS settings

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. For any configurable allocation, select "Content" = "CSI-RS".
4. For any CSI-RS allocation, select "Config" to configure the corresponding CSI-RS allocation.
5. Select "General".

   This dialog comprises general settings for the CSI reference signal (CSI-RS).

Settings:

Zero Power
Turns zero power transmission for the CSI-RS on and off (ZP CSI-RS or NZP CSI-RS).

If you turn on zero power transmission, the resource elements are allocated to the CSI-RS as if it were there, but it is not actually transmitted.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:ISZPower` on page 882

Row
The CSI-RS location in a slot is defined according to TS 38.211 as a function of the number of ports X, the "Density" and the "CDM-Type".

The possible combinations are listed in a table and the parameter "Row" indicates one of the combinations. It is not the consequent table row number in the CSI-RS resource table. The latter is defined with the suffix `RES<user0>` in the remote control command.

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:ROW on page 882

Density
Sets the value ρ that is the higher-layer parameter density in the CSI-RS-ResourceMapping or the CSI-RS-CellMobility messages.

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:DENSity on page 881

Bitmap
Sets the location of the CSI-RS in the frequency domain. The starting position and number of the resource blocks in which the CSI-RS is transmitted are defined by the higher-layer parameters freqBand.

This parameter is transmitted by the higher-layer parameters frequencyDomainAllocation as part of the CSI-RS-ResourceMapping or the CSI-RS-CellMobility messages.

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BITMap on page 881

Scrambling ID
Sets the parameter n_{ID} that is defined by the higher-layer parameter ScramblingID and used for the generation of the pseudo-random reference-signal generator.

Remote command:
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCID on page 882

I0/I1
Sets the parameters I_0 and I_1 and define the CSI-RS location relative to the start of as slot. Thus, the I_0 and I_1 give the location of the CSI-RS in time.

These parameters are transmitted by the higher-layer parameters firstOFDMSymbolInTimeDomain and firstOFDMSymbolInTimeDomain2 as part of the CSI-RS-ResourceMapping or the CSI-RS-CellMobility messages.

Remote command:
I_0: [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:I0 on page 881
I_1: [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:I1 on page 882

5.7.2 Antenna port configuration for CSI-RS

Access:

1. Select "5G New Radio > General > Link Direction > Downlink".
2. Select "5G New Radio > Scheduling".
3. For any configurable allocation, select "Content" = "CSI-RS".
4. For any CSI-RS allocation, select "Config" to configure the corresponding CSI-RS allocation.
5. Select "Antenna Ports".

   This dialog comprises antenna port settings for the CSI reference signal.

Settings:

Mapping Coordinates
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Mapping table
Defines the mapping of the antenna ports (AP) to the physical antennas.

For details on the antenna ports-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL` on page 774
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary` on page 775
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude` on page 775
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe` on page 776

5.8 RIM-RS setting (scheduling table)

The remote interference management reference signal (RIM-RS) is used by a base station to measure remote interference and provide that information to other base stations. Remote interference can occur under certain atmospheric conditions and cause downlink transmissions to interfere with uplink transmissions.

You can define various parameters that define the sequence generation of each RIM-RS you add to the scheduling table.

NScid
Defines the scrambling ID for the RIM reference signal sequence generation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:SCID` on page 884

NTRim
Defines the number of RIM-RS transmission periods since a certain reference time as defined in 3GPP 38.211, chapter 7.4.1.6.2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:NTRim` on page 883

Gamma
Defines the multiplier factor γ as defined in 3GPP 38.211, chapter 7.4.1.6.2 that has an effect on the sequence generation of the RIM-RS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:GAMMa` on page 883

Delta
Defines the offset δ as defined in 3GPP 38.211, chapter 7.4.1.6.2 that has an effect on the sequence generation of the RIM-RS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:DELTa` on page 883

5.9 PUCCH settings

Access:

1. Select "5G New Radio > General > Link Direction > Uplink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > PUCCH".
4. For the PUCCH allocation, select "User x BWP x > Format = e.g. F0"
5. Select "PUCCH > Settings > Config".

   This dialog comprises the settings of the physical uplink common channel (PUCCH).

PUCCH and PUCCH formats

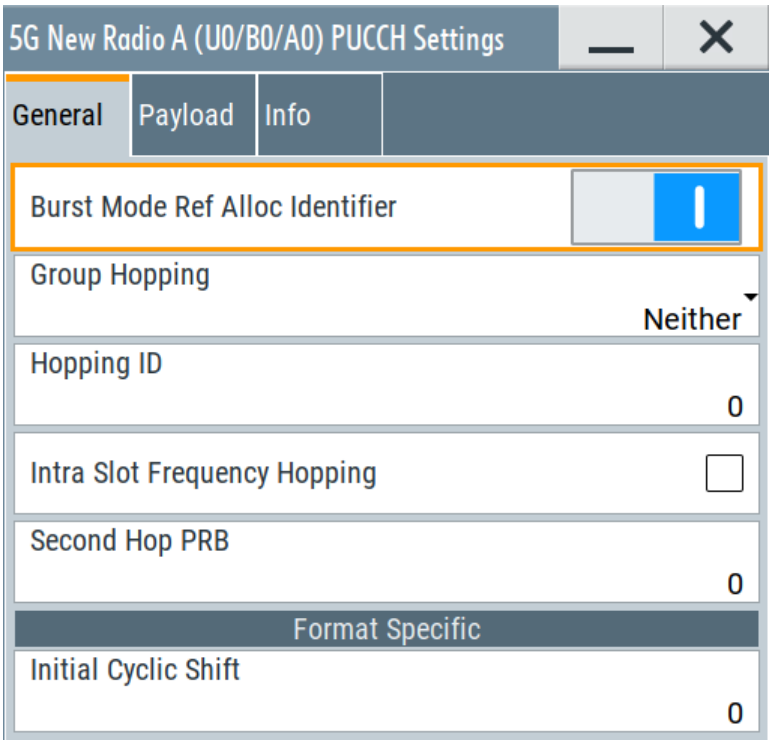
The PUCCH supports 5 different formats (F0 to F4), each of them spanning different number of OFDM symbols. PUCCH can be transmitted on a constant frequency or optionally use frequency hopping, where the latter is signaled by a higher-level parameter. If frequency hopping is enabled, the PUCCH in formats F1, F3 and F4 spans the half of the OFDM symbols available in the constant frequency case.

Settings:

5.9.1 General settings

Access:

1. Select "Scheduling > User x BWP x > Content > PUCCH > Settings > Config".
2. Select "General".



Settings:

Burst Mode Ref Alloc Identifier

If Power Mode > "Burst", sets whether the bandwidth of the current allocation is used as reference for the "Burst" power mode.

The icon in the Scheduling settings table indicates which allocation is set as burst reference.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:BMAid` on page 801

Group Hopping

Available for PUCCH formats 0 and 1.

Sets the higher-layer parameter `pucch-GroupHopping`, as defined in TS 38.211.

You turn group and sequence hopping for the PUCCH demodulation reference signal on and off as follows:

"Neither"	Disables group and sequence hopping
"Enable"	Enables group hopping
"Disable"	Enables sequence hopping

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:GRPHopping` on page 886

Hopping ID

Sets the parameter hopping ID (n_{ID}) used to select the frequency hopping sequence number and to initialize the pseudo-random sequence generator. In the practice, the value is transmitted by the higher-layer parameter `hoppingId` [TS 38.211].

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:HOPid` on page 887

Intra Slot Frequency Hopping

Enables PUCCH demodulation reference signal hopping within a slot.

If intra-slot hopping is enabled, you can define the physical resource block offset for the second hop ("Second Hop PRB").

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:ISFHopping` on page 887

Second Hop PRB
Sets the physical resource block (PRB) of the second hop.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:SHOPping` on page 888

Number of Interlaces
Option: R&S SMW-K148

Defines the number of interlaces. The maximum number depends on the current subcarrier spacing.

For PUCCH interlaces, the following conditions apply:
- PUCCH format 0 and 1: Only support one interlace whose interlace value (distance between interlaces) is defined by the resource block offset.
- PUCCH format 2 and 3: Support up to two interlaces whose position in the resource grid depends on the interlace value you have entered, the resource block offset and the spreading parameters.
- PUCCH format 4: No support of interlacing.
- Frequency hopping and interlacing at the same time is not possible.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:NINT` on page 887

Interlace <x>
Option: R&S SMW-K148

Defines the distance between resource elements used for interlacing. A value of 4, for example, would use every 4th resource element for the corresponding interlace.

Note that each interlace must have a different value. Otherwise interlaces would share the same allocation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:INT<il>:INTL` on page 887

Initial Cyclic Shift
For PUCCH formats F0 and F1, sets the initial cyclic shift (m0).

As defined in TS 38.211, the value is required to calculate the cyclic shift for the hopping sequence.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:CYCShift` on page 885

Cyclic Prefix Extension
Option: R&S SMW-K148

Defines the length of a cyclic prefix extension, which is added in front of the first PUCCH allocation in a slot. The other cyclic prefixes of the PUCCH allocations in the slot are not affected.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CPEXt` on page 798

Time Domain OCC Index
For PUCCH format F1, sets the orthogonal sequence index `I` (I = 0 to 6). As defined in TS 38.211, the value is required to select the orthogonal sequence, used for the block-wise spreading.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:TDOCc` on page 886

OCC Length
For PUCCH format F4, sets the value of the parameter N_{SF}^{PUCCH} and thus defines which of the orthogonal sequences $w_n(m)$ defined in TS 38.211 is used.

OCC lengths for PUCCH formats F2 and F3 are available with R&S SMW-K148.

Remote command:
F2: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:FMT2:OCCLength` on page 886
F3: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:FMT3:OCCLength` on page 886
F4: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:OCCLength` on page 885

OCC Index
For PUCCH format F4, sets the orthogonal sequence index `n` (n = 0 to 4). As defined in TS 38.211, the value is required to select the orthogonal sequence, used for the block-wise spreading.

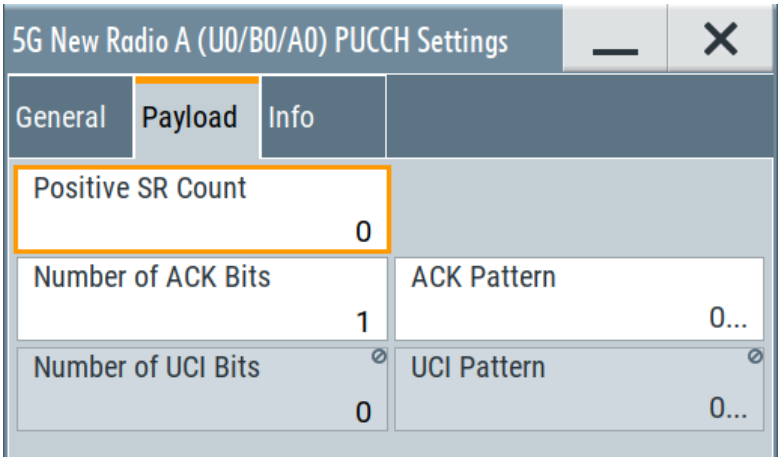
Display of the OCC index for PUCCH formats F2 and F3 are available with R&S SMW-K148.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:OCCindex` on page 885

5.9.2 Payload settings

Access:

1. Select "Scheduling > User x BWP x > Content > PUCCH > Settings > Config".
2. Select "Payload".



Settings:

Positive SR Count
Sets the number of positive scheduling requests (SR). The value is used to define the mapping of the HARQ-ACK and CSI bits. For details, see TS 38.213.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:SRCount` on page 888

Number of ACK Bits
Sets the number of ACK bits and defines the length of the "ACK Pattern" field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:ACK:BITS` on page 889

ACK Pattern
Sets the ACK bits in pattern form, where the pattern length is set with the parameter "Number of ACK Bits".

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out once.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:ACK:PATTern` on page 889

Number of UCI Bits
Sets the number of UCI bits and defines the length of the "UCI Pattern" field.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:UCI:BITS` on page 889

UCI Pattern
Sets the UCI bit sequence according to TS 38.212. The sequence is set in pattern form, where the pattern length is set with the parameter "Number of UCI Bits".

A "1" indicates an ACK, a "0" - a NACK.

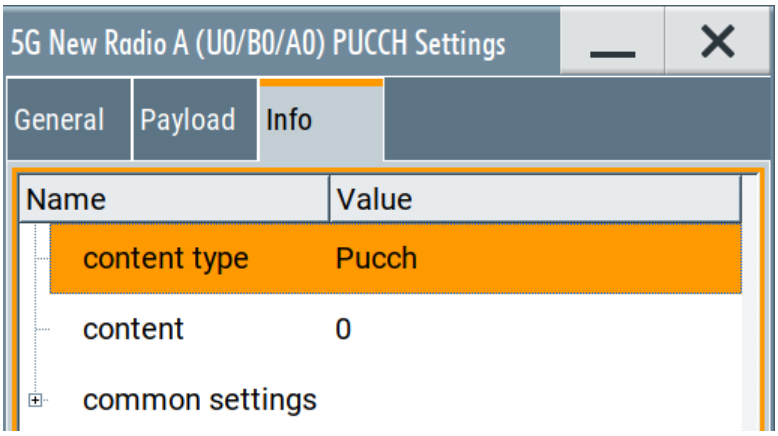
The pattern is read out once.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:UCI:PATTern` on page 889

5.9.3 Info

Access:

1. Select "Scheduling > User x BWP x > Content > PUCCH > Settings > Config".
2. Select "Info".



The dialog displays details on the PUCCH configuration.

Info
The dialog displays details on the configuration.

There are two information lists:

- "Stable": Naming and structure of the information in this list are stable in future firmware releases.

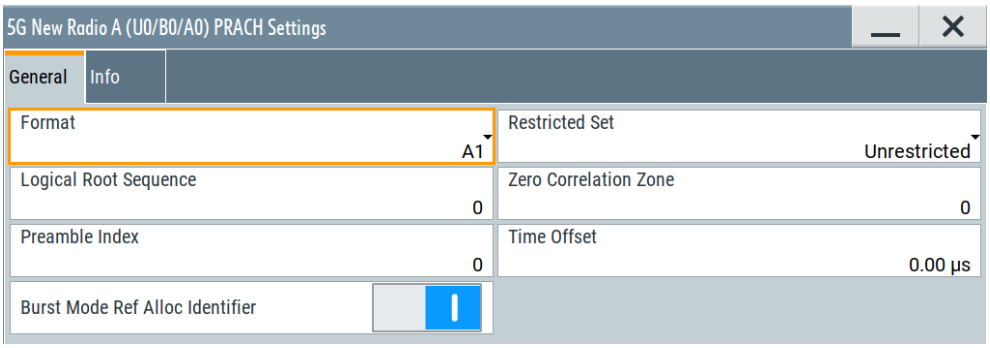
- "Mutable": Naming and structure of the information in this list can change in future firmware releases.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

5.10 PRACH settings

Access:

1. Select "5G New Radio > General > Link Direction > Uplink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > PRACH".
4. Select "PRACH > Settings > Config".



This dialog comprises the settings of the physical random access channel (PRACH).
According to TS 38.211, the 64 preambles (Preamble Index) defined in each time-frequency PRACH occasion are numbered starting from the first cyclic shift of a logical root sequence. Then following the logical root sequence index, starting with the index set by the parameter Logical Root Sequence.

Settings:

Format
Selects the PRACH format.

The available formats depend on the SC Spacing/CP as follows:

- SCS = {1.25 kHz; 5 KHz}: "Format" = 0, 1, 2, 3
- SCS = {15 kHz; 30 kHz; 60 kHz; 120 kHz; 480 kHz; 960 kHz }: "Format" = A1, A2, A3, B1, B2, B3, B4, C0, C2

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:FORMat` on page 891

Restricted Set
Sets the higher-layer parameter `restrictedSetConfig` that defines the type of restricted sets (unrestricted, restricted type A, restricted type B).

Supported restricted sets depend on the PRACH Format as follows:

- "Format" = 0, 1, 2, 3: "Restricted Type A, Restricted Type B"
- "Format" = A1, A2, A3, B1, B2, B3, B4, C0, C2: "Unrestricted"

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RSET` on page 891

Logical Root Sequence
Sets the higher-layer parameter `prach-RootSequenceIndex` that defines the starting logical root sequence index and thus the 64 PRACH preambles.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RSEQuence` on page 891

Zero Correlation Zone
Sets the parameter `zeroCorrelationZoneConfig` required to select the N_{cs} value that in turn is used for the calculation of the cyclic shift (TS 38.211).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:ZCZone` on page 892

Preamble Index
Sets the PRACH preamble index and thus defines which one of the 64 PRACH preambles is used.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:PRINdex` on page 892

Time Offset
Sets the timing offset base value for PRACH, required for the PRACH performance requirement tests according to TS 38.141-1.

The supported value range allows you to test PRACh detection also with in case of delay or misalignment greater than the values defined in the specification.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:TOFFset` on page 892

Burst Mode Ref Alloc Identifier
If Power Mode > "Burst", sets whether the bandwidth of the current allocation is used as reference for the "Burst" power mode.

The icon in the Scheduling settings table indicates which allocation is set as burst reference.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:BMAid` on page 890

Info
The dialog displays details on the configuration.

There are two information lists:
- "Stable": Naming and structure of the information in this list are stable in future firmware releases.
- "Mutable": Naming and structure of the information in this list can change in future firmware releases.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

5.11 SRS settings (scheduling table)

Access:

1. Select "5G New Radio > General > Link Direction > Uplink".
2. Select "5G New Radio > Scheduling".
3. For any configurable allocation, select "Content" = "SRS".
4. For any SRS allocation, select "Config" to configure the corresponding SRS allocation.

   This dialog comprises the settings of the sounding reference signal (SRS).
   For more information about the SRS, see Chapter 5.3.7.6, "SRS settings", on page 190.

Note that the settings available in this dialog are a subset of the settings available for the SRS in the "UL BWP Config" dialog. However, when you change a setting for the SRS in one place, it has no effect on the other - both ways to configure a SRS allocation are independent of each other.

5.11.1 General SRS settings

Access:

1. Select "5G New Radio > General > Link Direction > Uplink".
2. Select "5G New Radio > Scheduling".
3. For any configurable allocation, select "Content" = "SRS".
4. For any SRS allocation, select "Config" to configure the corresponding SRS allocation.
5. Select "General".

   This dialog comprises general settings for the sounding reference signal (SRS).

Settings:

Config
Option: R&S SMW-K148 and -K171

Selects the 3GPP release the SRS is based on.

As of 3GPP release 16, the SRS also can also be used for positioning purposes. Select "SRS Pos R16 IE" to generate signals in which the SRS carries positioning information.

Note that the value ranges for several SRS resources depend on which 3GPP release the SRS is based on.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONFig` on page 894

Resource Type
Selects the slots in which the sounding reference signal appears.

"Aperiodic" Aperiodic transmission transmits the SRS in arbitrary slots.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RSTYpe` on page 897

Periodicity
Sets the SRS repetition factor T_{SRS}. The periodicity is a time interval defined as number of slots that indicates how often (i.e. after how many slots) the SRS is transmitted.

As smaller the periodicity value as frequent is the SRS transmission. To enable the SRS for example in each slot, set "Periodicity = 1 slot".

Available for periodic SRS transmission.

Remote command:
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RSSET<gr0>:RES<user0>:PER` on page 769

Offset
Sets time position of first SRS allocation within an SRS periodicity, given as an offset in number of slots (T_{offset}) from the start of the frame.

Available for periodic SRS transmission and if periodicity > 1 slot.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:OFFSet` on page 896

Frequency Position
Sets the parameter k_0 that defines the starting position of the SRS allocation in the frequency domain.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FPOS` on page 895

Frequency Shift
The frequency shift n_{shift} influence the SRS transmission density in the frequency domain.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FQSHift` on page 895

B SRS
Sets the filed b-SRS contained in the higher-layer parameter `freqHopping` and used to define the length of the SRS sequence, see TS 38.211, Table 6.4.1.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BSRS` on page 894

C SRS
Sets the filed c-SRS contained in the higher-layer parameter `freqHopping` and used to define the length of the SRS sequence, see TS 38.211, Table 6.4.1.4.3-1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CSRS` on page 895

B Hop
Sets the parameter b_{Hop} that defines the frequency hopping of the SRS.

Set "B Hop" > "B SRS" to disable frequency hopping ("Rep. Factor" = 1).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BHOP` on page 894

Repetition Factor
Defines how many times the SRS symbols are repeated.

Available if B Hop < B SRS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REFactor` on page 897

Transmission Comb
Transmission comb (k_{TC}) is a method for interleaving SRS symbols by using alternating subcarriers (only the even or odd subcarriers).

The value of k_{TC} defines the maximum number of cyclic shifts n_{SRS}^{cs}.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TRTComb` on page 898

Comb Offset
Sets the parameter transmission comb offset.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COFFset` on page 894

Sequence Cyclic Shift
Sets the number of cyclic shifts n_{SRS}^{cs}, required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:CYCShift` on page 897

Sequence ID
Sets the higher-layer parameter `sequenceId` (n_{ID}^{SRS}), required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:ID` on page 898

Group or Sequence Hopping
Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group, required for the SRS sequence generation according to TS 38.211.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:HOPPing` on page 897

Frequency Scaling Factor
Option: R&S SMW-K171

Selects the frequency scaling factor defined in 3GPP 38.211, chapter 6.4.1.4.3.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FSFactor` on page 896

Start RB Index
Option: R&S SMW-K171

Defines the start RB index defined in 3GPP 38.331. The parameter is defined through the RRC parameter `startRbIndexAndFreqScalingFactor`.

Values depend on the frequency scaling factor: possible values = scaling factor - 1.

Available if the frequency scaling factor > 1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SRIDx` on page 898

5.11.2 Antenna port settings for SRS

Access:

1. Select "5G New Radio > General > Link Direction > Uplink".
2. Select "5G New Radio > Scheduling".

3. For any configurable allocation, select "Content" = "SRS".
4. For any SRS allocation, select "Config" to configure the corresponding SRS allocation.
5. Select "Antenna Ports".

   This dialog comprises antenna port settings for the sounding reference signal (SRS).

Settings:

Mapping Coordinates
Switches representation between the "Cartesian" (Real/Imag) and "Cylindrical" (Magn./Phase) coordinates.

Ports
Defines the number of antenna ports used by the SRS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PORTs` on page 896

Mapping table
Defines the mapping of the antenna ports (AP) to the physical antennas.

Set the number of antenna ports (AP) with the parameter "Ports" on page 296.

For details on the antenna ports-mapping concept, see Chapter 2.10, "Antenna port mapping", on page 31.

Remote command:
"Mapping Coordinates = Cartesian":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL` on page 774
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary` on page 775
"Mapping Coordinates = Cylindrical":
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude` on page 775
`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe` on page 776

5.12 PSSCH and PSCCH settings

Access:

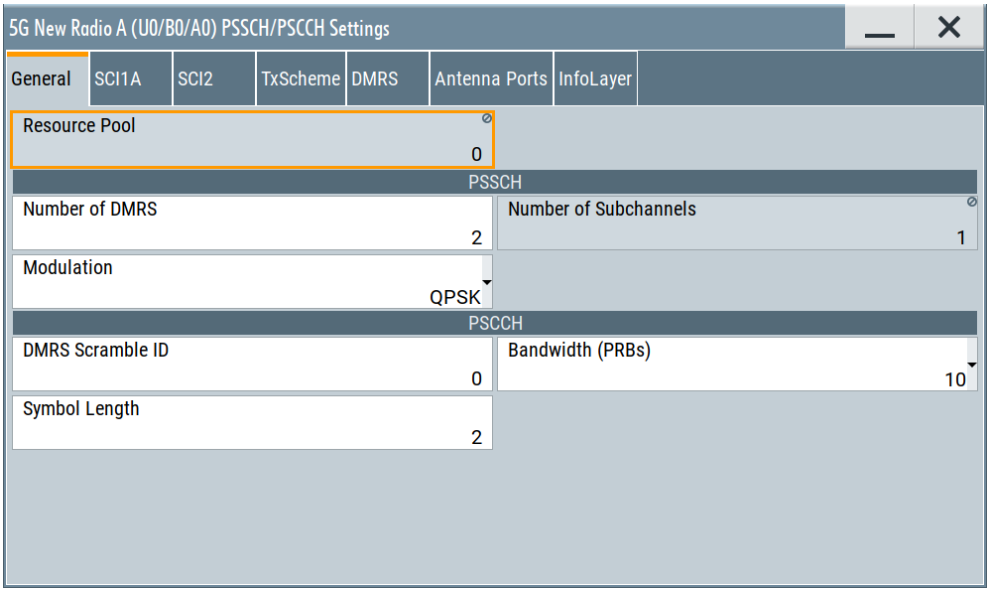
1. Select "5G New Radio > General > Link Direction > Sidelink".
2. Select "5G New Radio > Scheduling".
3. Select "User x BWP x > Content > PSSCH/PSCCH".
4. Select "PDSCH > Settings > Config".

   This dialog comprises the settings of the physical sidelink shared channel (PSSCH) or the physical sidelink control channel (PSCCH).
   The PDSCH carries the general user data and is therefore the most prominent channel in a radio frame; it occupies the most resources. The PSCCH carries control information.

5.12.1 General PSSCH and PSCCH settings

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "General".



Settings:

Resource Pool

Selects the resource pool the PSxCH settings apply to.

The number of available resource pools depends on the bandwidth part configuration for the sidelink (number of resource pools).

If you have defined only one resource pool, the field is read only.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:POOL` on page 901

Number of DMRS

Defines the number of PSSCH DMRS.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:NDMRs` on page 900

Number of Subchannels

Defines the number of subchannels the PSSCH uses.

The number of available subchannels depends on the bandwidth part configuration for the sidelink (number of subchannels).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:NSUBchan` on page 900

Modulation
Selects the modulation scheme for the PSSCH.

The available modulations depend on the selected MCS table.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:MOD` on page 900

DMRS Scramble ID
Defines the pseudo-random seed value with which the PSCCH DMRS sequence is generated.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:SCRid` on page 899

Bandwidth (PRBs)
Selects the size of the PSCCH in physical resource blocks.

The available values depend on the subchannel size.

When you change the bandwidth of the PSCCH here, the value in the scheduling table is automatically updated.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:BDWidth` on page 899

Symbol Length
Selects the number of symbols the PSCCH occupies. A PSCCH can use 2 or 3 symbols.

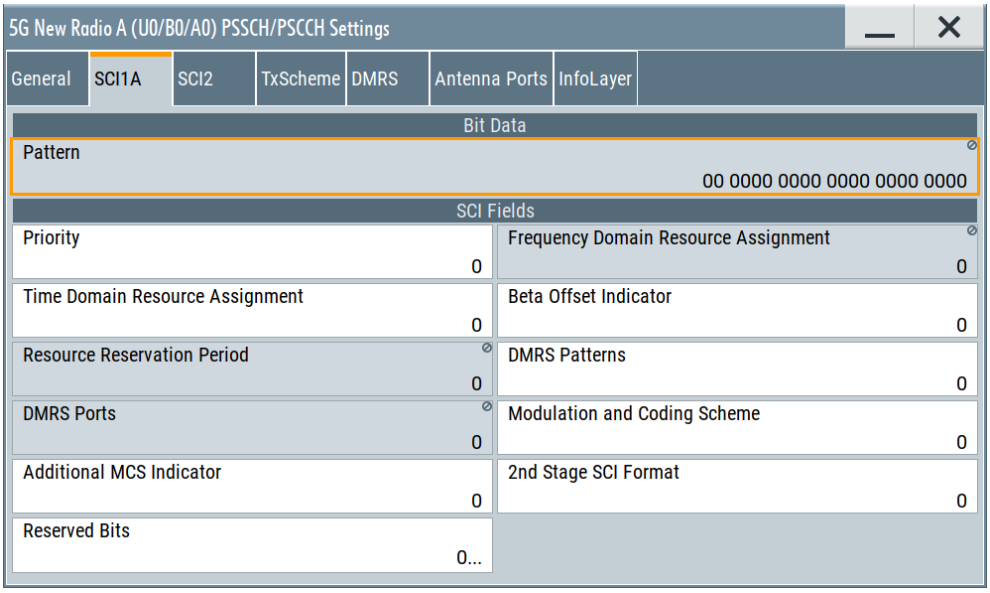
When you change the number of symbols here, the value in the scheduling table is automatically updated. Note that the symbol length here refers to the PSCCH without the AGC part, while the symbol length in the scheduling table also includes the AGC part (= one additional symbol).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:SYMLength` on page 900

5.12.2 SCI1A settings

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "SCI1A".



The "SCI1A" dialog contains all settings to configure the first stage SCI (sidelink control information). SCI1A carries scheduling information of the PSCCH.

The fields defined in the SCI are mapped to the information bits according to TS 38.212. The resulting bit pattern is displayed in the "Pattern" field. Padding bits are added in certain cases, that is zeros are append to the DCI format until the payload size is equal to a specified size.

For a list of remote commands required to configure the SCI1A fields, see Chapter 12.29.2, "SCI1A configuration commands", on page 901.

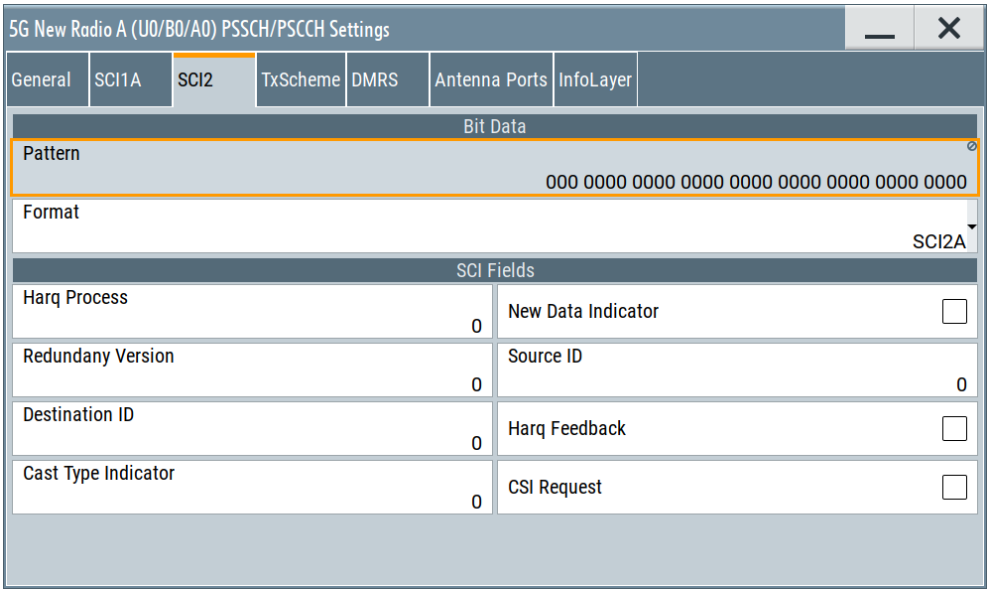
The following fields are available for the first stage SCI.

- "Priority"
- "Frequency domain resource assignment"
- "Time domain resource assignment"
- "Beta Offset Indicator"
  Value range depends on betaOffset 1...4.
- "Resource Reservation Period"
  Editable if resource reserve period list > 1.
- "DMRS Patterns"
  Value range depends on number of active DMRS patterns.
- "DMRS Ports"
  This value is read only and depends on the number of layers you have selected.
- "Modulation and Coding Scheme"
- "Additional MCS Indicator"
- "2nd Stage SCI Indicator"
  This value corresponds to the selected SCI2 format. If you change the format, the value is updated automatically and vice versa.
- "Reserved Bits"

5.12.3 SCI2A settings

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "SCI2" > "Format" = "SCI2A".



The "SCI2" dialog contains all settings to configure the second stage SCI (sidelink control information). SCI2 carries scheduling information of the PSSCH. 3GPP defines two formats for second stage SCI: "SCI2A" and "SCI2B".

Format "SCI2A" is for decoding of PSSCH with HARQ operation when HARQ-ACK information includes ACK or NACK, when HARQ-ACK information includes only NACK, or when there is no feedback of HARQ-ACK information.

The fields defined in the SCI are mapped to the information bits according to TS 38.212. The resulting bit pattern is displayed in the "Pattern" field. Padding bits are added in certain cases, that is zeros are append to the DCI format until the payload size is equal to a specified size.

For a list of remote commands required to configure the SCI2A fields, see Chapter 12.29.3, "SCI2A configuration commands", on page 905.

The following SCI fields are available for SCI2A.

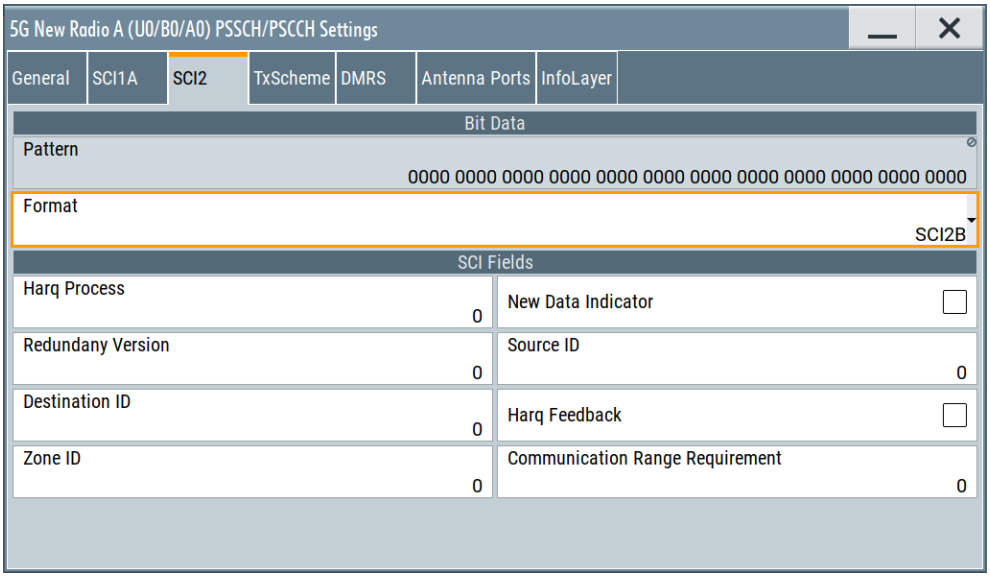
- "Harq Process"
- "New Data Indicator"
- "Redundancy Version"
- "Source ID"
- "Destination ID"
- "Harq Feedback"

- "Cast Type Indicator"
- "CSI Request"

5.12.4 SCI2B settings

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "SCI2" > "Format" = "SCI2B".



The "SCI2" dialog contains all settings to configure the second stage SCI (sidelink control information). SCI2 carries scheduling information of the PSSCH. 3GPP defines two format for second stage SCI: "SCI2A" and "SCI2B".

Format "SCI2B" is for decoding of PSSCH, with HARQ operation when HARQ-ACK information includes only NACK, or when there is no feedback of HARQ-ACK information.

The fields defined in the SCI are mapped to the information bits according to TS 38.212. The resulting bit pattern is displayed in the "Pattern" field. Padding bits are added in certain cases, that is zeros are append to the DCI format until the payload size is equal to a specified size.

For a list of remote commands required to configure the SCI2B fields, see Chapter 12.29.4, "SCI2B configuration commands", on page 907.

The following fields are available for SCI2B.

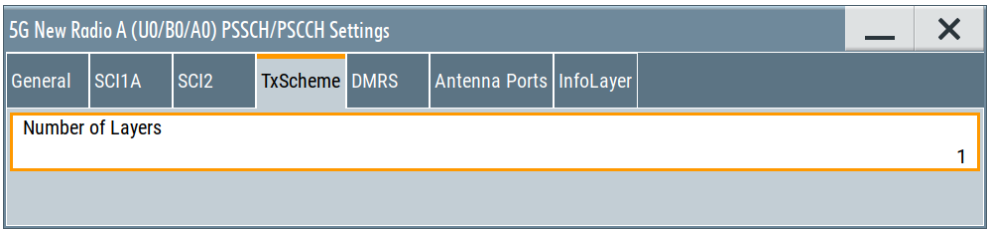
- "Harq Process"
- "New Data Indicator"
- "Redundancy Version"

- "Source ID"
- "Destination ID"
- "Harq Feedback"
- "Zone ID"
- "Communication Range Requirement"

5.12.5 TxScheme settings for PSSCH and PSCCH

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "TxScheme".



Settings:

Number of Layers
Selects the number of precoding layers for the PSSCH transmission.

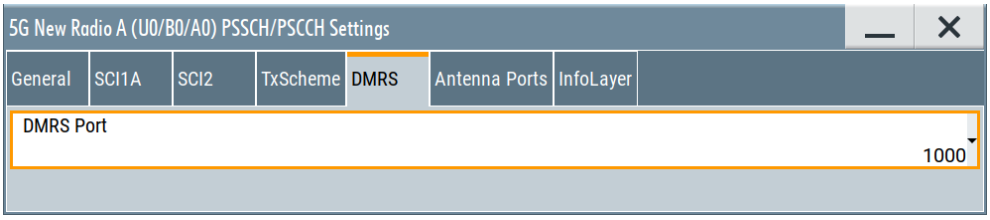
If you increase the number of layers, you can map the PSSCH to different antenna ports.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh|PSSCh:TXSCheme:NLAYers`
on page 908

5.12.6 DMRS settings for PSSCH

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "DMRS".



Settings:

DMRS Port

Selects the antenna port the PSSCH DMRS is transmitted on (AP 1000 or AP1001).

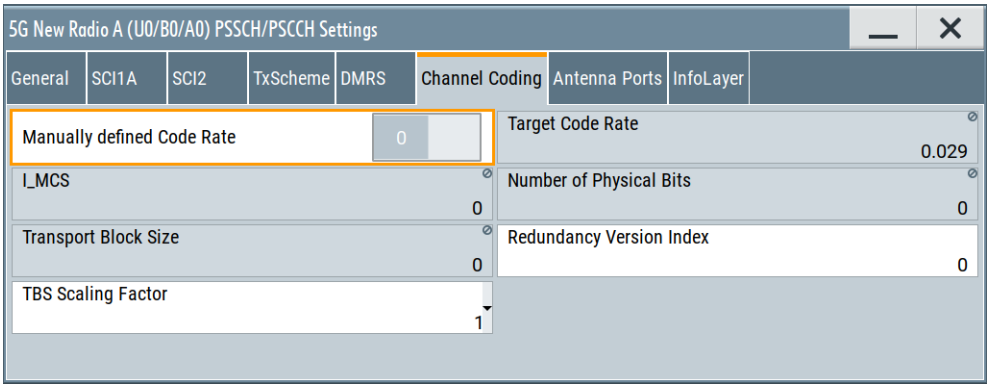
Selection of the antenna port is possible if the number of layers for PSSCH transmission = 1. If the number of layers = 2, the DMRS is transmitted on both antenna ports.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:DMRS:APSel` on page 909

5.12.7 Channel coding settings

Access:

1. Select "Users/BWP > Properties > SLSCH Channel Coding" = "On"
2. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
3. Select "Channel Coding".



The channel coding settings available for the PSSCH are the same as those for the PDSCH and PUSCH. For a comprehensive description about channel coding and its settings, see Chapter 5.5.4, "Channel coding settings", on page 234.

Settings:

Manually Defined Code Rate
Turns manual definition of the code rate on and off.

For details, see "Manually Defined Coderate" on page 235.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:FRCR` on page 910

Target Code Rate
Shows or defines the target code rate.

- For automatic code rate selection, the target code rate is automatically calculated depending on the modulation and coding scheme ("I_MCS)".
- For manual code rate definition, you can define a custom target code rate. Selecting an I_MCS is not possible in that case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TCRate` on page 912

I_MCS
Shows the currently applied modulation and coding scheme. The I_MCS depends on the selected modulation and coding scheme (SCI1A field).

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:MCS` on page 903

Number of Physical Bits
Shows the size of the selected allocation in bits.

The number of physical bits is calculated automatically based on the selected modulation and coding scheme for SC1A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SL:PHYSbits?` on page 910

Transport Block Size
Shows the transport block size (TBS). The transport block size is calculated automatically based on the modulation and coding scheme.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TBSize?` on page 911

Redundancy Version Index
Defines the redundancy version index for the PSSCH.

For more information about its effects, see "Redundancy Version Index" on page 236.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:RVINdex` on page 911

TBS Scaling Factor
Selects the transport block scaling factor S for the PSSCH.

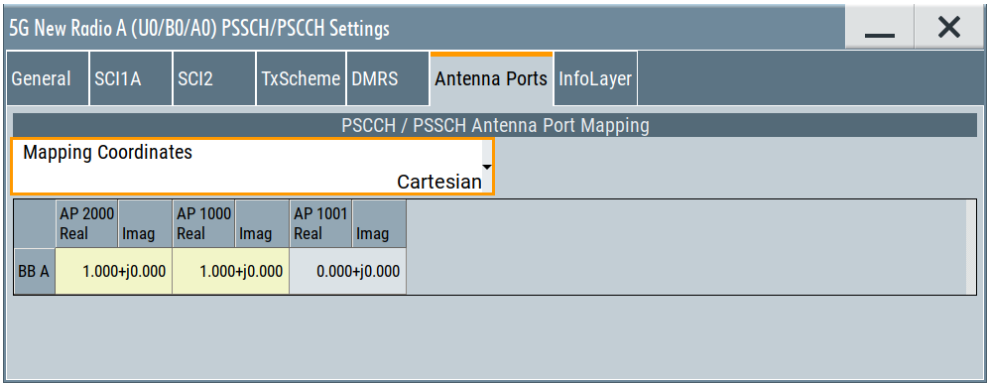
For more information about its effects, see "TBS Scaling Factor" on page 236.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TBSFactor` on page 911

5.12.8 Antenna ports settings for PSSCH and PSCCH

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "Antenna Ports".



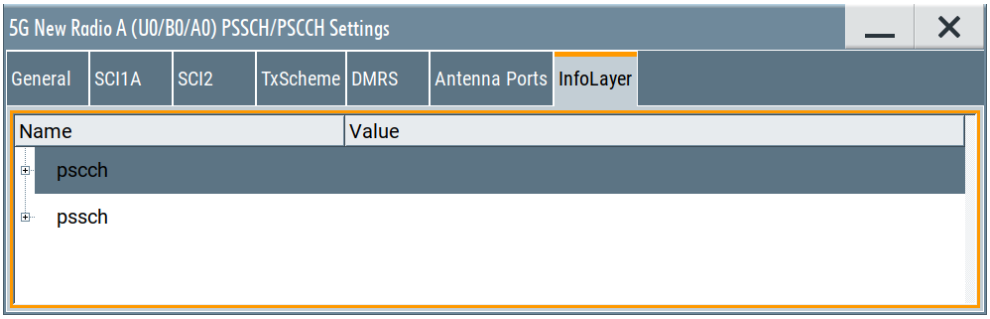
The antenna port configuration is the same as in the downlink and uplink. For more information, see Chapter 5.5.8, "Antenna ports", on page 243.

For an overview of the antenna port mapping, see Chapter 2.10, "Antenna port mapping", on page 31.

5.12.9 Info layer for PSSCH and PSCCH

Access:

1. Select "Scheduling > User x BWP x > Content > PSSCH/PSCCH > Settings > Config".
2. Select "InfoLayer".



The dialog displays details on the PSSCH/PSCCH configuration.

Info
The dialog displays details on the configuration.

There are two information lists:

- "Stable": Naming and structure of the information in this list are stable in future firmware releases.
- "Mutable": Naming and structure of the information in this list can change in future firmware releases.

Remote command:
`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?` on page 789

6 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:

6.1 Trigger settings

Access:

► Select "5G New Radio > Trigger In".

This tab provides settings to select and configure the trigger, like trigger source and mode, and to arm or trigger an internal trigger manually.
The header of the tab displays the status of the trigger signal and trigger mode. As in the tabs "Marker" and "Clock", this tab provides also access to the settings of the related connectors.

Routing and activating a trigger signal

1. Define the effect of a trigger event and the trigger signal source.
   a) Select "Trigger In" > "Mode".
   b) Select "Trigger In" > "Source".
2. For external trigger signals, define the connector for signal input. See Chapter 6.5, "Local and global connectors settings", on page 321.
   You can map trigger signals to one or more USER x or T/M connectors.

   Local and global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

The R&S SMW starts baseband signal generation after the configured trigger event.

About baseband trigger signals

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

Settings:

Trigger settings common to all basebands

To enable simultaneous signal generation in all basebands, the R&S SMW couples the trigger settings in the available basebands in any instrument's configuration involving signal routing with signal addition. For example, in MIMO configuration, routing and summing of basebands or of streams.

The icon indicates that common trigger settings are applied.

You can access and configure the common trigger source and trigger mode settings in any of the basebands. An arm or a restart trigger event applies to all basebands, too. You can still apply different delay to each of the triggers individually.

Mode

Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

For more information, refer to chapter "Basics" in the R&S SMW user manual.

- "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.

Remote command:
`[:SOURce<hw>]:BB:NR5G[:TRIGger]:SEQuence` on page 923

Time Based Trigger
Requires trigger "Mode" > "Armed Auto"/"Single".

Activates time-based triggering with a fixed time reference.

The R&S SMW triggers signal generation when its operating system time ("Current Time") matches a specified time trigger ("Trigger Time"). As trigger source, you can use an internal trigger or an external global trigger.

How to: Chapter "Time-based triggering" in the R&S SMW user manual.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:TIME[:STATe]` on page 929

Trigger Time
Requires trigger "Mode" > "Armed Auto"/"Single".

Sets date and time for a time-based trigger signal.

Set a trigger time that is later than the "Current Time". The current time is the operating system time of the R&S SMW. If you set an earlier trigger time than the current time, time-based triggering is not possible.

How to: Chapter "Time-based triggering" in the R&S SMW user manual.

Remote command:
Date: `[:SOURce<hw>]:BB:NR5G:TRIGger:TIME:DATE` on page 928
Time: `[:SOURce<hw>]:BB:NR5G:TRIGger:TIME:TIME` on page 928

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:NR5G:TRIGger:SLUNit` on page 927

Signal Duration
Requires trigger "Mode" > "Single".

Enters the length of the trigger signal sequence.

Use this parameter, for example, for the following applications:

- To output the trigger signal partly.

- To output a predefined sequence of the trigger signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:SLENgth` on page 927

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:NR5G:TRIGger:RMODe?` on page 927

Arm
Stops the signal generation until subsequent trigger event occurs.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:ARM:EXECute` on page 926

Execute Trigger
For internal trigger source, executes trigger manually.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:EXECute` on page 927

Source
The following sources of the trigger signal are available:

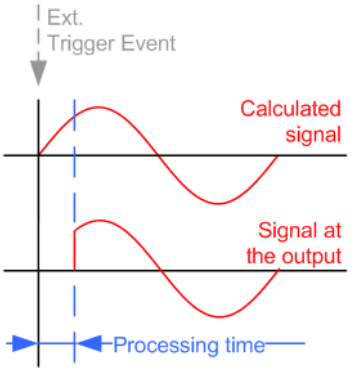
- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "Internal (Baseband A/B)"
  The trigger event is provided by the trigger signal from the other basebands.
  If common trigger settings are applied, this trigger source is disabled.
- "External Global Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the USER x connectors.
- "External Local Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C1/2/3 connectors.
- "External Local Clock"
  The trigger event is the active edge of an external local clock signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C1 connector.
- "Baseband Sync In"
  Option: R&S SMW-B9
  In primary-secondary instrument mode, secondary instruments are triggered by the active edge of the synchronization signal.

"External Local Clock/Trigger" require R&S SMW-B10.

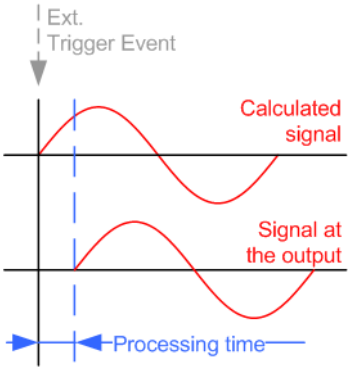
Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:SOURce` on page 923

Sync. Output to External Trigger/Sync. Output to 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.



In primary-secondary instrument mode, this setting ensures that once achieved, synchronization is not lost if the baseband signal sampling rate changes.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:SYNChronize:OUTPut` on page 924

External Inhibit/Trigger Inhibit
Applies for external trigger signal or trigger signal from the other path.

Sets the duration with that any following trigger event is suppressed. In "Retrigger" mode, for example, a new trigger event does not cause a restart of the signal generation until the specified inhibit duration does not expire.

For more information, see chapter "Basics" in the R&S SMW user manual.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger[:EXTernal]:INHibit` on page 924
`[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:INHibit` on page 926

(External) Delay Unit
Determine whatever the trigger delay is expressed in samples or directly defined as a time period (seconds).

To specify the delay, use the parameter (Specified) External Delay/(Specified) Trigger Delay.

The parameter Actual Trigger Delay/Actual External Delay displays the delay converted in time.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:DELay:UNIT` on page 924

(Specified) External Delay/(Specified) Trigger Delay
The name of the parameter and the units the delay is expressed in, changes depending on the parameter (External) Delay Unit.

Delays the trigger event of the signal from:
- The external trigger source
- The other path
- The other basebands (internal trigger), if common trigger settings are used.

Use this setting to:
- Synchronize the instrument with the device under test (DUT) or other external devices
- Postpone the signal generation start in the basebands compared to each other
- Compensate delays and align the signal generation start in multi-instrument setup

For more information, see chapter "Basics on ..." in the R&S SMW user manual.

For "(External) Delay Unit = Samples", the delay is relative to the sample rate of the first output of the respective baseband block.

The parameter displays the delay converted in time.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger[:EXTernal]:DELay` on page 924
`[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:TDELay` on page 925
`[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:DELay` on page 925
`[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:TDELay` on page 926

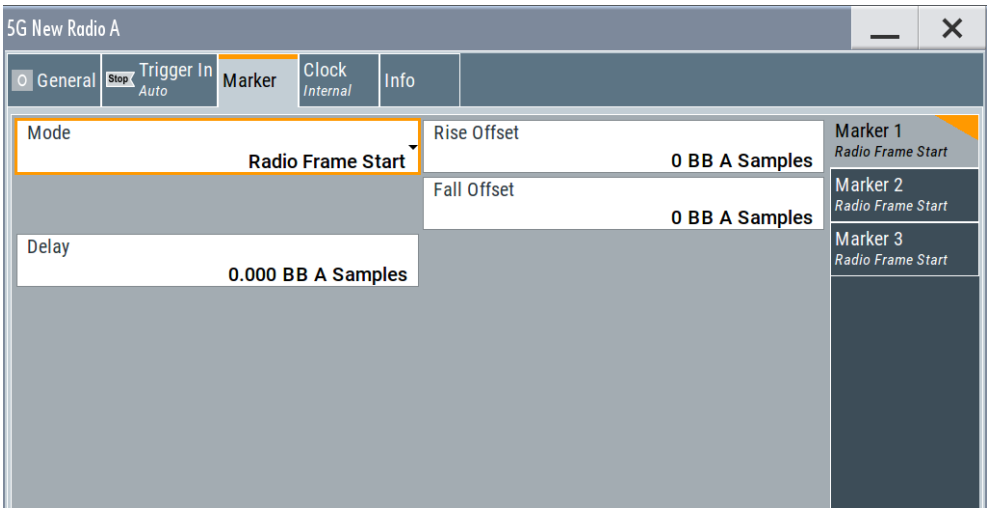
Actual Trigger Delay/Actual External Delay
Indicates the resulting trigger delay in "Time" unit.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:RDELay?` on page 925
`[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:RDELay?` on page 926

6.2 Marker settings

Access:

► Select "5G New Radio > Marker".



This tab provides access to the settings necessary to select and configure the marker output signal, like the marker mode or marker delay settings.

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

Routing and enabling a marker

The provided marker signals are not dedicated to a particular connector. They can be mapped to one or more USER x or T/M connectors.

To route and enable a marker signal, perform the following *general steps*:

- Define the shape of the generated marker, i.e. select the "Marker > Mode".
- Define the connector where the selected signal is provided.
  Use the Local and global connectors settings.

Settings:

Marker Mode

Marker configuration for up to 3 markers. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode.

"Subframe" A marker signal is generated at the start of each subframe.

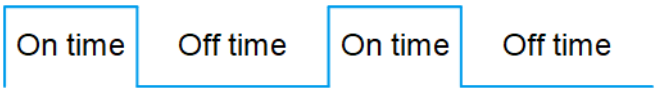
"Radio Frame Start"
A marker signal is generated at the start of each radio frame.

"Restart (ARB)"
A marker signal is generated at the start of each ARB sequence.

"User Period" A marker signal is generated at the beginning of every user-defined period, as set with the parameter "Period."

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:PERiod` on page 930

"On/Off Period"
A regular marker signal that is defined by an on/off ratio. A period lasts one on and off cycle.



Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ONTime` on page 931
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:OFFTime` on page 931

"System Frame Number (SFN) Restart"
A marker signal is generated at the start of every SFN period.

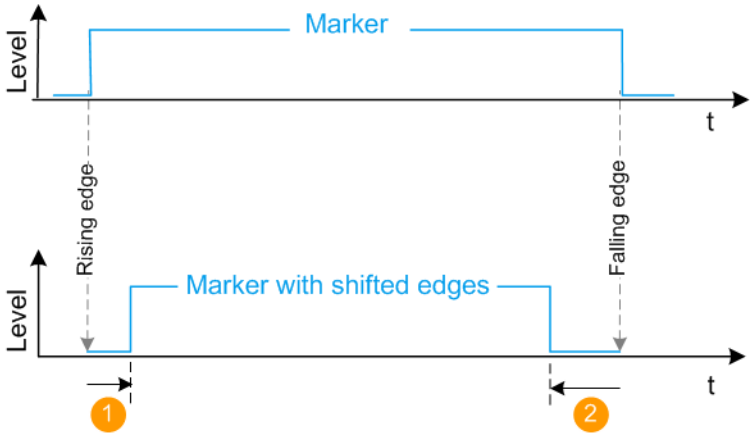
"TDD UL/DL" A marker signal is generated at the start of every UL/DL pattern.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:MODE` on page 930

Rise/Fall Offset

Sets the value for the rise/fall offset.

The ramps of the marker signal are shifted by the specified number of samples. Positive values delay the rising ramp; negative values - shift it back.



1 = Positive rise offset
2 = Positive fall offset

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ROFFset` on page 931
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:FOFFset` on page 931

Invert
Selects the method the marker signal is applied.

"Active High" Marker is placed on a rising edge of the signal.

"Active Low" Marker is placed on a falling edge of the signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:INVert` on page 931

Marker x Delay
Delays the marker signal at the marker output relative to the signal generation start.

Variation of the parameter "Marker x" > "Delay" causes signal recalculation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DELay` on page 930

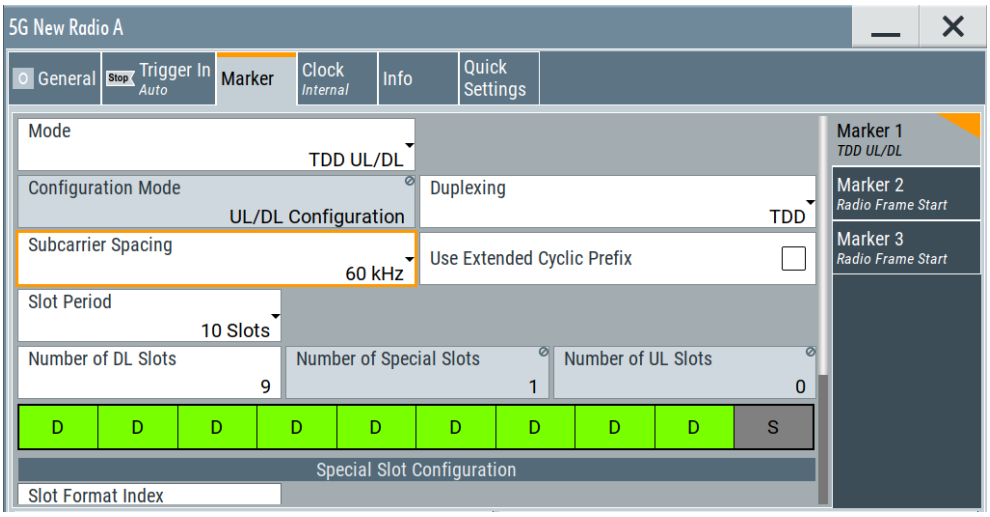
Delay (Time)
Shows the marker delay time in microseconds, milliseconds or seconds depending on the set marker delay.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DINSec?` on page 930

6.3 TDD UL/DL marker mode

Access:

► Select "5G New Radio > Marker > TDD UL/DL".



This dialog comprises the settings for the TDD UL/DL pattern in which you want to set a marker.

Marker settings are automatically adjusted when you apply the corresponding quick settings.

Settings:

Configuration Mode
Displays the marker mode being configured. In this case, "UL/DL Configuration". This field is disabled and you cannot change the configuration mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:MMODe` on page 932

Duplexing
Defines the duplexing mode for a UL/DL pattern containing a marker.

"TDD" Sets TDD (time division duplex) as the duplexing mode for the UL/DL pattern.

"FDD" Sets FDD (frequency division duplex) as the duplexing mode for the UL/DL pattern.
FDD is set by default.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DUPLexing` on page 932

Subcarrier Spacing
Defines the subcarrier spacing (SCS) value for a UL/DL pattern containing a marker.

The available values depend on the set Deployment value. See Table 2-2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SCSPacing` on page 934

Use Extended Cyclic Prefix
Enables/disables the extended cyclic prefix (ECP) for a UL/DL pattern containing a marker.

See Chapter 2.2, "5G NR numerology", on page 22 for more information.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ECPState` on page 932

Slot Period
Sets the duration of a UL/DL pattern containing a marker.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SLINt` on page 934

Use IAB Format
Option: R&S SMW-K148

Turns usage of the frame formats for integrated access backhaul (IAB) applications on and off. Using the IAB format changes the order of uplink, downlink and the special slot within the frame.

Supported for marker mode = TDD DL/UL

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:IAB:STATe` on page 934

Number of DL Slots
Sets the number of DL slots in a UL/DL pattern containing a marker.

Enabled if "Link Direction > Downlink" and "Duplexing > TDD".

The value is calculated as follows:

"Number of DL Slots" = "Slot Period" - "Number of UL Slots" - "Special Slots".

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NDLSlots` on page 933

Number of Special Slots
Displays the number of special slots in a UL/DL pattern containing a marker.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NSSLots?` on page 933

Number of UL Slots
Sets the number of UL slots in a UL/DL pattern containing a marker.

Enabled if "Link Direction > Uplink".

The value is calculated as follows:

"Number of UL Slots" = "Slot Period" - "Number of DL Slots" - "Special Slots".

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NULSlots` on page 933

Use Special Format Index
Turns usage of the special format index on and off.

If on, you can select one of the slot formats defined by 3GPP.

If off, you can configure a custom slot format by entering the required number of downlink symbols or uplink symbols.

Entering the number of downlink symbols is possible when you are in downlink mode.

Entering the number of uplink symbols is possible when you are in uplink mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SFI:STATe` on page 935

Slot Format Index
Sets the special slot format index of the special slot included in a UL/DL pattern containing a marker according to TS 38.213 and thus defines the slot structure.

See Chapter 2.4, "Frame structure, slots and slot formats", on page 24 for more information about the slot format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SLFMt` on page 936

Number of DL Symbols
Indicates the number of DL symbols in the special slot, depending on the selected slot format index.

In downlink mode, defining the number of downlink symbols is possible when you turn off usage of a special format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NDLSymbols`
on page 934

Number of Guarded Symbols
Indicates the number of guarded symbols in the special slot, depending on the selected slot format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NGSYmbols?`
on page 935

Number of UL Symbols
Indicates the number of UL symbols in the special slot, depending on the selected slot format index.

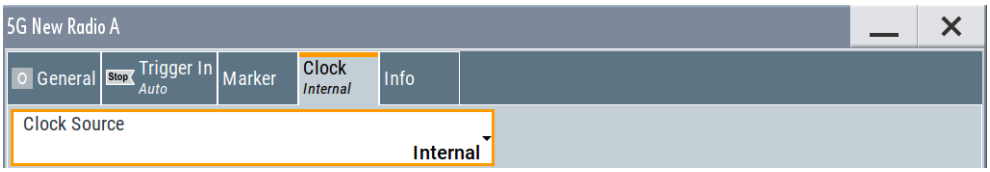
In uplink mode, defining the number of uplink symbols is possible when you turn off usage of a special format index.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NULSymbols`
on page 935

6.4 Clock settings

Access:

► Select "5G New Radio > Clock".



This tab provides access to the settings necessary to select and configure the clock signal, like the clock source and clock mode.

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

Defining the clock

The provided clock signals are not dedicated to a particular connector. They can be mapped to one or more USER x and T/M/C connectors.

Use the Local and global connectors settings to configure the signal mapping, the polarity, the trigger threshold, and the input impedance of the input connectors.

To route and enable a trigger signal, perform the following *general steps*:

- Define the signal source, that is select the "Clock > Source".
- Define the connector where the selected signal is provided.
  Use the Local and global connectors settings.

Settings:

Clock Source
Selects the clock source.

- "Internal"
  The instrument uses its internal clock reference.
- "External Local Clock"
  Option: R&S SMW-B10
  The instrument expects an external clock reference at the local T/M/C connector.

"External Local Clock" requires R&S SMW-B10.

Remote command:
`[:SOURce<hw>]:BB:NR5G:CLOCk:SOURce` on page 936

Clock Mode
Option: R&S SMW-B10

Sets the type of externally supplied clock.

Remote command:
`[:SOURce<hw>]:BB:NR5G:CLOCk:MODE` on page 937

Measured External Clock
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
`CLOCk:INPut:FREQuency?`

6.5 Local and global connectors settings

Accesses a dialog to configure local connectors or global connectors.

The button is available in the following dialogs or tabs:

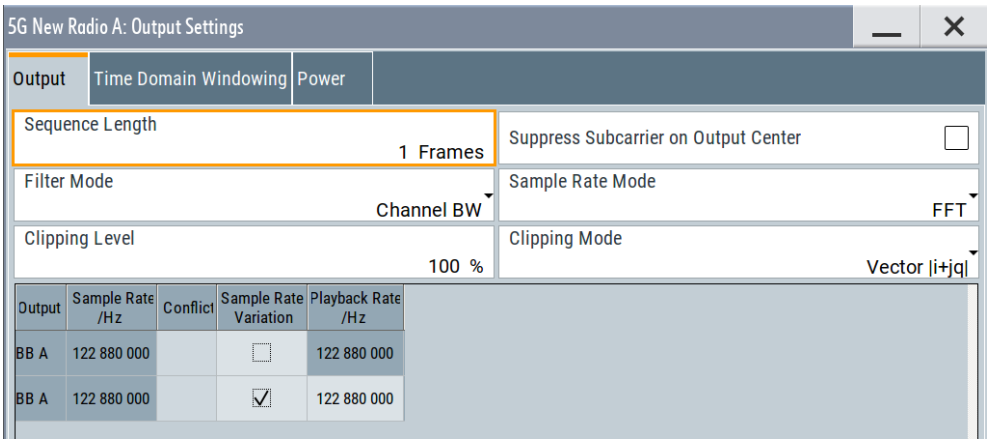
- "Trigger / Marker / Clock" dialog that is accessible via the "TMC" block in the block diagram.
- "Trigger In", "Marker" and "Clock" tabs that are accessible via the "Baseband" block in the block diagram.

See also chapter "Local and global connectors settings" in the user manual.

6.6 Output settings

Access:

► Select "5G New Radio" > "Output/Power" > "Output".



This dialog comprises the settings required for configuring the output power.

Settings:

Sequence Length

Sets the sequence length of the signal in terms of subframes. The signal is calculated in advance and output in the arbitrary waveform generator.

Remote command:

`[:SOURce<hw>]:BB:NR5G:OUTPut:SUSLen` on page 913

Suppress Subcarrier on Output Center

If enabled, the subcarriers that use the same frequency as the center frequency of the baseband output are not transmitted.

The suppressed subcarrier is not necessarily the center of a carrier (channel bandwidth), as it is if "Node > Carriers" > Delta f to Output/MHz ≠ 0 MHz is used to shift the center carrier relative to the output center. Not considered are center carrier shifts caused by baseband offsets applied by parameters like offsets in the "I/Q Stream Mapper" or "Baseband Offsets".

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:SSOC:STATe` on page 913

Filter Mode
Enables filtering and sets how the filter is applied:

"Channel BW"	Available if "Node > Feedback > Off". Applies a filter on the whole channel bandwidth.
"Per BWP"	Available if "Node > Feedback > Off". Filters the individual BWPs separately.
"Off"	Disables filtering.
"Fast"	Applies fast filtering with reduced number of filter taps. Non-average power modes are supported. Supported in the following configuration: • "Node > Carriers > Number of Carriers = 1" and "Node > Carriers > Δf to Output = 0". • "Node > Carriers > Number of Carriers ≥2" and "System Configuration > BB Sources = Coupled". • "Node > Feedback = On"
"User"	Available if "Node > Feedback > Off". You can load you custom filter, see "Load User Filter" on page 323.
"Optimize EVM"	Applies a filter to optimize the EVM of the signal.

Each of these filters is designed for different application field and optimized for a particular performance.

Depending on the filter implementation, these filters require different calculation time:
- "Channel BW" and "Per BWP": high-quality filters, providing good EVM and ACP but requiring long calculation time
- "Fast": short calculation time combined with real-time processing, good EVM performance while ignoring the effects on ACP

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:FMODe` on page 914

Load User Filter
For Filter Mode > "User", 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.

Example: Script that generates user filter file

This MATLAB® script creates a user filter file for a 5G NR carrier with 10 MHz bandwidth. The sampling rate is 30.72 MHz.

```
subcariersubspacing = 15e3;
f_s = 2*1024*subcariersubspacing;
used_bw = 52*12*subcariersubspacing; %52RBs*12 subcarriers per RB
trans_region = 0.02 * f_s/2; %controls steepness of filter slopes

%cutoff frequencies
f = [used_bw/2 used_bw/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,f_s);
%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_nr_user_filter_', num2str(n), 'coeffs_','bw', num2str(used_bw),
  'Hz_fs_', num2str(f_s), 'Hz.dat'],coeffs_out);
```

Remote command:
[:SOURce<hw>]:BB:NR5G:FMODe:USRFile on page 914

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:NR5G:OUTPut:CLEVel on page 916

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.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CMODe` on page 916

Sample Rate Mode
Sets how the sample rate is defined.

"FFT" Sample rate is derived from the used FFT.

"Minimum" Available if "Filter Mode"≠"Fast".
Sample rate is set to the minimum possible value.

This mode is set automatically in the following cases:
- If more than two carriers are enabled
- In uplink, if real-time feedback is enabled ("Node > Feedback" > "Closed Loop Feedback Mode" on page 559)

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:SAMRmode` on page 914

Output
Indicates the baseband (BB) output.

Sample Rate
Indicates the sample rate value, calculated according to the selected Sample Rate Mode, configured signal contents and several other settings, such as the "Channel Bandwidth" or "Deployment".

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:SRATe?` on page 915

Conflict
Indicates an existing conflict between the Playback Rate and Sample Rate values with the symbol ⚠.

Available if Sample Rate Variation is turned off.

Conflicts are caused by mismatch between the nominal sample rate, playback rate and sample rate values.

The playback rate is limited by the instrument capabilities. A conflict is indicated if the playback rate of the instrument is not enough for processing NR signals.

For example, if you configure a 400 MHz BW channel on an instrument which does not support this bandwidth value and you do not modify other parameters, e.g. the BWP value, the required playback rate for this configuration is > 490 MSps, which is higher than the value supported by the instrument, then a conflict is indicated.

An existing conflict is also indicated with the symbol ⚠ in the Output/Power field in the "General Settings" dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:CONFlict` on page 915
`[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:CONFlict?` on page 915

Sample Rate Variation
Activates sample rate variation and allows you to change the Playback Rate manually.

Enabling "Sample Rate Variation" is useful for chipset testing, where the chipset runs with a modified clock rate for test reasons.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:VARiation` on page 916

Playback Rate
Indicates the playback **speed**.

By default, the "Playback Rate = Sample Rate" but the "Playback Rate" value is also limited by the instrument capabilities (installed options).

If there is a mismatch between the sample rate and playback rate values, a conflict is indicated.

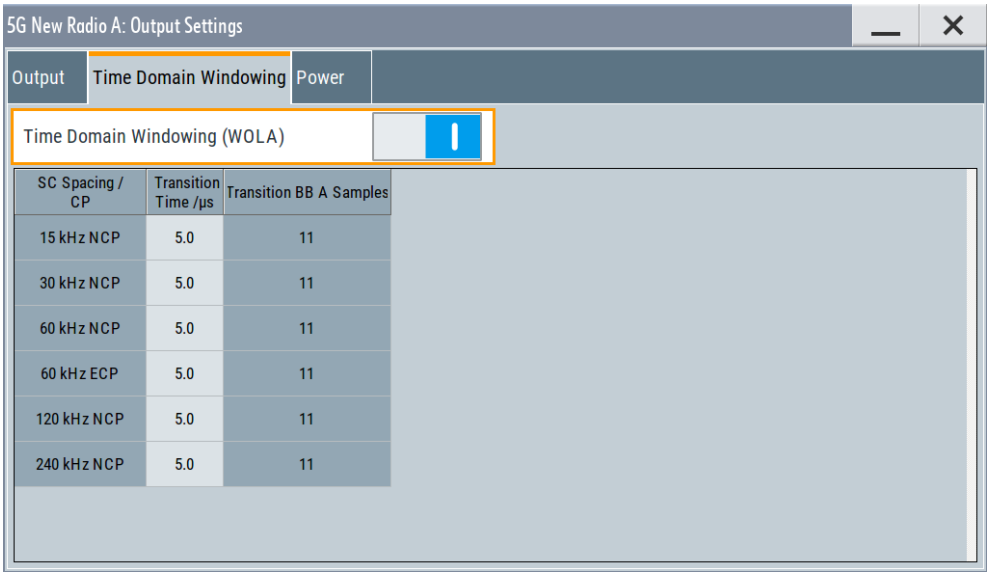
Changing the "Playback Rate" does not do resampling. If you need a resampled signal, generate a waveform and resample it, for example, with software like R&S®ARB Toolbox.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:PBRate` on page 916

6.7 Time domain windowing settings

Access:

► Select "5G New Radio" > "Output/Power" > "Time Domain Windowing".



This dialog comprises the settings required for configuring the time domain windowing. You can set different transition time for each of the specified numerologies.

Settings:

Time Domain Windowing (WOLA)
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.

The abbreviation WOLA stands for weighted-overlay-and-add.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TDWind:STATe` on page 917

SC Spacing/CP
Indicates all allowed combinations of the subcarrier spacing (SSC) and the cyclic prefix (CP), see Table 2-2.

Transition Time
Sets the transition time when time domain windowing is active.

The transition time defines the overlap range of two OFDM symbols. You can define different transition times for each of the numerologies (SC Spacing/CP).

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S240K:TRTime` on page 917
etc.

Transition BB A Samples
Indicates the number of samples during the Transition Time.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S240K:TRTSamples?` on page 917
etc.

6.8 Adjusting the signal power

In the R&S SMW, you can adjust the power level of the generated signal in different ways.

This section explains the different power calculation modes and outlines the signal settings influencing the relations between the power levels of the channels and signals in the signal itself.

Overview of the power-related settings

The following settings influence the power level of the generated signal:

- Output level (P_{out}) of the instrument
  To adjust the value, select "Status bar > Level".
- Selected power calculation method
  To define it, select "General > Output/Power > Power > Power Mode"
- Selected relative signal and channel power values
  - "5G New Radio > General > Node > SS/PBCH" > PSS/SSS Power
  - "5G New Radio > General > Node > SS/PBCH" > PBCH Power
  - "5G New Radio > General > Node > Dummy REs" > "Power" on page 91
  - "Scheduling > User x BWP x > Content > PDSCH/PUSCH > Settings > Config" > "Power" on page 233

General principles

By selecting the power calculation method ("Power Mode"), you define the **power level at the first instrument's output**. The signal power level of the other outputs is calculated automatically according to the current power relations of all channels and signals.

Relative vs absolute power

All the relative channel and signal power values are set **relative** to each other.

Example:
If "PSS Power = 2 dB" and "SSS Power = -3 dB", then the power level of the SSS subcarriers is with 5 dB higher than the power level of the PSS subcarriers.

The **absolute power level** of one resource element depends on the selected "Power Mode" and on the configuration during the remaining subframes.

6.8.1 Effects of the power mode

The power mode selects the method that is used to calculate the signal power at the first instrument output. The signal power at the other outputs is calculated according to the current power relations of all channels and signals.

The value displayed in the "Status bar > Level" is the current RMS level at the output. The RMS and PEP values are calculated different, depending on the selected power mode.

Average power mode

The power level set with the parameter "Status Bar > Level" is the average **RMS power of the complete signal**.

The absolute power of a subframe depends on the configuration of the remaining signal. In fully allocated frames, the average RMS value applies for all subframes. If the

frames are partly allocated, the absolute RMS power within an allocated subframe is greater than the displayed RMS value ("Status Bar > Level").

The following example is based on the following two signals.

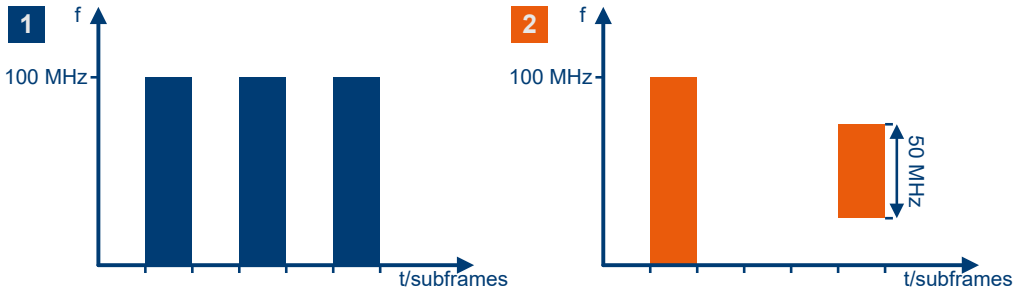


Figure 6-1: Time plan of signals to illustrate the effect of the power mode

Signal characteristics of signal 1

- All allocated subframes have a channel bandwidth = 100 MHz
- Every second subframe is allocated

Signal characteristics of signal 2

- Two subframes are allocated
- The first subframe has a channel bandwidth = 100 MHz
- The second subframe has a channel bandwidth = 50 MHz

The average power mode has the following effects on the power level of the two signals.

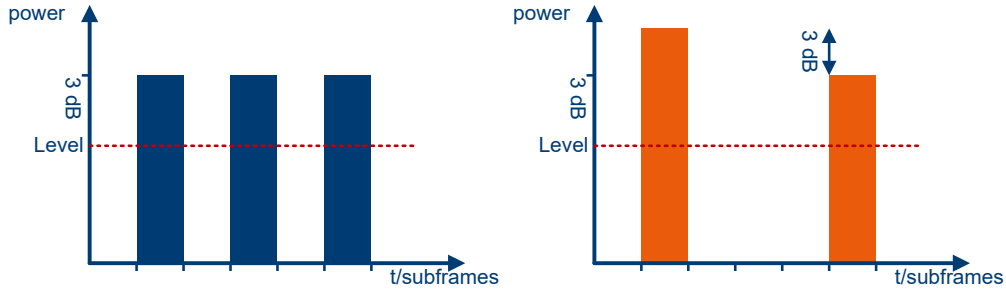


Figure 6-2: Signal power level for Power Mode = Average

Level = "Status Bar > Level"

If "Status Bar > Level" = -10 dBm, the RMS power measured with a power sensor in both cases is:

- $RMS_1 = RMS_2 = -10$ dBm

Average active subframes power mode

The power level set with the parameter "Status Bar > Level" is the **average power in all allocated subframes**.

Thus, the absolute power of the allocated subframe depends only on the configuration of the remaining allocated signal. This mode is usefully if a specific SNR is required for a particular channel but this channel is not transmitted in every subframe.

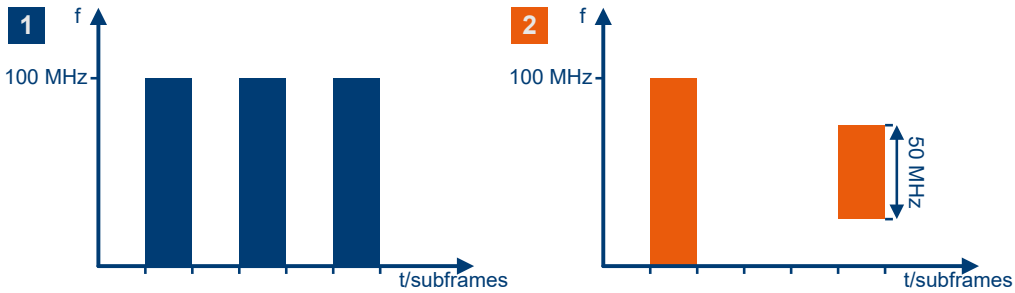


Figure 6-3: Time plan of signals to illustrate the effect of the power mode

Signal characteristics of signal 1

- All allocated subframes have a channel bandwidth = 100 MHz
- Every second subframe is allocated

Signal characteristics of signal 2

- Two subframes are allocated
- The first subframe has a channel bandwidth = 100 MHz
- The second subframe has a channel bandwidth = 50 MHz

The average active subframes power mode has the following effects on the two signals.

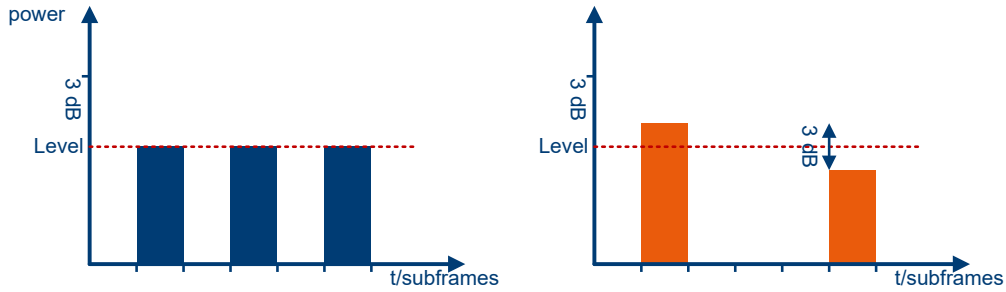


Figure 6-4: Signal power level for Power Mode = Average Active Subframes

Level = "Status Bar > Level"

If "Status Bar > Level" = -10 dBm, the RMS power measured with a power sensor in both cases is:

- RMS_1 = -13 dBm
- RMS_2 = -14.5 dBm

Average active signal power mode

The power level set with the parameter "Status Bar > Level" is the **average power of all active samples**. Active samples are samples that contain signal information.

The following example is based on the power level of the two signals.

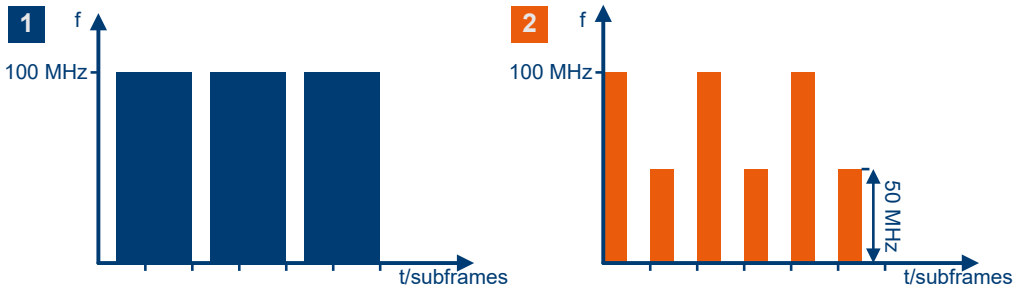


Figure 6-5: Time plan of signals to illustrate the effect of the power mode

1 = Every second subframe is allocated; for all subframes, channel bandwidth BW = 100 MHz
2 = 2 allocated subframes; channel bandwidth of the first allocation = 100 MHz, channel bandwidth of the second allocation = 50 MHz

Signal characteristics of signal 1

- All allocated subframe have a channel bandwidth = 100 MHz
- Subframes with an even index: first half = empty, second half = allocated
- Subframes with an odd index: fully allocated in the time domain

Signal characteristics of signal 2

- All allocated subframes: first half = allocated, second half = empty
- Subframes with an even index have a channel bandwidth = 100 MHz
- Subframes with an odd index have a channel bandwidth = 50 MHz

The average active signal power mode has the following effects on power levels of the signals:

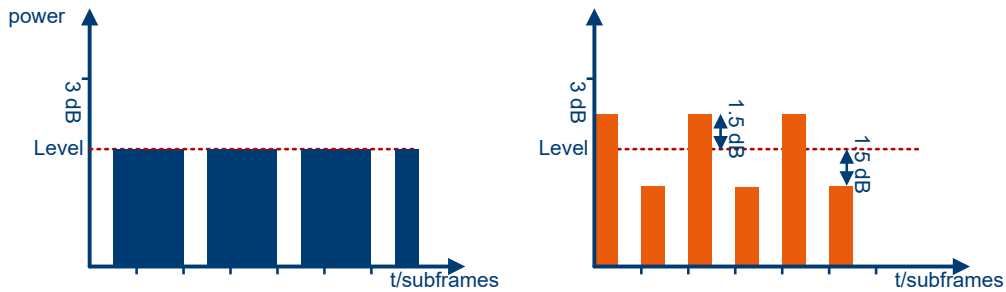


Figure 6-6: Signal power level for Power Mode = Average Active Signal

Level = "Status Bar > Level"

If "Status Bar > Level" = -10 dBm, the RMS power measured with a power sensor is:

- RMS_1 = -11.24 dBm
- RMS_2 = -13 dBm

Constant PSD power mode

The power level set with the parameter "Status Bar > Level" is the **power of a fully allocated, fictitious signal with a specific bandwidth** (Reference System Bandwidth). The power spectral density (PSD) of this fictitious signal is equal to the PSD of the current signal.

In this mode, you configure a specific power spectral density per resource element rather than the RMS of the complete signal. The absolute power of a particular allocation is then calculated by multiplying the configured PSD with the bandwidth of the allocation.

Thus, for a given "Reference System Bandwidth", the PSD and the signal power for a particular bandwidth ($SignalPower_{BW}$) are calculated as follows:

- PSD = "Status Bar > Level" / "Reference System Bandwidth"
- $SignalPower_{BW}$ = PSD*BW, where BW is the channel bandwidth.

This mode is useful if you need to configure an absolute SNR. To achieve an absolute SNR, set the "AWGN > System Bandwidth" value to be equal to the "5G New Radio > Output/Power > Power > Reference System Bandwidth".

The following example is based on the power level of the two signals.

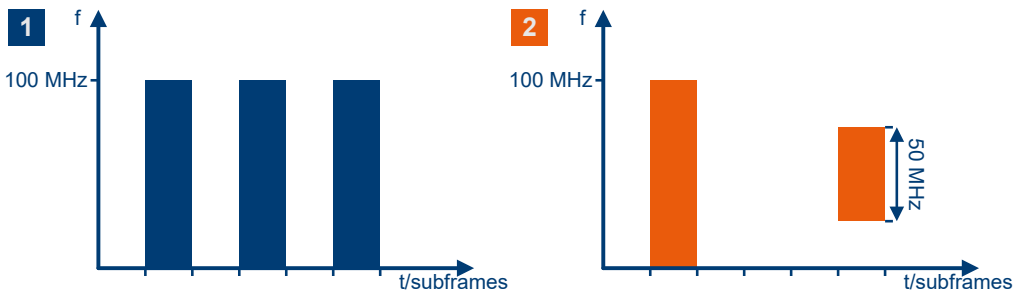


Figure 6-7: Time plan of signals to illustrate the effect of the power mode

Signal characteristics of signal 1

- All allocated subframes have a channel bandwidth = 100 MHz
- Every second subframe is allocated

Signal characteristics of signal 2

- Two subframes are allocated
- The first subframe has a channel bandwidth = 100 MHz
- The second subframe has a channel bandwidth = 50 MHz

The constant PSD power mode has the following effects on power levels of the signals.

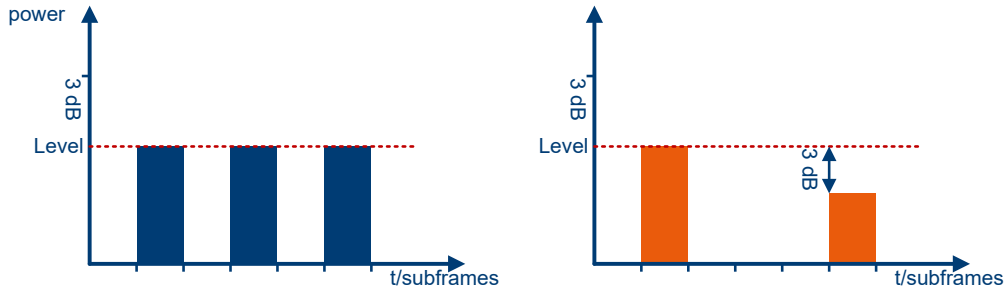


Figure 6-8: Signal power level for Power Mode = Constant PSD

Level = "Status Bar > Level"

For "Reference System Bandwidth" = 100 MHz, the signal power of a signal with 100 MHz bandwidth (BW = 100 MHz) is:

$SignalPower_{100\ MHz}$ = ("Status Bar > Level" / 100 MHz)*100 MHz = "Status Bar > Level"

The signal power of a signal with 50 MHz bandwidth (BW = 50 MHz) is then:

$SignalPower_{50\ MHz}$ = ("Status Bar > Level" / 100 MHz)*50 MHz = "Status Bar > Level"/2 or

$SignalPower_{50\ MHz}$ = "Status Bar > Level" - 3 dB

If "Status Bar > Level" = -10 dBm, the RMS power measured with a power sensor in both cases is:

- RMS_1 = -13 dBm
- RMS_2 = -16 dBm

Burst power mode

For users configured on the baseband output, a reference allocation from the scheduling table has to be chosen. The software **computes the signal PSD bandwidth**, such that the **absolute power of the reference allocation** is equal to the "Level" value in the "Status Bar".

For the case of multiple users configured on the same baseband output, each user signal has the same PSD level computed using the reference allocation. If AWGN is turned on, both UEs have the same SNR.

The "Burst" mode is a special case of the “Constant PSD” mode in the sense that it computes automatically a reference bandwidth based on the chosen allocation.

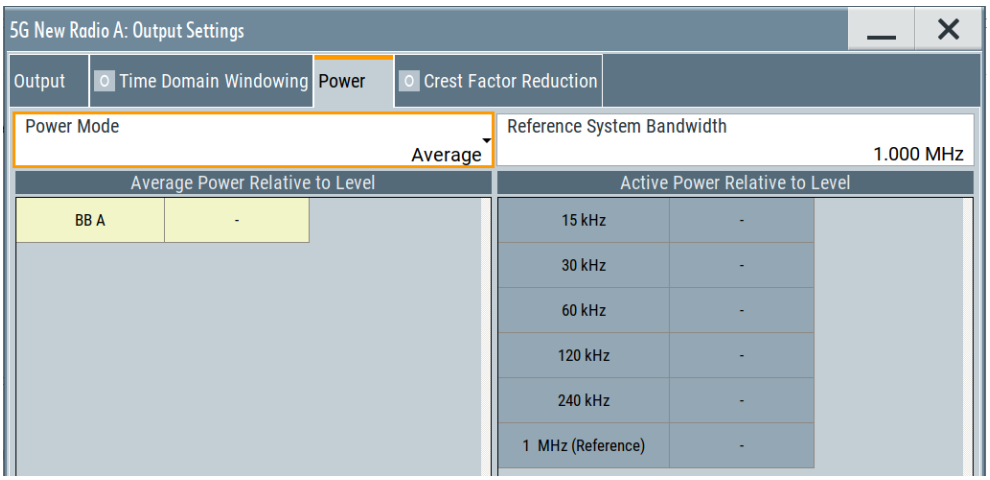
Thus, for a given "Reference System Bandwidth", the PSD and the signal power for a particular bandwidth ($SignalPower_{BW}$) are calculated as follows:

- PSD = "Status Bar > Level" / "Reference System Bandwidth"
- $SignalPower_{BW}$ = PSD*BW, where BW is the channel bandwidth.

6.8.2 Power settings

Access:

► Select "5G New Radio" > "Output/Power" > "Power".



This dialog comprises the settings required for configuring the output power.

Settings:

Power Mode

Selects the power mode used to calculate the power level at the signal output.

For background and effects of the power modes, see Chapter 6.8.1, "Effects of the power mode", on page 328.

"Average" Selects average power mode.

"Average Active Subframes" Selects average active subframes power mode.

"Constant PSD" Selects constant PSD power mode.

"Burst" Selects burst power mode.

"Average Active Signal" Selects average active signal power mode.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:MODE` on page 918

Reference System Bandwidth
In "Power Mode > Constant PSD", sets the system bandwidth used as reference for the calculation of the output power.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:RSBW` on page 919

Carrier/Subframe/User/Bwp/Alloc
If Power Mode > "Burst", displays the identifier of the allocation set as burst reference.

If you select "Carrier/Subframe/User/Bwp/Alloc", the Scheduling settings open. The allocation showing the icon is used as burst reference.

The system sets by default the bandwidth of the first allocation in the "Scheduling Settings" as the burst reference.

The power value of the burst reference allocation is displayed in the last row of the Active Power Relative To Level (per Bandwidth) table.

Average Power Relative To Level (per Baseband)
The table displays the average power relative to the level of all baseband outputs associated to the current block.

BB x ← Average Power Relative To Level (per Baseband)
Displays the baseband (BB) output.

Average Power ← Average Power Relative To Level (per Baseband)
Displays the average power relative to the level of the corresponding baseband output associated to the current block.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:BBConf:ROW<apr>:AVRL?`
on page 918

Active Power Relative To Level (per Bandwidth)
The table displays the power of an active signal of a certain bandwidth relative to the level.

Numerology ← Active Power Relative To Level (per Bandwidth)
Displays the bandwidth value according to the numerology associated to the current block.

Active Power ← Active Power Relative To Level (per Bandwidth)
Displays the power of an active signal of a certain bandwidth relative to the level.

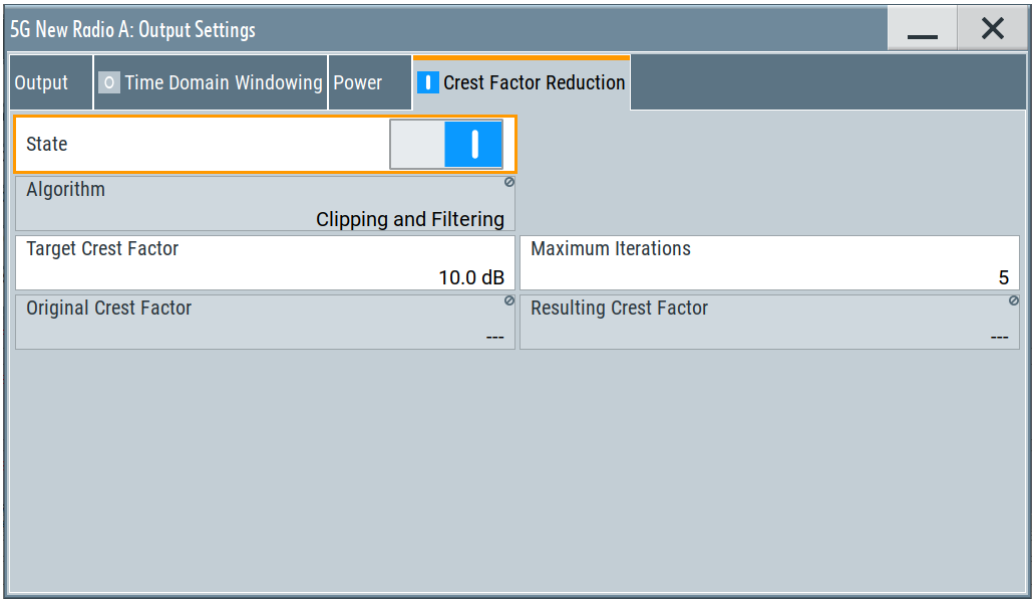
If Power Mode > "Burst" or "Constant PSD", the power value of the reference bandwidth set by Burst Mode Ref Alloc Identifier or Reference System Bandwidth is shown in the last row.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:BWRef:ACRL?` on page 919

6.9 Crest factor reduction settings

Access:

► Select the "Baseband > 5GNR > Output/Power...".



The remote commands required to define these settings are described in Chapter 12, "Remote-control commands", on page 569.

Settings:

State
Enables the crest factor reduction calculation.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:STATe` on page 922

Algorithm
Defines the algorithm for crest factor reduction.

"Clipping and Filtering"
This algorithm performs a hard clipping. It is followed by a low pass filtering of the result in an iterative manner until the target crest factor is reached. You can define the settings of the filter that is used for the calculation.

"Peak Cancelation"
This algorithm subtracts Blackman windowed sinc pulses from the signal wherever the amplitude is above a defined threshold.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ALGorithm` on page 919

Target Crest Factor
Sets the desired crest factor value.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:TCRFactor` on page 922

Max Iterations
Sets the number of iterations that are used for calculating the resulting crest factor. The iteration process is stopped when the desired crest factor is achieved by 0.1 dB.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ITERations` on page 921

Original Crest Factor
Displays the original crest factor of the waveform after the calculation of the resulting crest factor is completed. The original crest factor is calculated as an average over the whole waveform, including any idle periods that might be present in TDD waveforms.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:OCFactor?` on page 921

Resulting Crest Factor
Displays the resulting crest factor of the waveform after the calculations are completed. The resulting crest factor is calculated as an average over the whole waveform, including any idle periods that might be present in TDD waveforms.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:RCFactor?` on page 921

Cancellation Pulse Bandwidth
Sets the bandwidth of the cancellation pulse.

Available for the peak cancellation algorithm.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:CPBWidth` on page 920

Transition Bandwidth
Sets the transition bandwidth of the cancellation pulse.

Available for the peak cancellation algorithm.

Remote command:
`[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:TRBWidth` on page 920

7 Observing current allocations on the time plan

You can observe the current allocations on the time plan.

The time plan shows active channels and signals, the allocations of the active and selected UEs and indicates the cell it applies for. The time plan shows also an overview of the configured BWPs. It indicates overlapping allocations, too.

Per default, the time plan shows the allocation per used channel bandwidth and one frame but you can change the displayed time region to up to 20 subframes. You can also scroll over all available subframes.

Zooming into the time plan is possible using a mouse or the touch screen.

With the mouse, click and hold the left mouse button and drag a rectangle on the area to be zoomed. Double-click the time plan to zoom out.

With the touch screen, tap and drag a rectangle on the area to be zoomed. Double-tap the time plan to zoom out.

Once the zoom is active, you can scroll through the time plan and view to areas in the zoomed display that are currently not displayed.

In the time plan the DMRS symbols are shown (shaded with the color of the associated allocation type).

Access:

► In the "General" dialog, select "Time Plan".

Allocations are calculated as configured in the "Scheduling" dialog and depend on the "Link Direction" and configured BWPs.

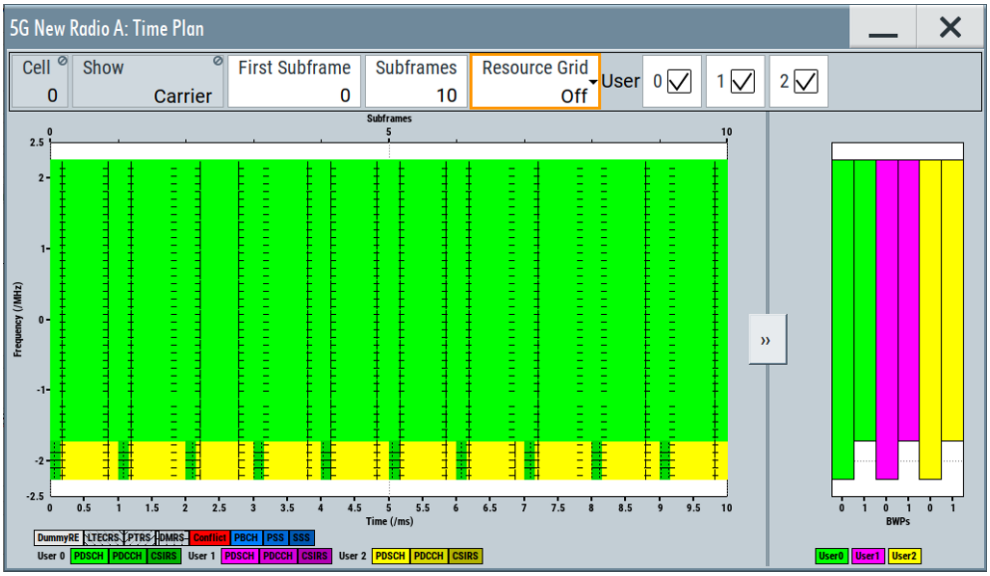


Figure 7-1: Time Plan: understanding the displayed information

1 = User 0, BWP 1
2 = User 2 , BWP 1
3 = User 0 , BWP 1
4 = User 0 , BWP 2
3 = User 1 , BWP 1
3 = User 1 , BWP 2
3 = User 2 , BWP 1
3 = User 2 , BWP 2
a = "No. RBs"
b = "RB Offset in TxBW" - illustrated as principle (because the time plan shows the entire channel bandwidth and the different Tx BWs use different SCSs, the RB offset in TxBw is not given as an offset relative to the lower edge of the channel bandwidth)

Settings:

Cell
Selects/indicates to which carrier/cell the settings apply.

Remote command:
via suffix at `CELL<ch>`

Show
Defines which portion of the carrier bandwidth is displayed:

"Carrier" Displayed is the entire carrier bandwidth.

Remote command:
n.a.

First Subframe
Selects the first subframe to be displayed.

Remote command:
n.a.

Subframe
Selects the number of subframes to be displayed.

Change the value to zoom in and out in the time plan. The maximum number of subframes that you can display, depends on the sequence length. For each radio frame, you can display up to 10 subframes.

Remote command:
n.a.

Ressource Grid
Displays a grid in the time plan. The size of the grid can be changed between coarse and fine.

The scale of the x- and y-axes depend on your selection.

"Off"
- X-axis: Time in ms
- Y-axis: Frequency in MHz

"Coarse"
- X-axis: Slots
- Y-axis: Resource blocks

"Fine"
- X-axis: Symbols
- Y-axis: Resource elements

Remote command:
n.a.

User
Enable a User to display its allocations on the time plan.

Remote command:
n.a.

8 Performing BS tests according to TS 38.141 specifications

The "Test Case Wizard" supports tests on base stations according to the 3GPP TS 38.141 specifications.

The TS 38.141 specifications are divided in two parts depending on the required test methodology:

- TS 38.141-1: Part 1: Conducted conformance testing
- TS 38.141-2: Part 2: Radiated conformance testing

The "Test Case Wizard" offers a selection of predefined settings according to test cases in 3GPP TS 38.141-1 and TS 38.141-2. For an overview of the test cases covered by the test case wizard, refer to Chapter 8.3, "Supported test cases", on page 344.

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 configuration.

The "Test Case Wizard" also affects:

- AWGN
- Co-located modulation signals
- CW interferers

The "Test Case Wizard" presets the instrument for tests according to 3GPP TS 38.141-1 and TS 38.141-2 specifications. If it is required, you can change the predefined settings by varying the corresponding parameter in the 5GNR dialogs.

8.1 Introduction to BS conformance testing

The main purpose of the conformance testing is to ensure that the base station (BS) is fulfilling a defined level of minimum performance.

3GPP defines several requirements for the 5G new radio BS:

- **TS 38.104**: NR; Base Station (BS) radio transmission and reception
- **TS 38.113**: NR; Base Station (BS) ElectroMagnetic Compatibility (EMC)
- **TS 38.141**: NR; Base Station (BS) conformance testing
- **TS 38.817-02**: General aspects for Base Station (BS) Radio Frequency (RF) for NR

BS RF conformance test specifications

- The BS RF conformance tests are based on the core specification TS 38.104 and are defined in the TS 38.141 specifications.
- TS 38.141-1: NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing
- TS 38.141-2: NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing

A BS type 1-C only has conducted requirements so it requires compliance to TS 38.141-1 only.

A BS type 1-H has both conducted and radiated requirements so it requires compliance to the applicable requirements of TS 38.141-1 and TS 38.141-2.

BS type 1-O and BS type 2-O have only radiated requirements so they require compliance to TS 38.141-2 only.

The supported BS RF conformance tests TS 38.141-1 and TS 38.141-2 are described in Chapter 8.3, "Supported test cases", on page 344.

8.2 Required options

The basic equipment layout for preforming test with the aid of "Test Case Wizard" is the same as for the 5G NR signal generation. It includes the options:

- Standard or wideband baseband generator (R&S SMW-B10 or /-B9)
- Baseband main module (R&S SMW-B13 or /-B13T) or wideband baseband main module (R&S SMW-B13XT)
- Digital standard 5G new radio (NR) (R&S SMW-K144)
- Frequency option (e.g. R&S SMW-B1003)

Some of the tests require further options. You find a list of the required option at the beginning of each section that describes a group of test cases.

The following equipment and options are required to support **all test cases**:

- 2x option baseband generator (R&S SMW-B10) or
  2x option wideband baseband generator (R&S SMW-B9)
- 1x option baseband main module (R&S SMW-B13T) or
  1x option wideband baseband main module (R&S SMW-B13XT)
- 4x option fading simulator (R&S SMW-B15)
- 1x option frequency (e.g. R&S SMW-B1003)
- 1x option frequency (e.g. R&S SMW-B2003)
- 2x option additive white Gaussian noise (AWGN) (R&S SMW-K62)
- 2x option digital standard 5G NR (R&S SMW-K144)
- 2x option closed loop feedback 5G NR (R&S SMW-K145)
- 1x option 5G NR Release 16 (R&S SMW-K148)

Test cases where the signal generator hardware and/or software equipment is not sufficient are grayed out and not selectable.

RF power and frequency limitations of the hardware equipment restrict the setting ranges.

8.3 Supported test cases

The BS RF conformance tests defined in the TS 38.141-1 and TS 38.141-2 specifications are divided into the following three main groups:

- Transmitter characteristics tests
- Receiver characteristics tests
- Performance requirements tests

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 8-1: Transmitter characteristics tests

Chapter	Test case	Section in this document with further information
Conducted tests. Specification TS 38.141-1		
6.7	Reference sensitivity level	chap. 8.7.4, on page 381
Radiated tests. Specification TS 38.141-2		
6.8	OTA transmitter intermodulation	chap. 8.10.4, on page 465

Table 8-2: Receiver characteristics tests

Chapter	Test case	Section in this document with further information
Conducted tests. Specification TS 38.141-1		
7.2	Reference sensitivity level	chap. 8.8.4, on page 386
7.3	Dynamic range	chap. 8.8.5, on page 388
7.4.1	Adjacent channel selectivity (ACS)	chap. 8.8.6, on page 390
7.4.2A	In-band general blocking	chap. 8.8.7, on page 392
7.4.2B	In-band narrow-band blocking	chap. 8.8.8, on page 394
7.5	Out-of-band blocking	chap. 8.8.9, on page 396
7.7	Receiver intermodulation	chap. 8.8.10, on page 398
7.8	In-channel selectivity	chap. 8.8.11, on page 402
Radiated tests. Specification TS 38.141-2		

Chapter	Test case	Section in this document with further information
7.2	OTA sensitivity	chap. 8.11.4, on page 472
7.3	OTA reference sensitivity level	chap. 8.11.5, on page 474
7.4	OTA dynamic range	chap. 8.11.6, on page 476
7.5.1	OTA adjacent channel selectivity (ACS)	chap. 8.11.7, on page 477
7.5.2A	OTA in-band general blocking	chap. 8.11.8, on page 479
7.5.2B	OTA in-band narrowband blocking	chap. 8.11.9, on page 482
7.6	OTA out-of-band blocking	chap. 8.11.10, on page 484
7.8	OTA receiver intermodulation	chap. 8.11.11, on page 486
7.9	OTA in-channel selectivity	chap. 8.11.12, on page 489

Table 8-3: Performance requirements tests

Chapter	Test case	Section in this document with further information
Conducted tests. Specification TS 38.141-1		
8.2.1	PUSCH transform precoding disabled	chap. 8.9.3, on page 406
8.2.2	PUSCH transform precoding enabled	chap. 8.9.4, on page 408
8.2.3	UCI multiplexed on PUSCH	chap. 8.9.5, on page 410
8.3.1	Performance requirements for PUCCH format 0	chap. 8.9.16, on page 429
8.3.2.1	NACK to ACK detection for PUCCH format 1	chap. 8.9.17, on page 431
8.3.2.2	ACK missed detection for PUCCH format 1	chap. 8.9.18, on page 433
8.3.3.1	ACK missed detection for PUCCH format 2	chap. 8.9.19, on page 435
8.3.3.2	UCI BLER for PUCCH format 2	chap. 8.9.20, on page 437
8.3.4	Performance requirements for PUCCH format 3	chap. 8.9.21, on page 439
8.3.5	Performance requirements for PUCCH format 4	chap. 8.9.22, on page 440
8.3.6.1A	NACK to ACK detection for multi-slot PUCCH format 1	chap. 8.9.23, on page 442
8.3.6.1B	ACK missed detection for multi-slot PUCCH format 1	chap. 8.9.24, on page 444
8.4.1	PRACH false alarm probability and missed detection	chap. 8.9.34, on page 461
Radiated tests. Specification TS 38.141-2		
8.2.1	OTA PUSCH with transform precoding disabled	chap. 8.12.3, on page 494
8.2.2	OTA PUSCH with transform precoding enabled	chap. 8.12.4, on page 496
8.2.3	OTA UCI multiplexed on PUSCH	chap. 8.12.5, on page 497
8.3.1	OTA performance requirements for PUCCH format 0	chap. 8.12.16, on page 516

Chapter	Test case	Section in this document with further information
8.3.2.1	OTA NACK to ACK detection for PUCCH format 1	chap. 8.12.17, on page 518
8.3.2.2	OTA ACK missed detection for PUCCH format 1	chap. 8.12.18, on page 520
8.3.3.1	OTA ACK missed detection for PUCCH format 2	chap. 8.12.19, on page 522
8.3.3.2	OTA UCI BLER for PUCCH format 2	chap. 8.12.20, on page 524
8.3.4	OTA performance requirements for PUCCH format 3	chap. 8.12.21, on page 525
8.3.5	OTA performance requirements for PUCCH format 4	chap. 8.12.22, on page 527
8.3.6.1A	OTA NACK to ACK detection for multi-slot PUCCH format 1	chap. 8.12.23, on page 528
8.3.6.1B	OTA ACK missed detection for multi-slot PUCCH format 1	chap. 8.12.24, on page 530
8.4.1	OTA PRACH false alarm probability and missed detection	chap. 8.12.34, on page 547

8.3.1 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 from the 3GPP test specification.
- Prerequisites and required hardware and software options
- Test setup
- Description of test case-specific parameters

8.4 Exemplary test setups

The tests can be performed using the standard test setup according to TS 38.141-1 and TS 38.141-2. Test setups beside the standard test setups described below are specified at the individual description of the corresponding test case.

8.4.1 Exemplary test setups for conducted tests (TS 38.141-1)

8.4.1.1 Exemplary test setup - one path

For two-path instruments, signal routing to path A is assumed for the graph below. RF port A outputs the wanted signal (with or without interference) and is connected to the

Rx port of the base station. The signal generator starts signal generation at the first received gNB frame trigger.

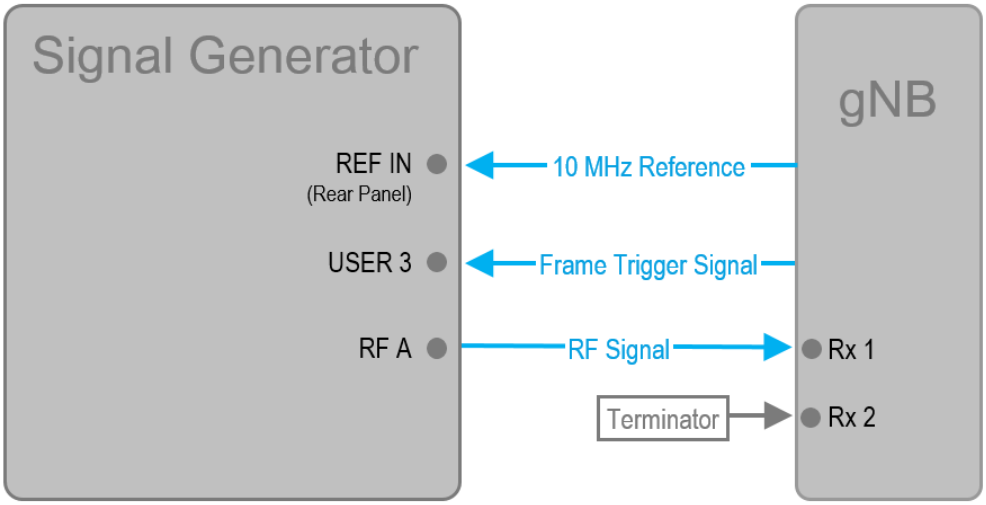


Figure 8-1: One path test setup (example of R&S SMW simulating the test case 7.3 "Dynamic range")

For two-path instruments, it is also possible to route baseband signal A to RF output B and connect RF output B to the Rx port of the base station.

8.4.1.2 Exemplary test setup - two paths

Two-paths measurements require option for second RF path (e.g. R&S SMW-B2003), an option baseband main module (R&S SMW-B13T or /-B13XT) and at least one option for the interfering signal in addition. 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 at output RF B. After combining the two (three) signals, the sum signal is fed into the base station Rx port. The signal generator starts signal generation at the first received gNB frame trigger.

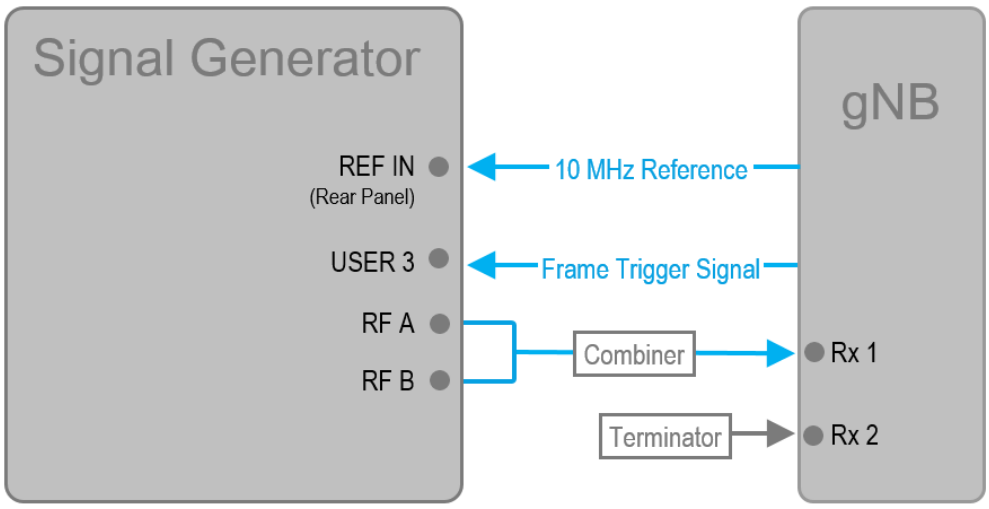


Figure 8-2: Two paths test setup (example of R&S SMW simulating test case 7.7 "Receiver intermodulation")

8.4.1.3 Exemplary test setup - 8 Rx test setups

A test setup for conducted tests on base stations with 8 receiving antennas requires the following equipment:

- 1 x R&S SMW equipped with all hardware options required for the test (see Chapter 8.2, "Required options", on page 343)
- 6 x R&S SGT

Make sure to connect the R&S SGTs to the R&S SMW using Dig I/Q cables with a length of 0.5 m (order number 1208.3213.00).

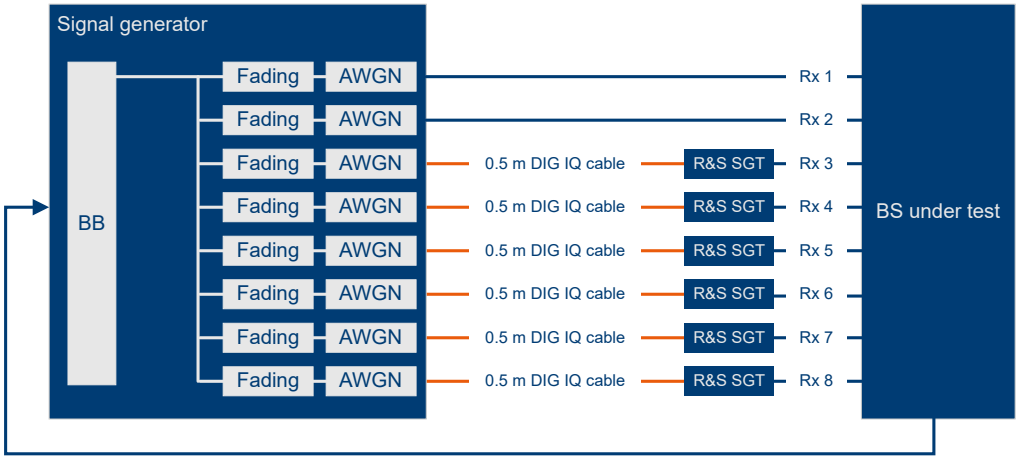


Figure 8-3: Test setup for setups testing 8 Rx base stations

8.4.2 Exemplary test setups for radiated (OTA) tests (TS 38.141-2)

8.4.2.1 Exemplary test setup - one path

For two-path instruments, signal routing to path A is assumed for the graph below. RF port A outputs the wanted signal (with or without interference) and is connected to the test antenna port of the OTA chamber. The signal generator starts signal generation at the first received gNB frame trigger.

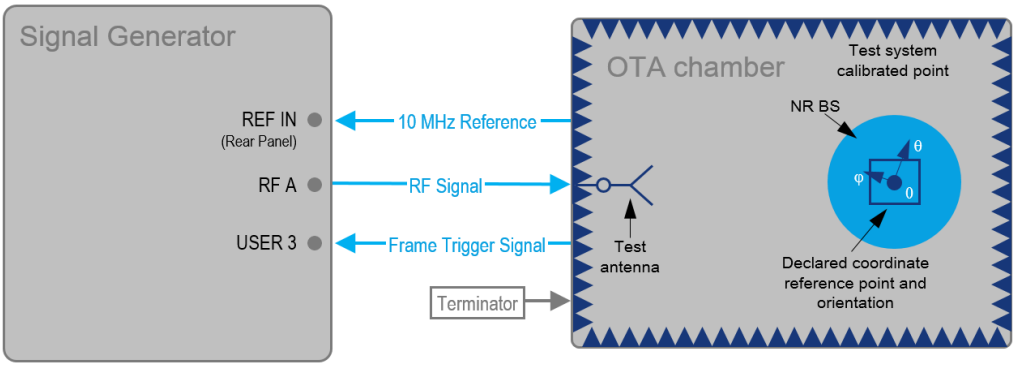


Figure 8-4: One path test setup (example of R&S SMW simulating the test case 7.4 "OTA dynamic range")

For two-path instruments, it is also possible to route baseband signal A to RF output B and connect RF output B to the test antenna port of the OTA chamber.

8.4.2.2 Exemplary test setup - two paths

Two-paths measurements require option for second RF path (e.g. R&S SMW-B2003), an option baseband main module (R&S SMW-B13T or /-B13XT) and at least one option for the interfering signal in addition. 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 at output RF B. After combining the two (three) signals, the sum signal is fed into the test antenna port of the OTA chamber. The signal generator starts signal generation at the first received gNB frame trigger.

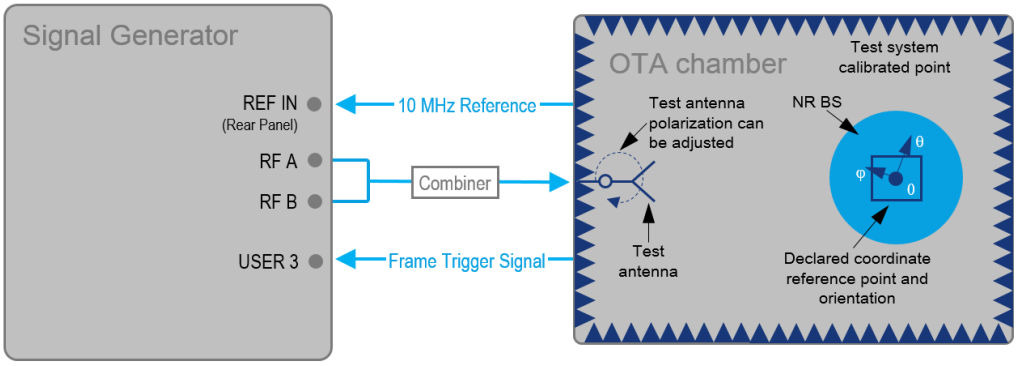


Figure 8-5: Two paths test setup (example of R&S SMW simulating test case 7.8 "OTA receiver intermodulation")

8.5 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.

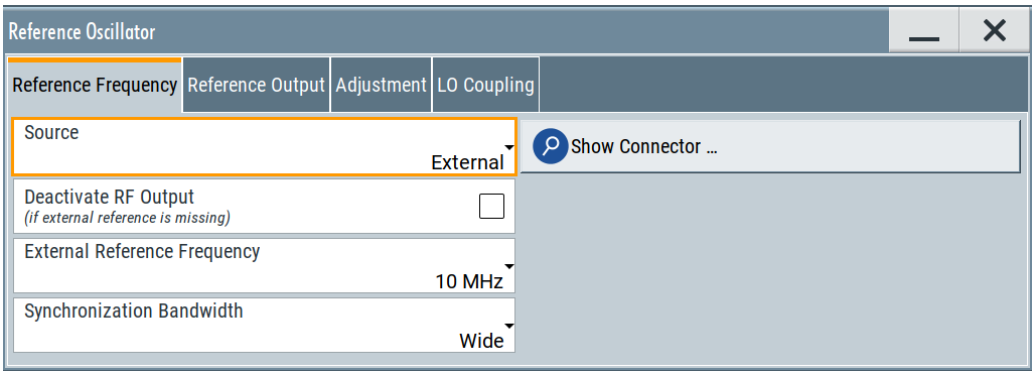
Test frequencies

5G NR is designed to operate in the operating bands defined in TS 38.104, tables 5.2-1 and 5.2-2.

The measurements have to be performed using 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 bottom, middle and top (B, M and T).

Reference frequency

When building up the measurement setups according to TS 38.141-1 and TS 38.141-2, it can be useful that all the instruments share a common reference frequency. Fed in the external reference frequency at the REF IN connector and enable "RF > Reference Frequency > Source = External".



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 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.

Resource block 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 "RB Offset" to define the position of the RBs.

Use also the Observing current allocations on the time plan to visualize the RB allocation for the wanted signal (path A) and the interfering signal (path B).

8.5.1 General considerations for radiated (OTA) tests

Base stations and reference points

In TS 38.141-2 and TS 38.104 two different base station types are defined for frequency range one (FR1) and two (FR2). Radiated requirements are also referred to as OTA requirements.

BS type 1-O and 2-O (FR1, FR2, radiated)

For base station types 1-O and 2-O the radiated characteristics are defined over-the-air (OTA) where the OTA interface is referred to as radiated interface boundary (RIB). Co-location requirements are specified at the conducted interface of the co-location reference antenna.

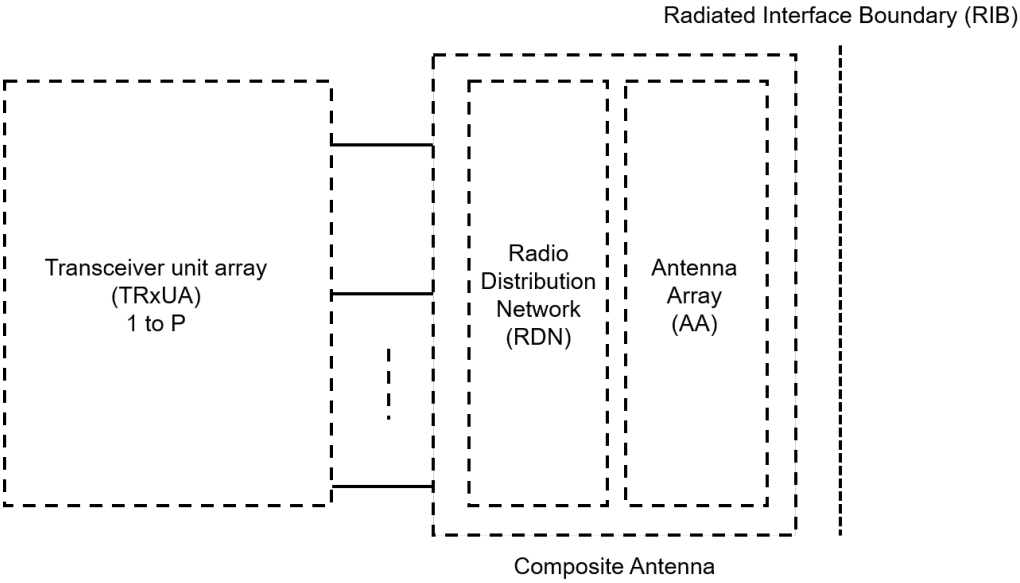


Figure 8-6: Radiated reference points for BS type 1-O and BS type 2-O as defined in TS 38.141-2

BS type 1-H (hybrid, radiated)

This base station type has two reference points fulfilling both radiated and conducted requirements.

Radiated characteristics are defined OTA and to be measured at the radiated interface boundary (RIB). The specific requirements and test cases are defined in TS 38.141-2.

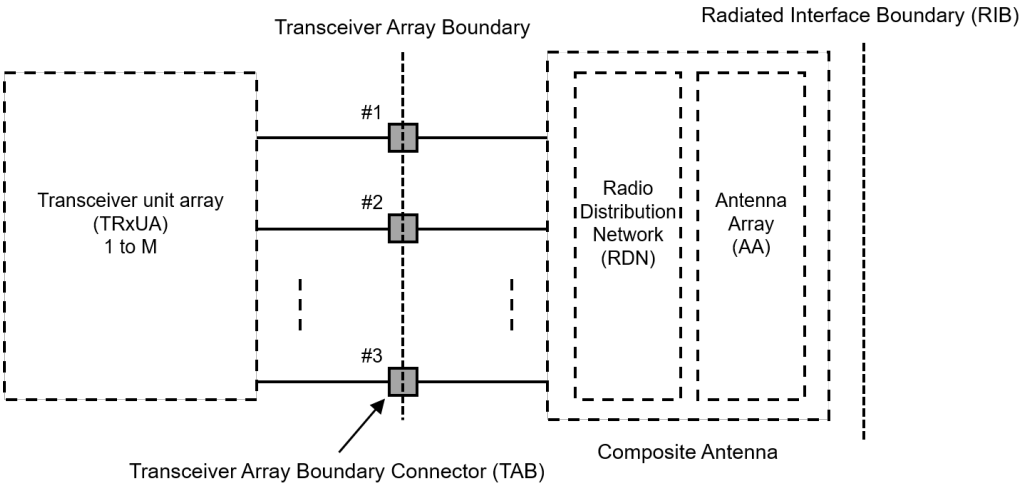


Figure 8-7: Radiated and conducted reference points for BS type 1-H as defined in TS 38.141-2

Base station classes

The specification TS 38.104 distinguishes base station classes by BS type 1-O and 2-O (Table 8-4) and BS type 1-H (Table 8-5).

Table 8-4: Base station classes for BS types 1-O and 2-O

BS type	BS class	Cell size	Minimum distance along the ground (m)
Type 1-O and type 2-O	Wide area	Macro cell	35
	Medium area	Micro cell	5
	Local area	Pico cell	2

Table 8-5: Base station classes for BS type 1-H

BS type	BS class	Cell size	Minimum coupling loss (dB)
Type 1-H	Wide area	Macro cell	70
	Medium area	Micro cell	53
	Local area	Pico cell	45

Reference coordinate system

For radiated test setups a reference coordinate system is required. The reference coordinate system should be associated to an identifiable physical feature on the base station enclosure.

The reference coordinate system is created of a Cartesian coordinate system with rectangular axis x,y,z and spherical angles θ, φ as shown in Figure 8-8.

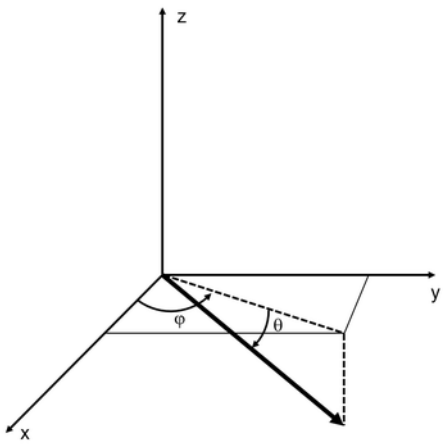


Figure 8-8: Reference coordinate system

8.6 User interface

Access:

► Select "Baseband Block > 5G NR > General > Test Case Wizard".

The "Test Case Wizard" graphically shows the actual test case configuration in a diagram in the upper part of the dialog.

The corresponding settings are displayed in tabs in the lower part of the dialog.

The number of displayed tabs depends on the selected test case. Use the fields in the different tabs to modify the default setting values as needed.

The "Test Case Wizard" dialog contains the tabs:

8.6.1 General settings

Access:

► Select "Baseband Block > 5G NR > General > Test Case Wizard".

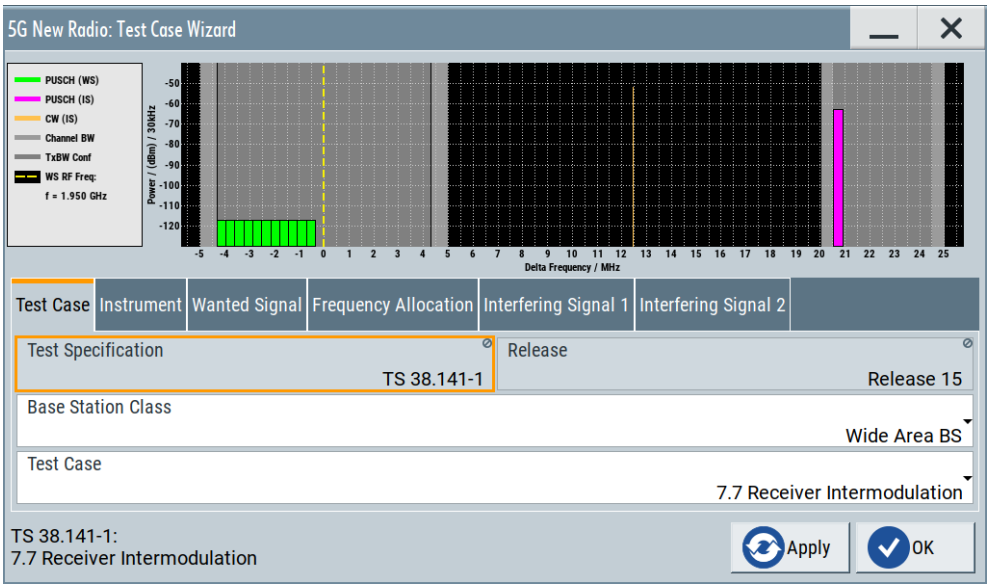


Diagram
In the upper part, the dialog displays a graph with the interference scenario defined by power level and frequency offset of the currently selected test case.

Apply,OK
Activates the current settings of the test case wizard.

The "Apply" triggers a selective preset of the signal generator before the presetting according to the selected test case. Further modification of the generator settings is still possible. Signal generation starts with the first trigger event.

Use "Ok" to apply the settings and close the dialog.

Note: The settings of the selected test case become active only after selecting "Apply" or "OK" button.

Before triggering the signal generator, you can still change these other settings. This configuration is particularly useful when compensating for cable loss or adjusting the RF power level offset of also inserted attenuators.

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.

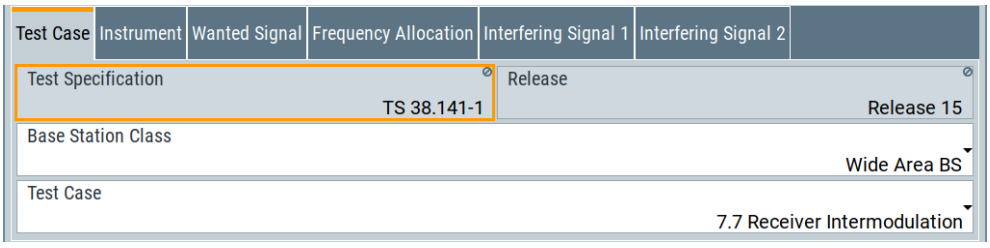
Note: The settings in the dialogs "5G NR > Trigger/Marker/Clock" and in the "Global/ Local Connector Settings" are not affected by the selective preset, if the parameter "Trigger/Marker Configuration" is set to "Unchanged".

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:APPLy` on page 944

8.6.2 Test case settings

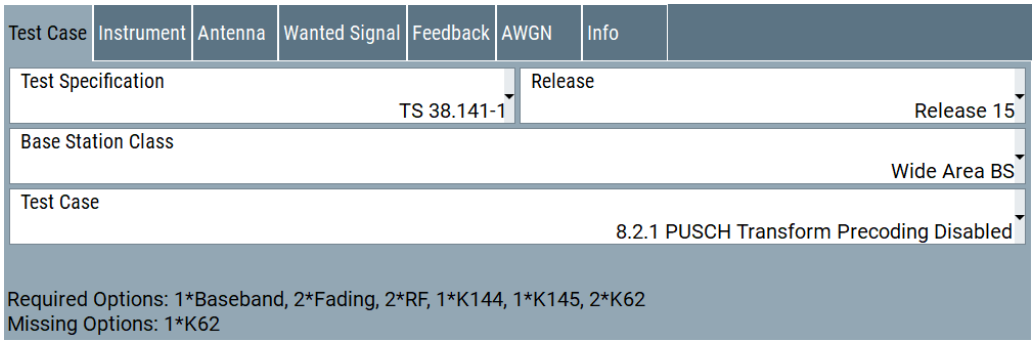
Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".
2. Select "Test Case".



This dialog comprises the settings for selecting the test case, the 3GPP test specification, release, and BS class.

When your signal generator misses an option required to perform the selected test case, it shows a message that lists all required options and a list of missing options.



Test Specification

Displays the 3GPP test specification used as a guide line for the test cases.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:SPEC` on page 954

Release

Displays the 3GPP test specification release version used as a guide line for the test cases.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:RELease` on page 954

Base Station Class

Determines whether the test is to be performed for an NR local area, NR medium area or an NR wide area base station. The different base station classes are specified for different output power (see also "Power Level" on page 364).

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:BSCLass` on page 945

Test Case

Selects the test case.

See Chapter 8.3, "Supported test cases", on page 344 for an overview of the available test cases.

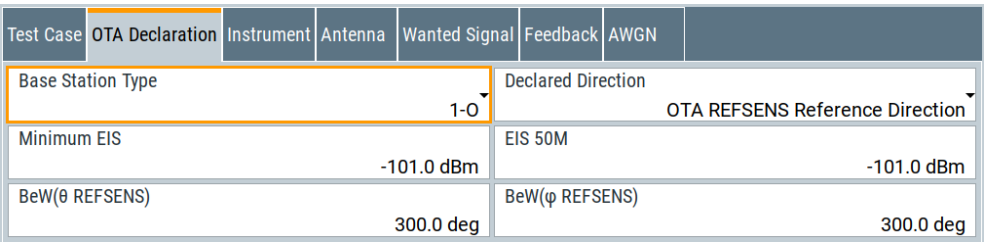
Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:TC` on page 956

8.6.3 OTA declaration

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".
2. Select "OTA Declaration".



This dialog comprises the settings for the OTA sensitivity directions declaration (OSDD).

Base Station Type
Sets the base station type used for the OSDD.

"1-H"
Sets the BS type 1-H (FR1, hybrid) for the OTA settings.
This base station type has two reference points fulfilling both radiated and conducted requirements. Radiated characteristics are defined over-the air (OTA) and to be measured at the radiated interface boundary (RIB) as specified in TS 38.141-2.

"1-O" Sets the BS type 1-O (FR1) for the OTA settings.

"2-O" Sets the BS type 2-O (FR2) for the OTA settings.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:BSTYpe` on page 946

Declared Direction
Sets the reference for the OSDD.

"OTA minSENS Reference Direction"
Sets the OTA minimum sensitivity (minSENS) value as the reference for the OSDD.

"OTA REFSENS Reference Direction"
Sets the OTA reference sensitivity (REFSENS) value as the reference for the OSDD.

"Other Direction"

Sets a value different than the minSENS and REFSENS as the reference for the OSDD.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:DCLDirection` on page 946

Minimum EIS

Sets the lowest equivalent isotropic sensitivity value ($EIS_{minSENS}$) for the OSDD.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:MEIS` on page 953

EIS 50M

Sets the $EIS_{REFSENS\_50M}$ level value applicable in the OTA REFSENS RoAoA.

The $EIS_{REFSENS\_50M}$ value is the declared OTA reference sensitivity basis level for FR2 based on a reference measurement channel with 50MHz BS channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:E50` on page 947

BeW(θ REFSENS)

Sets the angle of the beamwidth for to the OTA REFSENS RoAoA in the θ-axis ($BeW_{\theta,REFSENS}$), applicable for FR1 only.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:BEWThet` on page 945

BeW(φ REFSENS)

Sets the angle of the beamwidth for to the OTA REFSENS RoAoA in the φ-axis ($BeW_{\theta,REFSENS}$), applicable for FR1 only.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:BEWPhi` on page 945

Frequency Range

Available if Test Case > "7.5.1 OTA Adjacent Channel Selectivity (ACS)" and Base Station Type > "2-O".

Sets the frequency range FR2 for the BS type 2-O.

Note: To reach the frequency range FR2, connect an external RF device to your instrument, e.g. an R&S SGS100A.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:FR` on page 947

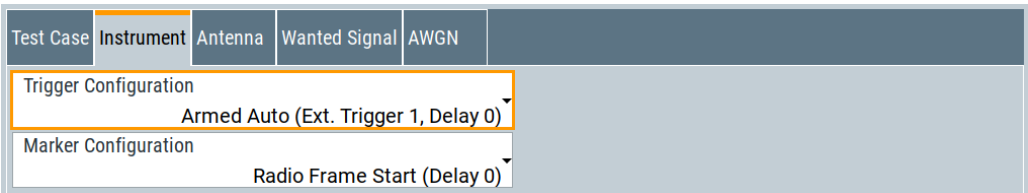
8.6.4 Instrument settings

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".

2. Select "Instrument".

   The "Instrument" dialog comprises instrument-related settings, like trigger and marker settings or routing related settings.



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 following settings apply:

- "Trigger Mode > Armed Auto"
- "Trigger Source > External Global Trigger 1"
- "Trigger Delay = 0"
  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:NR5G:TCW:TRIGgerconfig` on page 957

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. The following settings apply:

- "Marker Mode 1/2/3 > Radio Frame Start"
- "Global Connector Settings > User 1/2 > Direction > Output" and "User 1/2 > Signal > Baseband A Marker 1/2"
  "Local Connector Settings > T/M 2/3 > Direction > Output" and "T/M 2/3 > Signal > Marker A 1/2"
  Marker signals "Marker 1" and "Marker 2" are output at the local T/M 2/3 and global USER1/2 connectors
- "Marker Delay = 0"

"Unchanged" The current marker settings of the signal generator are retained unchanged.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:MARKerconfig` on page 953

Instrument Setup
Selects the number of generator RF ports you are using for the test case. You can use one or two RF ports.

Using a different number of RF ports is supported for selected OTA test cases (for example 7.5.1, 7.5.2A, 7.5.2B).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:INSTsetup` on page 948

Signal Outputs
Selects the type of signal outputs used for the test case.

Using different signal outputs requires the following options:
- R&S SMW-B13XT (wideband baseband)
- R&S SMW-K74 (MIMO fading / routing)
- R&S SMW-K19 (digital baseband output for wideband baseband)

Selecting the signal output is supported for test case from 3GPP 38.141-1/-2, chapter 8.

"Analog & Digital" Signal output on the analog and digital I/Q interface.

"Analog & Digital (HS)" Signal output on the analog and high speed digital I/Q interface.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:OUTPut:MODE` on page 953

Generated Signal
Selects the signals that are generated for test cases that require the generation of a wanted and a interferer signal.

"All Signals" Generates both the wanted signal and the interferer signal. This option requires a generator with two baseband generators.

"Wanted Signal" Generates only the wanted signal. You can use this option if your generator has only one baseband generator. This option requires a second signal generator to generate the interferer signal.

"Interferer Signal" Generates only the interferer signal. You can use this option if your generator has only one baseband generator. This option requires a second signal generator to generate the wanted signal.

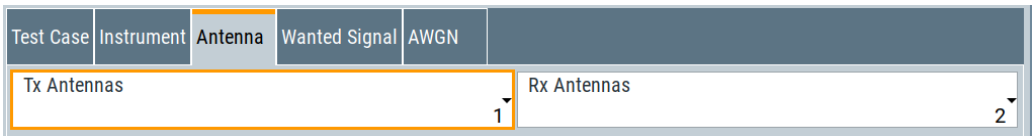
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:GENSignal` on page 948

8.6.5 Antenna settings

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".
2. Select "Antenna".

   The "Antenna" dialog comprises instrument-related settings, like Tx and Rx antenna-related settings.



Tx Antennas
Shows or sets the number of Tx antennas used for test case.

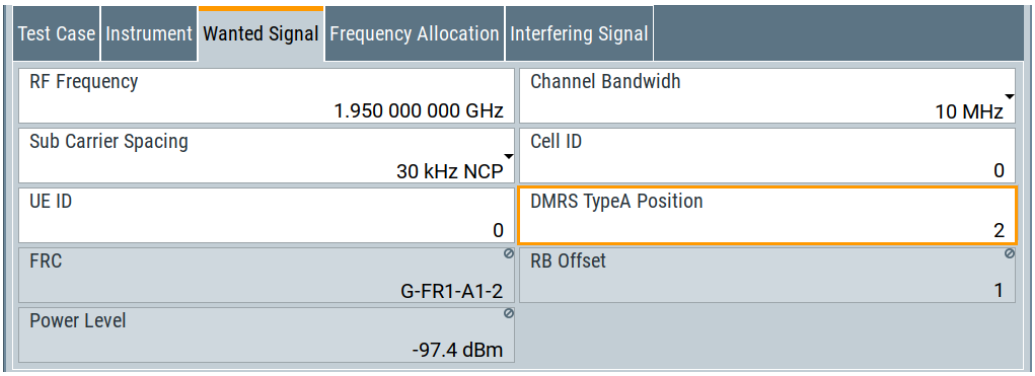
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:ANT:TXANtennas` on page 944

Rx Antennas
Shows or sets the number of Rx antennas used for test case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:ANT:RXANtennas` on page 944

8.6.6 Wanted signal 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.



Additional DMRS

Enables or disabled the additional DMRS.

Additional DMRS signals increase the probability that the UE receives the demodulation reference symbols. It leads to a support of lower SNR conditions.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:ADMRs:STATe` on page 958

Cell ID

Sets the cell ID.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:CELLid` on page 958

CSI Part

Defines the CSI part selected for the test case.

The PUCCH-based CSI and the PUSCH-based CSI reporting, always padding the CSI report to the worst-case UCI payload size would result in too large overhead. For these cases, the CSI content is instead divided into two CSI parts.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSIPart` on page 967

CSI 1 Pattern
Defines the frequency and time domain of the CSI part 1 subcarrier location.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSI1:PATTern` on page 967

CSI 2 Pattern
Defines the frequency and time domain of the CSI part 2 subcarrier location.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSI2:PATTern` on page 967

Channel Bandwidth
Selects the channel bandwidth (see also Chapter 2.2, "5G NR numerology", on page 22).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:CBW` on page 958

DMRS Type A Position
Sets l_0, i.e. the position of first DM-RS symbol for PUSCH (and PDSCH) mapping type A (`dmrs-TypeA-Position`).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:TAPos` on page 966

Duplexing
The duplexing mechanism used can be switched between FDD and TDD.

TDD	Time division duplex is used. In TDD mode, both uplink and downlink use the same spectrum frequencies but at different times.
FDD	Frequency division duplex is used. In FDD mode, both uplink and downlink can transmit at the same time at different spectrum frequencies.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:DUPLex` on page 959

Fraction of Max. Throughput
The required throughput is expressed as a fraction of maximum throughput for the FRC. The performance requirements assume HARQ retransmissions.

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs at the given SNR.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:FMTHroughput` on page 959

FRC
Displays the fixed reference channel used. An overview of the FRCs and the cross-reference between the selected Channel Bandwidth and Sub Carrier Spacing / Sub Carrier Spacing (BWP) is given in the individual description of the test cases.

See also 3GPP TS 138 141-1, annex A (normative): Reference measurement channels.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:FRC:TYPE` on page 959

Frequency Offset
Sets the frequency offset used for the PRACH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:FROFfset` on page 962

Mapping Type
Sets the mapping type A or B for the PUSCH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:MAPType` on page 962

Mode
Switches between the detection rate (Pd) and the false detection rate (Pfa).

Detection rate (Pd)	Pd is defined as the probability of detection of preamble.
False detection rate (Pfa)	Pfa is defined as the total probability of false detection of the preamble.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:MODE` on page 962

Number of OFDM Symbols
Sets the number of used OFDM symbols.

The starting symbol index is 13 for 1 OFDM symbol and 12 for 2 OFDM symbols.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:SYMNumber` on page 965

Preamble Format
Sets the designated PRACH preamble format.

The preamble is used to obtain the UL synchronization. In 5G NR, there are 64 preambles defined in each time-frequency PRACH occasion. The preamble consists of two parts cyclic prefix (CP) and preamble sequence.

In 5G NR, there are 13 types of preamble format supported known as format 0, format 1, format 2, format 3, format A1, format A2, format A3, format B1, format B2, format B3, format B4, format C0, format C1.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PRACh:FORMat` on page 963

Power Level
Displays the power level, depending on the selected test case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PLEVel` on page 963

Propagation Conditions
The propagation conditions define the multipath fading environment.

They indicated as a combination of channel model name and maximum Doppler frequency, i.e. TDLA<DS>-<Doppler> where <DS> indicates the desired delay spread and <Doppler> indicates the maximum Doppler frequency.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PROCondition` on page 964

PTRS
Available for Test Cases "8.2.1 OTA PUSCH" and "8.2.3 OTA UCI multiplexed on PUSCH" with Base Station Type "2-O".

Enables PTRS (phase-tracking reference signal) for the wanted signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PTRS:STATe` on page 964

RB Offset
Sets the shift of the allocated wanted signal in No. of RBs (see also "Resource block offset" on page 351).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:RBOFfset` on page 964

Restricted Set
Selects the restricted set type for the PRACH used in the test case.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:RSET` on page 965

RF Frequency
Sets the RF frequency of the wanted signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:RFFRequency` on page 964

Sub Carrier Spacing / Sub Carrier Spacing (BWP)
Sets the subcarrier spacing using normal cyclic prefix (NCP) or extended cyclic prefix (ECP). See also Chapter 2.2, "5G NR numerology", on page 22.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:SCSPacing` on page 965

Sub Carrier Spacing (PRACH)
Sets the subcarrier spacing for PRACH.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PRACh:SCSPacing` on page 963

Test Requirement
Selects the test environment.

"Normal" Requirement for normal conditions.

"High Speed Train" Requirement for high speed train coniditons.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:TREQuire` on page 968

Test Setup
With the test setup selector, the signal definitions can be switched.

Parameter	Test Setup 1	Test Setup 2
Modulation	QPSK	
First PRB prior to frequency hopping	0	
Intra-slot frequency hopping	enabled	
First PRB after frequency hopping	The largest PRB index (number of PRBs -1)	
Group and sequence hopping	neither	
Hopping ID	0	
Number of PRBs	1	3
Number of symbols	14	4
Number of UCI information bits	16	
First symbol	0	

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:TSETup` on page 966

Timing Offset Base Value
Displays the timing offset base value.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:TIOBase?` on page 966

UCI Bits
Set the number of UCI bits used.

Defines the size of the uplink control information bits carried in the PUCCH channel. They consist of the HARQ feedback, CSI and SR.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:BITS` on page 966

CG-UCI Pattern
Sets the ACK bits in pattern form.

A "1" indicates an ACK, a "0" a NACK.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CGUCi:PATTern` on page 967

UE ID
Sets the UE ID.

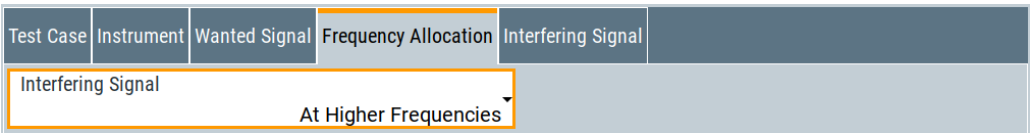
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UEID` on page 968

Virtual Downlink RF Frequency
Sets the virtual downlink RF frequency.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:VDRF` on page 968

8.6.7 Frequency allocation settings

Determines the frequency position of the wanted and the interfering signal.



Frequency Allocation of the Interfering signal
Determines the frequency position of the wanted and the interfering signal.

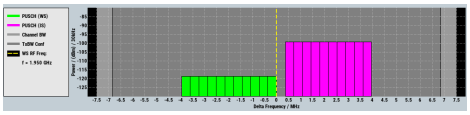
Example: Wanted and interfering signal within the same channel

"Test Case" = "7.8 In-channel selectivity"

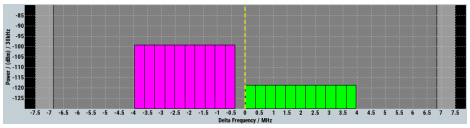
"Channel Bandwidth" = 15 MHz

The parameter "Frequency Allocation" determines the position of the allocated RBs within the channel. Allocation in the lower or higher frequencies is possible.

"Frequency Allocation of the Interfering signal" = At higher resource blocks



"Frequency Allocation of the Interfering signal" = At lower resource blocks



Example: Interfering signal in the adjacent channel

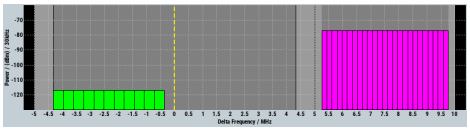
"Test Case" = "7.4.1 Adjacent channel selectivity"

"Channel Bandwidth (WS)" = 10 MHz

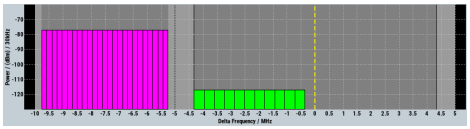
"Channel Bandwidth (IS)" = 5 MHz

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.

"Frequency Allocation of the Interfering signal" = At higher frequencies



"Frequency Allocation of the Interfering signal" = At lower frequencies



Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:FA:FRALlocation` on page 947

8.6.8 Interfering signal settings

Almost all receiver tests require an interfering signal (IS).

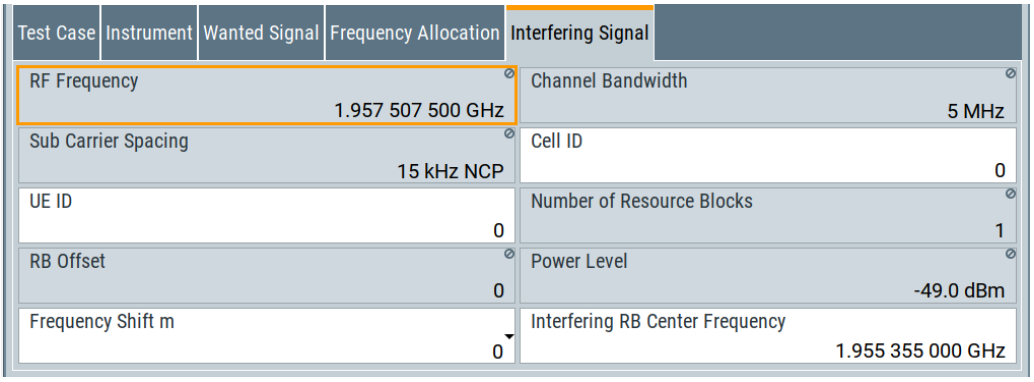


Figure 8-9: Interfering signal for in-band narrowband blocking (7.4.2B)

Band
Set the frequency band (n1 to n86) for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:BAND` on page 948

n
Set the offset factor for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:OFN` on page 950

Duplexing
The duplexing mechanism used for the interfering signal can be switched between FDD and TDD.

TDD	Time division duplex is used. In TDD mode, both uplink and downlink use the same spectrum frequencies but at different times.
FDD	Frequency division duplex is used. In FDD mode, both uplink and downlink can transmit at the same time at different spectrum frequencies.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:DUPLex` on page 949

Test Model
Shows the test model set for the test case. The NR-TMs for FR1 are defined in TS 38.141-1 section 4.9.2.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:TMODel?` on page 952

Interferer Type
Selects the type of the interfering signal:
- For **out-of-band blocking** tests, the interfering signal is always a CW signal.
- For **receiver intermodulation** tests, the first interfering signal can be an 5G NR signal or narrow-band 5G NR signal.
- The second interfering signal is always a CW signal.

Refer to Chapter 8.8.9, "Test case 7.5: out-of-band blocking", on page 396.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:IFTYpe` on page 950
`[:SOURce<hw>]:BB:NR5G:TCW:IS2:IFTYpe` on page 949

Test Requirement

For CW interfering signal, selects whether the standard out-of-band blocking test is performed or the optional test, when the BS is co-located with another BS in a different operating band.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:IS:TREQuire` on page 952

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 $\text{Frequency}_{\text{interfering signal}}$" = "RF $\text{Frequency}_{\text{wanted signal}}$" + Delta
- For "Frequency Allocation > Interfering Signal > At Lower Frequencies"
  "RF $\text{Frequency}_{\text{interfering signal}}$" = "RF $\text{Frequency}_{\text{wanted signal}}$" - Delta

Where for both cases Delta is calculated as follows:

Delta = "Channel $\text{Bandwidth}_{\text{wanted signal}}$"/2 + $\text{Offset}_{\text{interfering signal}}$

Example:

"Channel $\text{Bandwidth}_{\text{wanted signal}}$" = 5 MHz

"RF $\text{Frequency}_{\text{wanted signal}}$" = 1 950 MHz

$\text{Offset}_{\text{interfering signal}}$ = 2.5025 MHz.

(see Table 8-12).

Delta = 5/2 + 2.5025 = 5.0025 MHz

For "Frequency Allocation > Interfering Signal > At Higher Frequencies": "RF $\text{Frequency}_{\text{interfering signal}}$" = 1 950 + 5.0025 = 1 955.0025 MHz

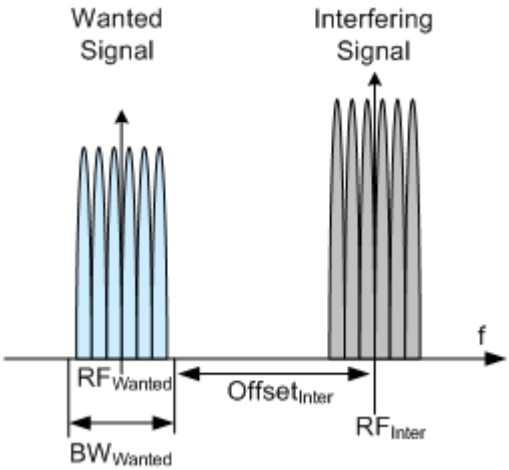


Figure 8-10: Example: adjacent channel selectivity (ACS)

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:IS:RFFRequency` on page 951

`[:SOURce<hw>]:BB:NR5G:TCW:IS2:RFFRequency?` on page 951

Channel Bandwidth
Displays the channel bandwidth of the interfering signal. The bandwidth of the interfering signal is specified by 3GPP for a particular test case. Refer to Chapter 8.8, "Conducted receiver characteristics (TS 38.141-1, chapter 7)", on page 382.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:CHBW?` on page 948

Sub Carrier Spacing
Sets the subcarrier spacing for the interfering signal using normal cyclic prefix (NCP) or extended cyclic prefix (ECP). See also Chapter 2.2, "5G NR numerology", on page 22.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:SCSPacing?` on page 952

Cell ID
Sets the cell ID for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:CLID` on page 949

UE ID
Sets the UE ID for the interfering signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:UEID` on page 952

Number of Resource Blocks
The number of RBs used by the 5G NR 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 specified by 3GPP for a particular test case. Refer to Chapter 8.8, "Conducted receiver characteristics (TS 38.141-1, chapter 7)", on page 382.
- For **narrow-band blocking** tests, the interfering signal is a single resource block 5G NR signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:NRBLock?` on page 950

RB Offset
(Test cases 7.4.x, 7.7 and 7.8 only)

The position of the RBs allocated by the 5G NR interfering signal is determined automatically, depending on the selected "Channel Bandwidth" and the RBs allocation of the wanted signal.

- For **ACS testing**, **in-band blocking testing** and **receiver intermodulation testing**, the "RB Offset" is fixed to 0.
- For **in-channel selectivity testing**, the "RB Offset" is set in the way, that depending on the "Frequency Allocation" of the interfering signal. This parameter is used to allocate the wanted and the interfering signal around the center frequency (see also Figure 8-14).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:RBOFfset` on page 951

Power Level
The power level of the interfering 5G NR signal is set automatically depending on the selected channel bandwidth.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:PLEVel?` on page 950
`[:SOURce<hw>]:BB:NR5G:TCW:IS2:PLEVel?` on page 950

Frequency Shift m
By default, the narrow-band interfering signal is allocated at the most left (interfering signal at higher frequencies)/ most right (interfering signal at lower frequencies) subcarrier in the allocated channel bandwidth. However, the position of the interfering signal can be set by the parameter "Frequency Shift m", i.e. the allocated RB can be offset to a different center frequency (see Figure 8-12).

The parameter displays the center frequency of the resource block the interfering signal is allocated on. See also Table 8-14.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:FRSHift` on page 949

Interfering RB Center Frequency
Displays the center frequency of the single resource block interfering signal (see also Figure 8-12).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:RBCFrequency?` on page 951

Distance
Sets the distance between the test object and test antenna injecting the interferer signal.

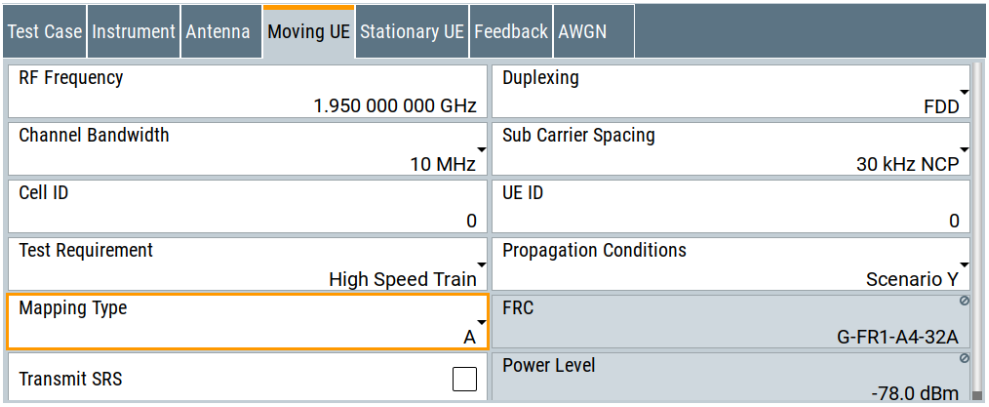
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:DISTance` on page 946

8.6.9 Moving UE settings

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".
2. Select "Moving UE".

   The "Moving UE" dialog comprises settings for moving UE's according to the test specifications.



RF Frequency

Selects the RF frequency that the signal generator uses for the test.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:RFFRequency` on page 964

Duplexing

Selects the duplexing method used for the test.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:DUPLex` on page 959

Channel Bandwidth

Selects the channel bandwidth used for the test.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:CBW` on page 958

Sub Carrier Spacing

Selects the subcarrier spacing used for the test.

Remote command:

`[:SOURce<hw>]:BB:NR5G:TCW:WS:SCSPacing` on page 965

Cell ID

Selects the cell ID used for the test.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:CELLid` on page 958

UE ID
Selects the UE IDof the DUT.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:UEID` on page 968

Test requirement
Selects the test environment.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:TREQuire` on page 968

Propagation Conditions
Selects the propagation conditions used for the test.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PROCondition` on page 964

Mapping Type
Selects the mapping type used for the test.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:MAPType` on page 962

FRC
Displays the "FRC" on page 168 used for the test.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:FRC:TYPE` on page 959

Transmit SRS
Turns transmission of the SRS for the test on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:MUE:TSRS` on page 953

Power Level
Displays the power level used in the test.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:WS:PLEVel` on page 963

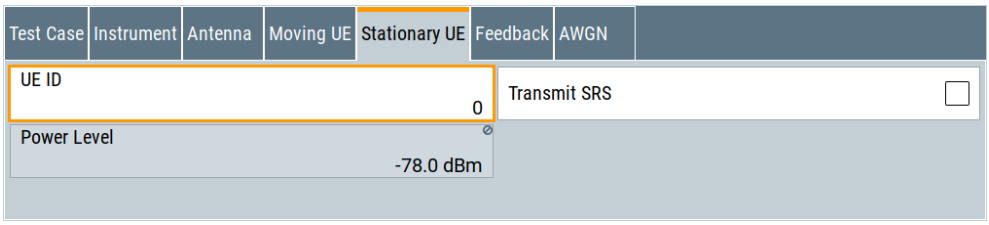
8.6.10 Stationary UE settings

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".

2. Select "Stationary UE".

   The "Stationary UE" dialog comprises settings for moving UE's according to the test specifications.



UE ID
Selects the UE ID of the DUT.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:UEID` on page 952

Transmit SRS
Turns transmission of the SRS for the test on and off.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:SUE:TSRS` on page 968

Power Level
Displays the power level used in the test.

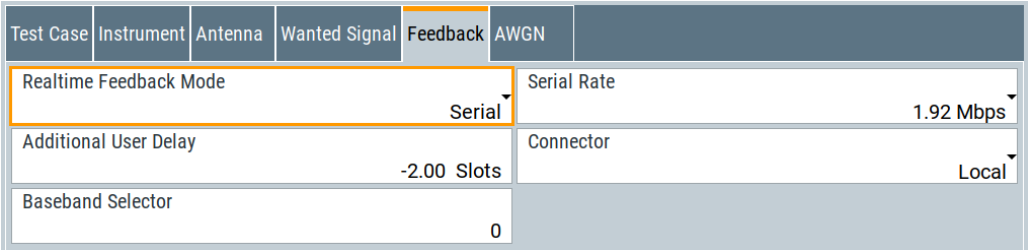
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:IS:PLEVel?` on page 950

8.6.11 Feedback settings

Access:

1. Select "Baseband Block > 5G NR > General > Test Case Wizard".
2. Select "Feedback".

   The "Feedback" dialog comprises settings for the closed loop feedback.



Realtime Feedback Mode

Defines the serial line mode used for the real-time feedback.

Serial — Sets the serial line to 16 bits width.

Serial 3x8 — Sets the serial line to an array with 3 times 8 bits width (24 bits).

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:MODE` on page 955

Serial Rate

Sets the bit rate of the serial transmission. You can select one of the predefined serial rates (115.2 kbps, 1.6 Mbps and 1.92 Mbps) or define a custom serial rate.

If you select a custom serial rate, you can define it in the "Resulting Serial Rate" field. The supported value range is 100 000 bps to 2 500 000 bps.

See also "Serial Rate" on page 559.

Remote command:
Mode: `[:SOURce<hw>]:BB:NR5G:TCW:RTF:SERRate` on page 956
Custom serial rate: `[:SOURce<hw>]:BB:NR5G:TCW:RTF:CSRate` on page 956

Additional User Delay

Defines the delay added to the real-time feedback.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:AUSDelay` on page 954

(Moving UE) Connector

Shows the connector used for the real-time feedback.

For some test cases, this is the connector for the moving UE.

Feedback uses the local connector, therefore the displayed value is always "Local".

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:CONNector` on page 955

(Moving UE) Baseband Selector
Defines which baseband selector index is used in the serial messages to address the baseband.

For some test cases, this is the connector for the moving UE.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:BBSelector` on page 954

Stationary UE Connector
Shows the connector used for the real-time feedback of the stationary UE.

Feedback uses the local connector, therefore the displayed value is always "Local".

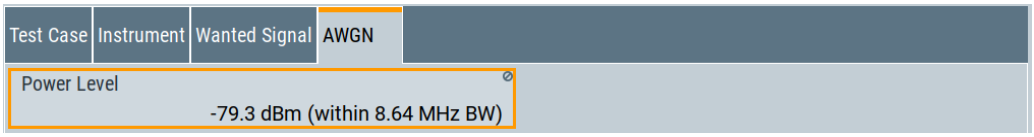
Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:SUE:CONNector` on page 956

Stationary UE Baseband Selector
Defines which baseband selector index is used in the serial messages to address the baseband of the stationary UE.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:RTF:SUE:BBSelector` on page 955

8.6.12 AWGN settings

Comprises the settings of the interfering signal (only for test case 7.3 Dynamic Range).



Power Level
Displays the power level of the AWGN signal. The value is set automatically.

Remote command:
`[:SOURce<hw>]:BB:NR5G:TCW:AWGN:PLEVel?` on page 945

8.6.13 Information

Using the test case wizard automatically adjusts the signal and other generator settings for the selected test case in the background. It can be hard to understand which settings the application adjusts and which values it applies for each setting. In the "Info", you can keep track of the settings that have been changed.

1. Select a test case.
2. "Apply" the test case.
3. Select the "Info" tab.
   The "Info" tab contains a list of all SCPI commands that have been used to configure the selected test case, including the selected parameters.

```
:SOURce1:BB:NR5G:TRIGger:SEQuence AAUT
:SOURce1:BB:NR5G:TRIGger:SOURce EGT1
:SOURce1:INPut:USER3:DIRection INP
:SOURce1:INPut:USER3:SIGNal TRIG1
:SOURce1:BB:NR5G:LINK UP
:SOURce1:BB:NR5G:NODE:CELL0:CELLid 0
:SOURce1:BB:NR5G:NODE:CELL0:TAPos 2
:SOURce1:BB:NR5G:NODE:CELL0:CARDeply FR1LT3
```

In addition, you can copy the list of SCPI commands and use them elsewhere.

4. Touch and hold the panel containing the SCPI commands to open the context menu.
5. From the context menu select the text you want to copy. Selected text is highlighted in orange.
6. Touch and hold the panel again to open the context menu.
7. Select "Copy Text To Clipboard" to copy the SCPI commands.

8.7 Conducted transmitter characteristics (TS 38.141-1, chapter 6)

The wizard supports 3GPP tests TS 38.141-1, chapter 6: Conducted transmitter characteristics.

The 3GPP TS 38.141-1 contains several test cases in chapter 6, but only one transmitter test needs a signal generator. Therefore only one test case is listed in this document.

The transmitter requirements are divided into the following main categories, intended to:

- Prove the transmitters ability to transmit the wanted signal:
  - Output power dynamics (6.3)
  - Transmit ON/OFF power (6.4)
- Prove how susceptible the transmitter is to different types of interfering signals:
  - Transmitter signal quality (6.5)
  - Unwanted emissions (6.6)
- Prove the transmitter intermodulation:
  - Chapter 8.7.4, "Test case 6.7: transmitter intermodulation", on page 381

The tests cover a wide range of scenarios with different impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

8.7.1 Required options

The table below lists the required options for performing the transmitter tests according to 3GPP TS 38.141-1, chapter 6.

Table 8-6: Required options

Chapter in TS 38.141-1	Hardware options					Software options	
	RF path		Baseband		BB genera-tor	AWGN	5G NR
	A	B	1 path	2 paths			
	B100x	B200x	B13 B13XT	B13T B13XT	B10 B9	K62	K144
6.7 Transmitter Intermodulation					1		1

The following equipment and options are required, for **transmitter characteristics tests**:

- 1x option baseband generator (R&S SMW-B10 or /-B9)
- 1x option digital standard 5G NR (R&S SMW-K144)
- Spectrum analyzer like an R&S FSW or R&S FSVA3000.

8.7.2 Prior considerations

BS type 1-C

General test conditions for conducted transmitter tests are given in TS 38.141-1. These test conditions include interpretation of measurement results and configurations for testing. Base station configurations are also given in TS 38.141-1.

If some single-band connectors or multi-band connectors have been declared equivalent, only a representative one is necessary to be tested to demonstrate conformance.

BS type 1-H

General test conditions for conducted transmitter tests are given in TS 38.141-1. Test conditions include interpretation of measurement results and configurations for testing. Base stations configurations are also given in TS 38.141-1.

If some single-band connectors or multi-band connectors have been declared equivalent, only a representative one is necessary to be tested to demonstrate conformance.

The manufacturer of the base stations has to declare the minimum number of supported geographical cells (i.e. geographical areas). This number relates to the base station setting with the minimum amount of cell splitting supported with transmission on all TAB connectors supporting the operating band. The manufacturer also declares the TAB connector Tx min cell groups. Every TAB connector supporting transmission in an operating band map to one TAB connector Tx min cell group supporting the same operating band. The mapping of TAB connectors to cells is implementation-dependent.

Test purpose

The minimum requirement applies per single-band connector, or per multi-band connector supporting transmission in the operating band.

Test requirements

The test purpose is to verify the accuracy of the maximum carrier output power across the frequency range and under normal and extreme conditions.

8.7.3 General workflow for carrying out a transmitter 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 base station according to the corresponding test case setup.
   See also Chapter 8.4, "Exemplary test setups", on page 346.
2. Set the base station to the basic state:
   a) Initialize the base station.
   b) Set the frequency.
   c) Set the base station to transmit the downlink signal (for most transmitter test cases).
   d) Adjust ATT attenuator so that level of the interfering signal is as defined in clause 6.7.5 of 3GPP TS 38.141-1.
3. Preset the signal generator to ensure a defined instrument state.
4. Configure the test case wizard.
   a) Select "Baseband Block > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-1: "6.7 Transmitter Intermodulation".
   c) Enter additional required parameters, e.g. base station class.
   d) Enter the test frequency of the wanted signal.
      The setting must match with the base station configuration.
   e) Select "Apply Settings" to activate the settings.

   The signal generator is now ready.
5. Switch on RF output.
6. If necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
   See also Chapter 8.5, "General considerations", on page 350.

7. Start the measurement.
   a) Send a start trigger impulse from the base station to the signal generator.

   The signal generator starts signal generation.
8. Calculate the results.

8.7.4 Test case 6.7: transmitter intermodulation

Test purpose

From 3GPP 38.141-1: The test purpose is to verify the ability of the transmitter units associated with the single-band connectors or multi-band connector under test to restrict the generation of intermodulation products in its nonlinear elements. The non-linear elements are caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna to below specified levels.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 6.7.

Required options

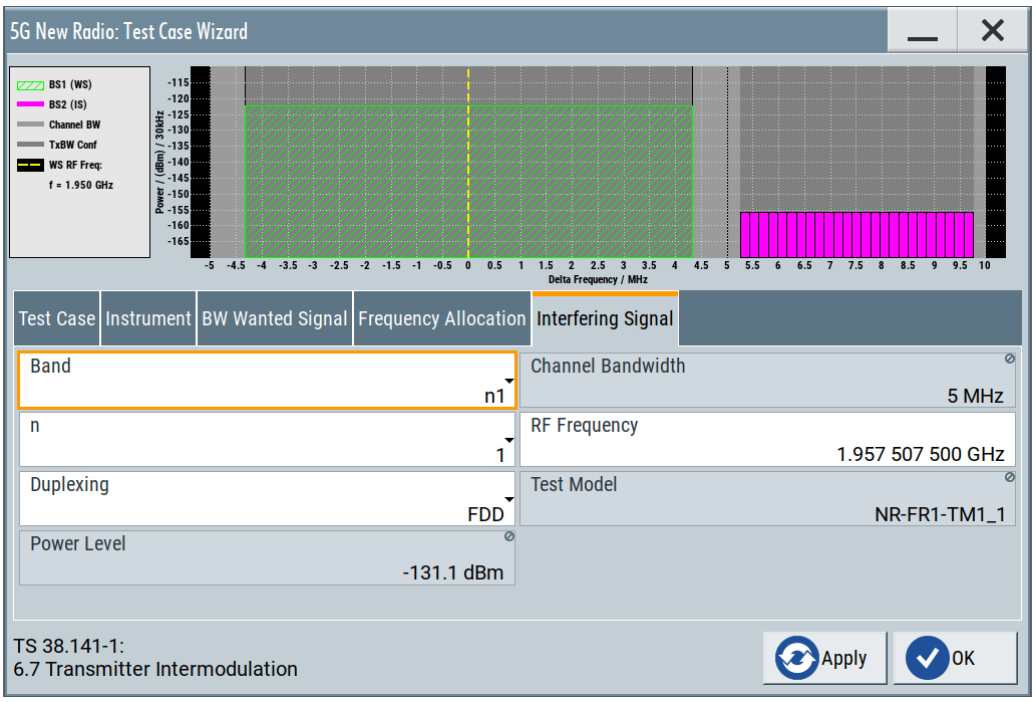
See also Chapter 8.7.1, "Required options", on page 379.

Test setup

See also Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The transmitter intermodulation requirement reflects the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit. The requirement applies during the transmitter ON period and the transmitter transient period.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.7, "Frequency allocation settings", on page 367
- Chapter 8.6.8, "Interfering signal settings", on page 368

8.8 Conducted receiver characteristics (TS 38.141-1, chapter 7)

The wizard supports 3GPP tests TS 38.141-1, chapter 7: Conducted receiver characteristics.

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 8.8.4, "Test case 7.2: reference sensitivity level", on page 386
  - Chapter 8.8.5, "Test case 7.3: dynamic range", on page 388
- Prove how susceptible the receiver is to different types of interfering signals:
  - Chapter 8.8.6, "Test case 7.4.1: adjacent channel selectivity (ACS)", on page 390
  - Chapter 8.8.7, "Test case 7.4.2A: in-band general blocking", on page 392

– Chapter 8.8.8, "Test case 7.4.2B: in-band narrowband blocking", on page 394
– Chapter 8.8.9, "Test case 7.5: out-of-band blocking", on page 396
– Chapter 8.8.10, "Test case 7.7: receiver intermodulation", on page 398
– Chapter 8.8.11, "Test case 7.8: in-channel selectivity", on page 402

The tests cover a wide range of scenarios with different impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

8.8.1 Required options

The table below lists the required options for performing the receiver tests according to 3GPP TS 38.141-1, chapter 7.

Table 8-7: Required options

Chapter in TS 38.141-1	**Hardware options**					**Software options**	
	RF path		**Baseband**		**BB genera-tor**	**AWGN**	**5G NR**
	A	**B**	**1 path**	**2 paths**			
	e.g., B1003	**e.g., B2003**	**B13 B13XT**	**B13T B13XT**	**B10 B9**	**K62**	**K144**
7.2 Reference sensitivity level	1		1		1		1
7.3 Dynamic range	1		1		1	1	1
7.4.1 Adjacent channel selectivity (ACS)	1	1		1	2		2
7.4.2A In-band general blocking	1	1		1	2		2
7.4.2B In-band narrowband blocking	1	1		1	2		2
7.5 Out-of-band blocking [1)]	1	1		1	2		2
7.6 Receiver spurious emissions [2)]							
7.7 Receiver intermodulation	1	1		1	2	1	2
7.8 In-channel sensitivity [1)]	1	1		1	2		2

[1)] An additional R&S instrument required for CW/5GNR signal

[2)] No signal generator required

The following equipment and options are required, for **receiver characteristics tests**:

- 2x option baseband generator (R&S SMW-B10 or /-B9)
- 1x option baseband main module (R&S SMW-B13T or /-B13XT)
- 1x option frequency (e.g. R&S SMW-B1003)
- 1x option frequency (e.g. R&S SMW-B2003)
- 1x option additive white Gaussian noise (AWGN) (R&S SMW-K62)
- 2x option digital standard 5G NR (R&S SMW-K144)
- For CW blocking interferer (7.5) and receiver intermodulation (7.7) tests:

An additional R&S device required for interfering signal

8.8.2 Prior considerations

Fixed reference channels (FRC)

The receiver tests use fixed reference channels (FRC) as defined in TS 38.141-1, annex A "Reference measurement channels".

The following FRCs are defined for the receiver tests.

Table 8-8: Supported FRC

FRC	Description
G-FR1-A1-1 to G-FR1-A1-9	FRC for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity (QPSK, R=1/3)
G-FR1-A2-1 to G-FR1-A2-6	FRC for FR1 dynamic range (16QAM, R=2/3)

Channels

According to the TS 38.141-1, 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 Chapter 8.5, "General considerations", on page 350 for an overview of the supported frequency operating bands.

Channel bandwidth of the 5G NR interfering signal

For all test cases using an interfering 5G NR signal, the bandwidth of the interfering signal must be the same as the wanted signal.

Reference sensitivity power level $P_{REFSENS}$

The reference sensitivity power level $P_{REFSENS}$ is the minimum mean power received at the BS connector.

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).

Table 8-9: Reference sensitivity levels

Channel bandwidth in MHz	Subcarrier spacing in kHz	FRC	Reference sensitivity power level, $P_{REFSENS}$ in dBm
5, 10, 15	15	G-FR1-A1-2	-101.7
10, 15	30	G-FR1-A1-3	-101.8
10, 15	60	G-FR1-A1-4	-98.9
20, 25, 30, 40, 50	15	G-FR1-A1-5	-95.3
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-6	-95.6
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-2	-95.7

Filter settings

The 3GPP 5G NR specifications do not define a standardized transmit filter for the UE or for the base station. Therefore, when a test case for the UL direction is activated, a filter type 5G NR with "Per BWP" is automatically selected

8.8.3 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 8.4, "Exemplary test setups", on page 346.
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 > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-1: "7.3 Dynamic Range".
   c) Enter additional required parameters, e.g. base station class.
   d) Enter the test frequency of the wanted signal, e.g. M.
      The setting must match with the base station configuration.
   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 necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
   See also Chapter 8.5, "General considerations", on page 350.
7. Start the measurement.
   a) Send a start trigger impulse from the base station to the signal generator.

   The signal generator starts signal generation.
8. Calculate the results.

The base station internally calculates the BER, BLER. or the probability of detection of preamble (Pd), depending on the test case. This value is compared to the required value.

8.8.4 Test case 7.2: reference sensitivity level

Test purpose

To verify that at the BS reference sensitivity level, the throughput requirements are met for a specified reference measurement channel.

The reference sensitivity power level $P_{REFSENS}$ is the minimum mean power received at the BS connector at which a throughput requirement is met for a specified reference measurement channel.

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

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.

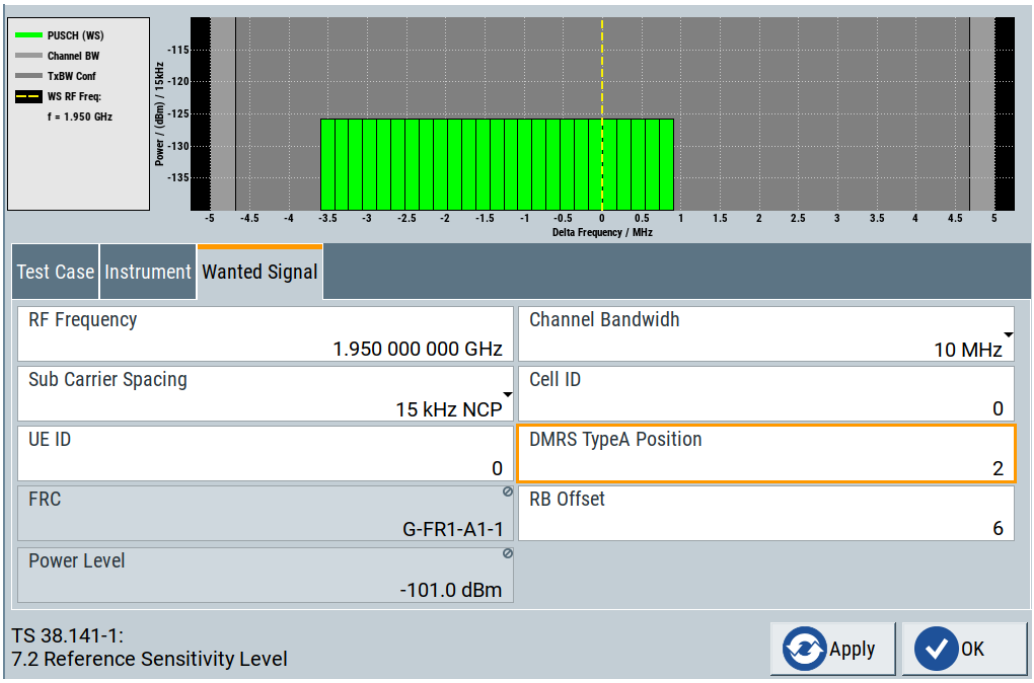
Perform the test on three channels (B, M and T). The selected "Channel Bandwidth" and "Sub Carrier Spacing" determine the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; to adjust the position of the allocated RBs within the selected channel bandwidth, use the parameter "RB Offset".

For the parameter in the following table, the throughput measured must be equal or greater than 95%.

Table 8-10: Reference sensitivity levels

Channel bandwidth in MHz	Subcarrier spacing in kHz	FRC	Base station class	Reference sensitivity power level, $P_{REFSENS}$ in dBm		
				f ≤ 3.0 GHz	3.0 GHz < f ≤ 4.2 GHz	4.2 GHz < f ≤ 6.0 GHz
5, 10, 15	15	G-FR1-A1-1	wide area	-101	-100.7	-100.5
			medium area	-96	-95.7	-95.5
			local area	-93	-92.7	-92.5
10, 15	30	G-FR1-A1-2	wide area	-101.1	-100.8	-100.6
			medium area	-96.1	-95.8	-95.6
			local area	-93.1	-92.8	-92.6

Channel band-width in MHz	Subcar-rier spacing in kHz	FRC	Base station class	Reference sensitivity power level, $P_{REFSENS}$ in dBm		
				f ≤ 3.0 GHz	3.0 GHz < f ≤ 4.2 GHz	4.2 GHz < f ≤ 6.0 GHz
10, 15	60	G-FR1-A1-3	wide area	-98.2	-97.9	-97.7
			medium area	-93.2	-92.9	-92.7
			local area	-90.2	-89.9	-89.7
20, 25, 30, 40, 50	15	G-FR1-A1-4	wide area	-94.6	-94.3	-94.1
			medium area	-89.6	-89.3	-89.1
			local area	-86.6	-86.3	-86.1
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	wide area	-94.9	-94.6	-94.4
			medium area	-89.9	-89.6	-89.4
			local area	-86.9	-86.6	-86.4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	wide area	-95	-94.7	-94.5
			medium area	-90	-89.7	-89.5
			local area	-87	-86.7	-86.5



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

8.8.5 Test case 7.3: dynamic range

Test purpose

To verify that at the BS receiver dynamic range, the relative throughput fulfills the specified limit.

Required options

- See Chapter 8.8.1, "Required options", on page 383.
- Option additive white Gaussian noise AWGN (R&S SMW-K62)

Test setup

See Chapter 8.4.1.1, "Exemplary test setup - one path", on page 346.

Short description

The dynamic range test aims to stress the receiver and measure its capability to demodulate the signal even in the presence of an 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.

Perform the test on three channels (B, M and T). The selected "Channel Bandwidth" and "Sub Carrier Spacing" determine 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 "RB Offset".

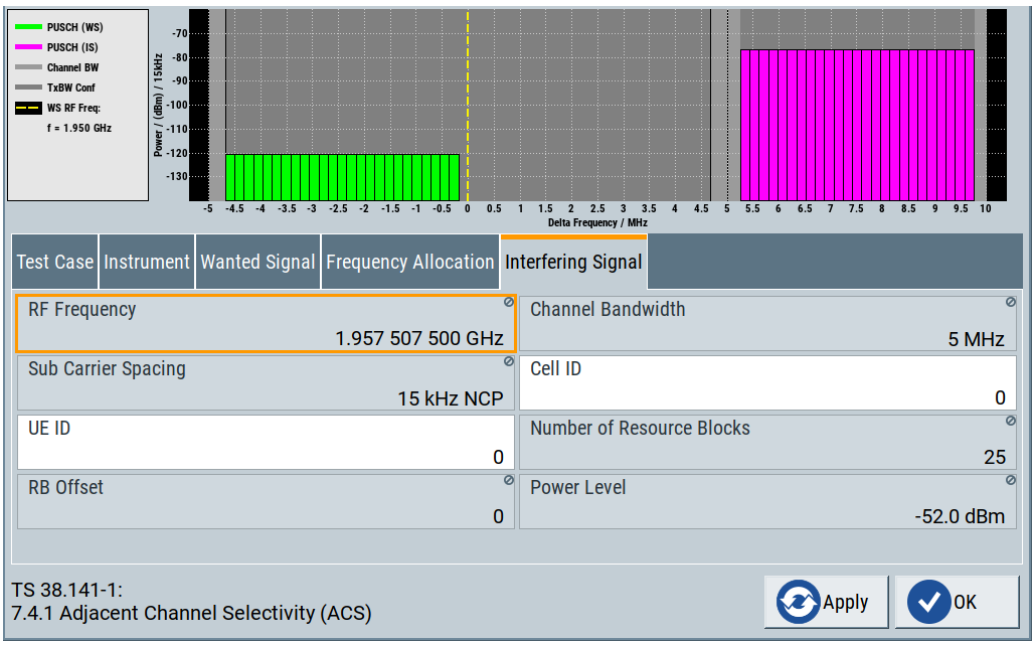
For the parameter in the following table, the throughput must be equal or greater than 95%.

Table 8-11: Dynamic range (NR wide area BS)

Channel bandwidth in MHz	Subcarrier spacing in kHz	Reference measurements channel	Wanted signal: mean power in dBm	Interfering signal: mean power in dBm / BW_{Config}	Type of interfering signal
5	15	G-FR1-A2-1	-70.7	-82.5	AWGN
	30	G-FR1-A2-2	-71.4		
10	15	G-FR1-A2-1	-70.7	-79.3	AWGN
	30	G-FR1-A2-2	-71.4		
	60	G-FR1-A2-3	-68.4		
15	15	G-FR1-A2-1	-70.7	-77.5	AWGN
	30	G-FR1-A2-2	-71.4		
	60	G-FR1-A2-3	-68.4		
20	15	G-FR1-A2-4	-64.5	-76.2	AWGN
	30	G-FR1-A2-5	-64.5		

Channel bandwidth in MHz	Subcarrier spacing in kHz	Reference measurements channel	Wanted signal: mean power in dBm	Interfering signal: mean power in dBm / BW_{Config}	Type of interfering signal
	60	G-FR1-A2-6	-64.8		
25	15	G-FR1-A2-4	-64.5	-75.2	AWGN
	30	G-FR1-A2-5	-64.5		
	60	G-FR1-A2-6	-64.8		
30	15	G-FR1-A2-4	-64.5	-74.4	AWGN
	30	G-FR1-A2-5	-64.5		
	60	G-FR1-A2-6	-64.8		
40	15	G-FR1-A2-4	-64.5	-73.1	AWGN
	30	G-FR1-A2-5	-64.5		
	60	G-FR1-A2-6	-64.8		
50	15	G-FR1-A2-4	-64.5	-72.2	AWGN
	30	G-FR1-A2-5	-64.5		
	60	G-FR1-A2-6	-64.8		
60	30	G-FR1-A2-5	-64.5	-71.4	AWGN
	60	G-FR1-A2-6	-64.8		
70	30	G-FR1-A2-5	-64.5	-70.8	AWGN
	60	G-FR1-A2-6	-64.8		
80	30	G-FR1-A2-5	-64.5	-70.1	AWGN
	60	G-FR1-A2-6	-64.8		
90	30	G-FR1-A2-5	-64.5	-69.9	AWGN
	60	G-FR1-A2-6	-64.8		
100	30	G-FR1-A2-5	-64.5	-69.1	AWGN
	60	G-FR1-A2-6	-64.8		

For the parameters of the other base station classes (NR local area BS and NR medium area BS), refer to 3GPP TS 38.141-1.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

8.8.6 Test case 7.4.1: adjacent channel selectivity (ACS)

Test purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels next to the wanted channel .

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

See Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347.

Short description

The adjacent channel selectivity (ACS) test verifies that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" interfering signal in the adjacent channel.

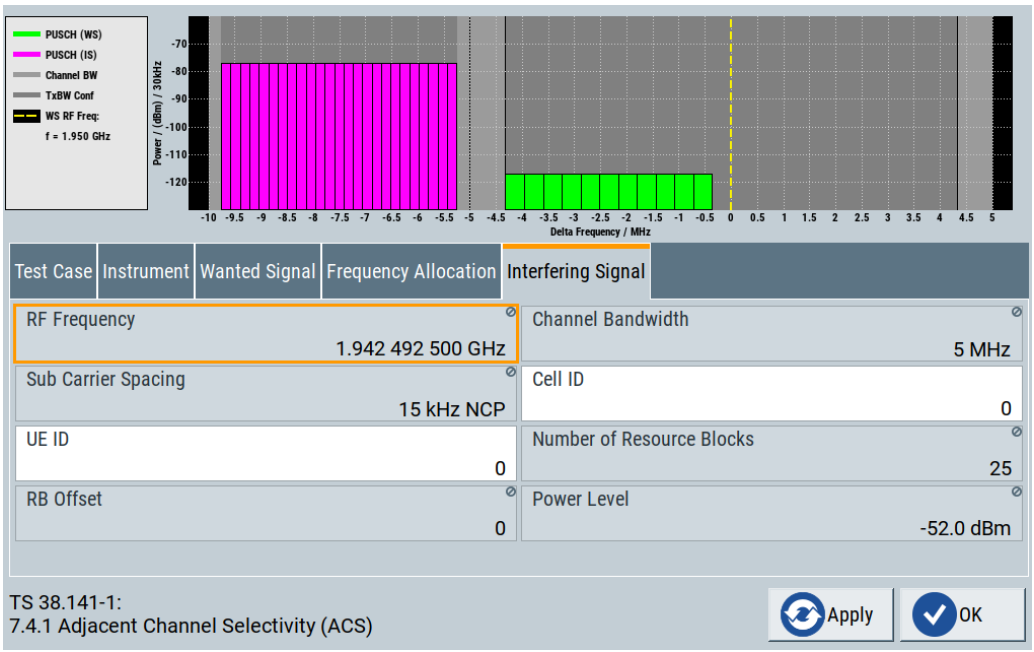
The reference measurement channel for the wanted signal is identified in Table 8-10. The interfering signal is a 5G NR QPSK signal (PUSCH) allocated selectable at higher or lower frequencies (see Figure 8-10). Perform the test on three channels (B, M and T).

For the parameter in the Table 8-12, the throughput has to be equal or greater than 95%.

Table 8-12: Adjacent channel selectivity

Channel bandwidth in MHz	Interfering signal center frequency offset from the lower (upper) edge of the wanted signal in MHz	Type of interfering signal	Interfering signal: mean power in dBm	Wanted signal: mean power in dBm
5	±2.5025	5 MHz 5G NR signal, 15 kHz SCS, 25 RBs	wide area: -52 medium area: -47 local area: -44	$P_{REFSENS}$ + 6 dB
10	±2.5075			
15	±2.5125			
20	±2.5025			
25	±9.4675	20 MHz 5G NR signal, 15 kHz SCS, 100 RBs		
30	±9.4725			
40	±9.4675			
50	±9.4625			
60	±9.4725			
70	±9.4675			
80	±9.4625			
90	±9.4725			
100	±9.4675			

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

8.8.7 Test case 7.4.2A: in-band general blocking

Test purpose

The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

The blocking test using a 5G NR interfering signal can be performed with one instrument, see Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347. This setup can also be used for the CW interfering signal up to 3 GHz or 6 GHz carrier, depending on the installed option. For tests with CW with frequency greater than 6 GHz a second signal generator is necessary, like R&S SMF for instance.

Short description

The blocking characteristics is a test case that verifies the ability of the receiver to demodulate a wanted signal in the presence of a strong interfering signal.

The reference measurement channel for the wanted signal is identified in Table 8-10. The interfering signal is a 5G NR QPSK signal (PUSCH) allocated selectable at higher or lower frequencies (see Figure 8-10).

The test of in-band blocking is performed with an 5G NR interfering signal inside one of the operating bands defined in TS 38.104, table 5.2-1, but not next to the wanted signal.

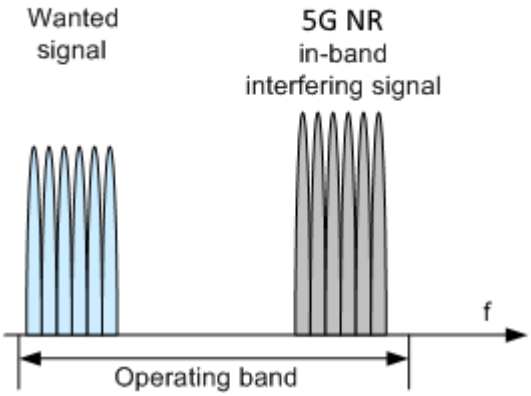


Figure 8-11: Example: Blocking

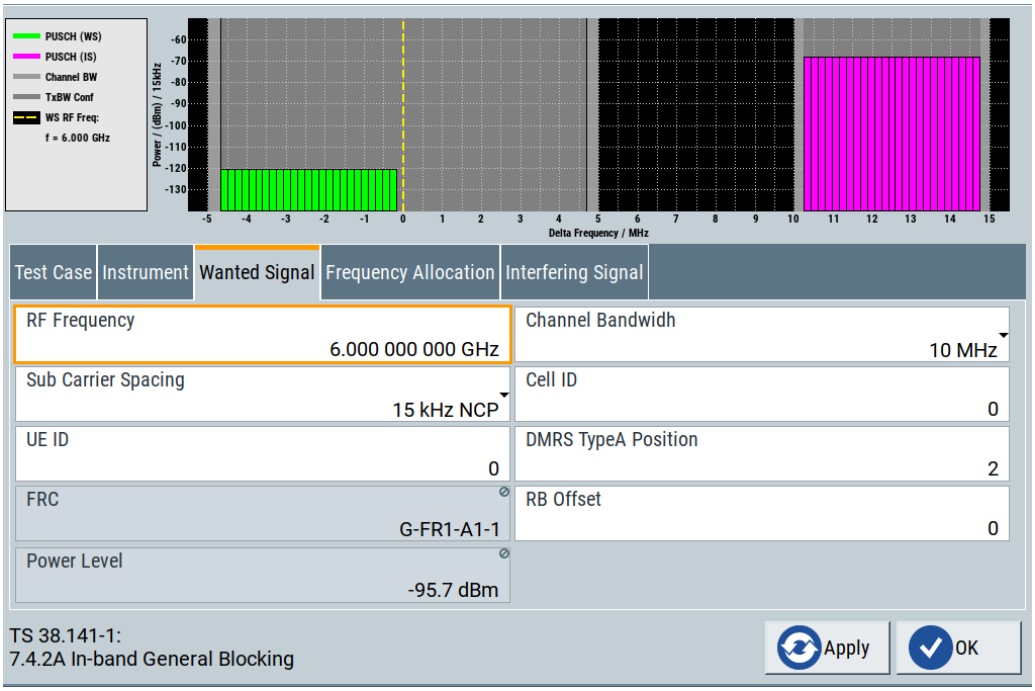
Perform the test on one channel (M).

For the parameter in the following table, the throughput has to be equal or greater than 95%.

Table 8-13: 5G NR interfering signals for in-band general blocking tests

BS channel bandwidth of the lowest/highest received carrier in MHz	Wanted signal: mean power in dBm	Interfering signal: mean power in dBm	Interfering signal center frequency minimum offset to the lower (upper) channel edge of the wanted signal in MHz	Type of interfering signal
5, 10, 15, 20	$P_{REFSENS}$ + 6dB	wide area: -43 medium area: -38 local area: -35	±7.5	5 MHz 5G NR signal, 15 kHz SCS, 25 RBs
25, 30, 40, 50, 60, 70, 80, 90, 100	$P_{REFSENS}$ + 6dB	wide area: -43 medium area: -38 local area: -35	±30	20 MHz 5B NR signal, 15 kHz SCS, 100 RBs

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

8.8.8 Test case 7.4.2B: in-band narrowband blocking

Test purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels next to the wanted channel.

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

See Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347.

Short description

The narrow-band blocking test verifies that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" narrow-band interfering signal in the adjacent channel.

The reference measurement channel for the wanted signal is identified in Table 8-10.

The interfering signal is a single resource block 5G NR signal in a channel with the same bandwidth as the wanted signal. The interfering signal is at a specified center frequency offset and adjacently to the lower (upper) channel edge of the wanted signal (see Figure 8-12).

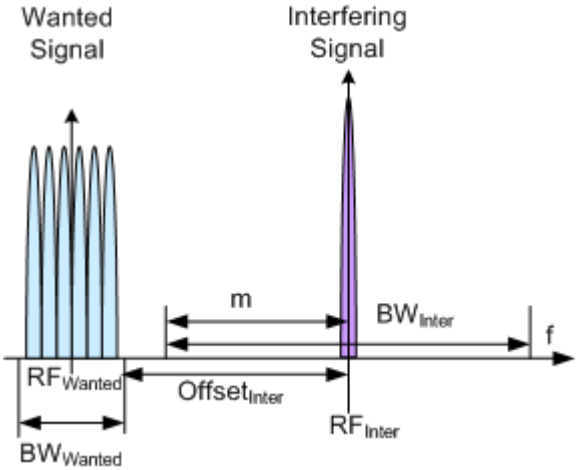


Figure 8-12: Example: Narrow-band blocking

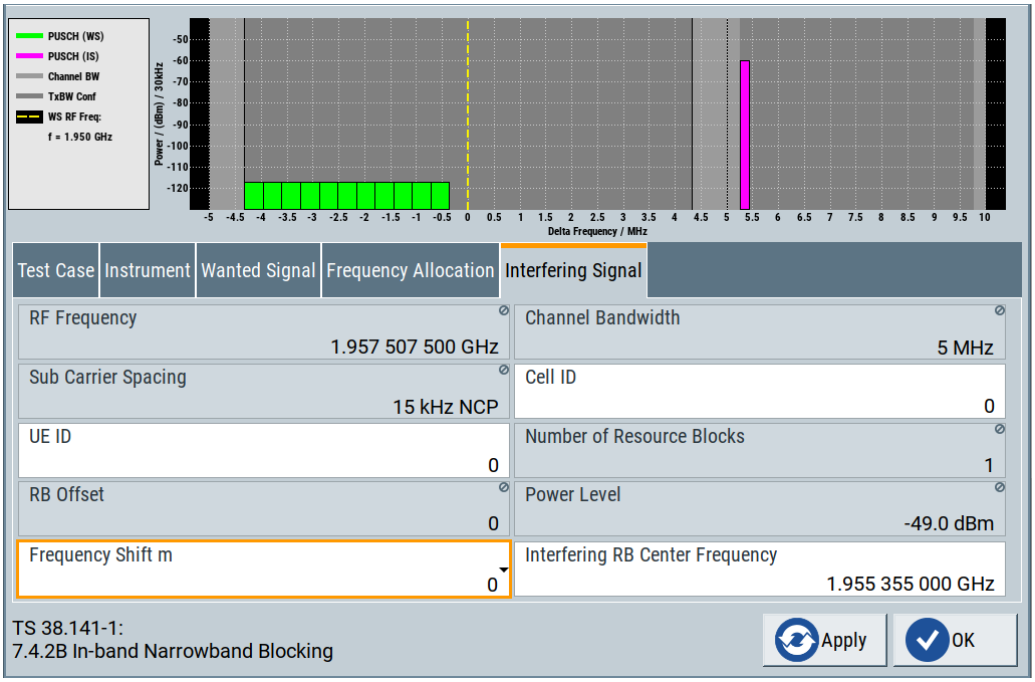
Perform the test on one channel (M).

For the parameter in the following table, the throughput has to be equal or greater than 95%.

Table 8-14: 5G NR interfering signals for in-band narrowband blocking tests

BS channel bandwidth of the lowest/highest received carrier in MHz	Wanted signal: mean power in dBm	Interfering signal: mean power in dBm
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that BS channel bandwidth	$P_{REFSENS}$ + 6dB	wide area: -43 medium area: -38 local area: -35

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

8.8.9 Test case 7.5: out-of-band blocking

Test purpose

The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

The out-of-band blocking test uses a CW interfering signal up to 3 GHz or 6 GHz carrier, depending on the installed option. It can be performed with one instrument, see Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347. For tests with CW with frequency greater than 6 GHz, a second signal generator capable of the frequency is necessary.

Short description

The blocking characteristics is a test case that verifies the ability of the receiver to demodulate a wanted signal in the presence of a strong interfering signal.

The reference measurement channel for the wanted signal is identified in Table 8-10.

Test of out-of-band blocking is performed with a CW interfering signal with 1 MHz up to 12.750 GHz.

There is an additional (optional) blocking requirement for co-location with other base station.

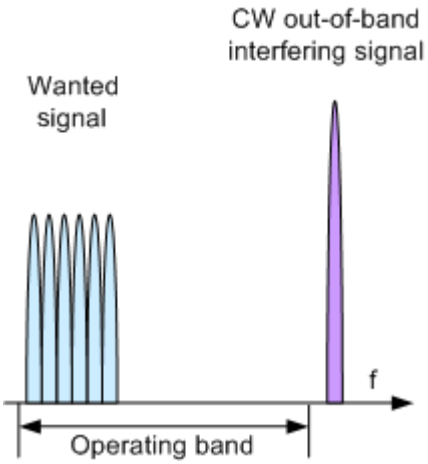


Figure 8-13: Example: Blocking

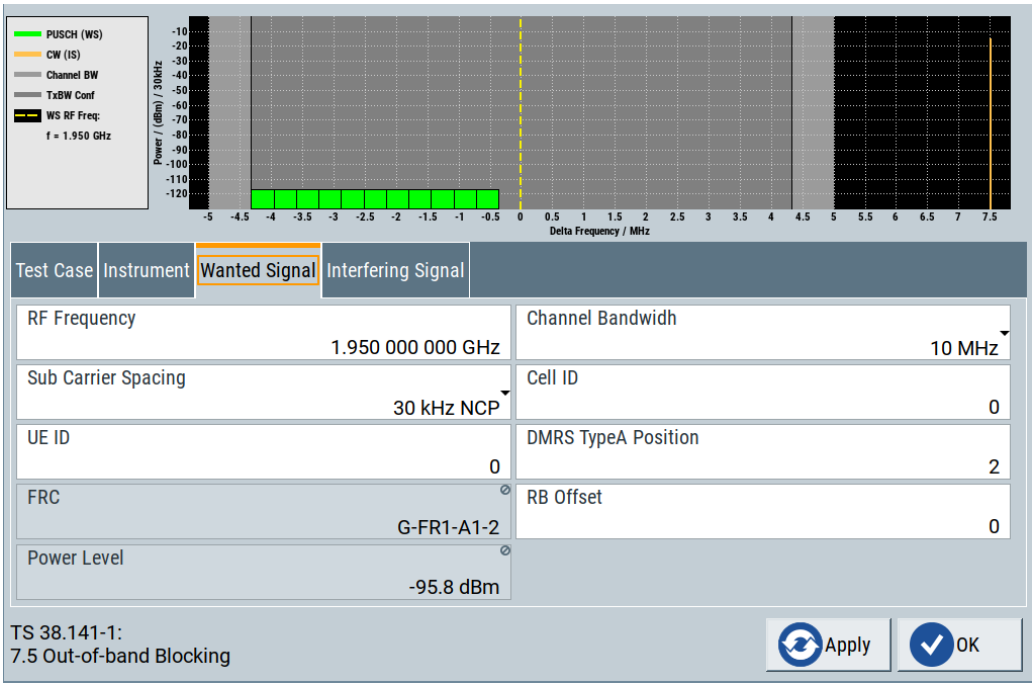
Perform the test on one channel (M).

For the parameter in the following table, the throughput has to be equal or greater than 95%.

Table 8-15: 5G NR interfering signals for blocking performance requirement

Wanted signal: mean power in dBm	Interfering signal: mean power in dBm	Type of interfering signal
$P_{REFSENS}$ + 6dB	-15	CW carrier

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

8.8.10 Test case 7.7: receiver intermodulation

Test purpose

The test verifies the ability of the BS receiver to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high-level interfering signals at frequencies with a specific relationship to the frequency of the wanted signal.

Required options

See Chapter 8.8.1, "Required options", on page 383.

Test setup

See Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347.

Short description

The receiver intermodulation test is a test scenario with two interfering signals, one CW and one 5G NR signal. The center frequency of the interfering signals is selected so that the third and higher order mixing products falls inside the band of the wanted signal. There is also a second narrow-band intermodulation scenario defined. The 5G NR

interfering signal is a narrow-band signal with single resource block allocation and the CW interfering signal is placed very close to the wanted one.

The reference measurement channel for the wanted signal is identified in Table 8-10.

Perform the test on one channel (M).

For the parameter in the Table 8-17, the throughput has to be equal or greater than 95%.

Table 8-16: Intermodulation requirement

Wanted signal: mean power in dBm	Interfering signal: mean power in dBm
$P_{REFSENS}$ + 6dB	wide area: -52 medium area: -47 local area: -44

Table 8-17: Interfering signals for general intermodulation requirement

Channel bandwidth in MHz	Interfering signal center frequency offset from the channel edge of the wanted signal in MHz	Type of interfering signal
5	±7.5	CW
	±17.5	5 MHz 5G NR signal [1)]
10	±7.45	CW
	±17.5	5 MHz 5G NR signal [1)]
15	±7.43	CW
	±17.5	5 MHz 5G NR signal [1)]
20	±7.38	CW
	±17.5	5 MHz 5G NR signal [1)]
25	±7.45	CW
	±25	20 MHz 5G NR signal [2)]
30	±7.43	CW
	±25	20 MHz 5G NR signal [2)]
40	±7.45	CW
	±25	20 MHz 5G NR signal [2)]
50	±7.35	CW
	±25	20 MHz 5G NR signal [2)]
60	±7.49	CW
	±25	20 MHz 5G NR signal [2)]
70	±7.42	CW
	±25	20 MHz 5G NR signal [2)]

Channel bandwidth in MHz	Interfering signal center frequency offset from the channel edge of the wanted signal in MHz	Type of interfering signal
80	±7.44	CW
	±25	20 MHz 5G NR signal [2]
90	±7.43	CW
	±25	20 MHz 5G NR signal [2]
100	±7.45	CW
	±25	20 MHz 5G NR signal [2]

[1] For the 15 kHz subcarrier spacing, the number of RB is 25. For the 30 kHz subcarrier spacing, the number of RB is 10.

[2] For the 15 kHz subcarrier spacing, the number of RB is 100. For the 30 kHz subcarrier spacing, the number of RB is 50. For the 60 kHz subcarrier spacing, the number of RB is 24.

Table 8-18: Interfering signals for narrowband intermodulation requirement in FR1

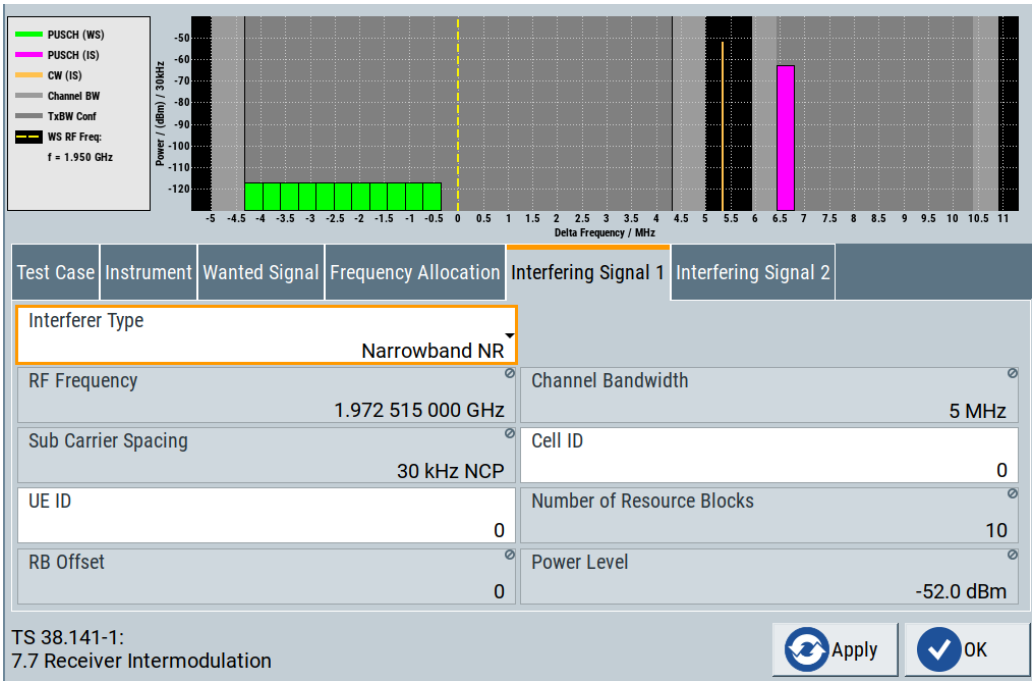
Channel bandwidth in MHz	Interfering signal center frequency offset from the channel edge of the wanted signal in MHz	Type of interfering signal
5	±360	CW
	±1420	5 MHz 5G NR signal [1]
10	±325	CW
	±1780	5 MHz 5G NR signal [1]
15 [2]	±380	CW
	±1600	5 MHz 5G NR signal [1]
20 [2]	±345	CW
	±1780	5 MHz 5G NR signal [1]
25 [2]	±325	CW
	±1990	20 MHz 5G NR signal [1]
30 [2]	±320	CW
	±1990	20 MHz 5G NR signal [2]
40 [2]	±310	CW
	±2710	20 MHz 5G NR signal [1]
50 [2]	±330	CW
	±3250	20 MHz 5G NR signal [1]
60 [2]	±350	CW
	±3790	20 MHz 5G NR signal [1]

Channel bandwidth in MHz	Interfering signal center frequency offset from the channel edge of the wanted signal in MHz	Type of interfering signal
70 [2]	±400	CW
	±4870	20 MHz 5G NR signal [1]
80 [2]	±390	CW
	±4870	20 MHz 5G NR signal [1]
90 [2]	±340	CW
	±5770	20 MHz 5G NR signal [1]
100 [2]	±340	CW
	±5770	20 MHz 5G NR signal [1]

[1] Interfering signal consists of one RB positioned at the stated offset. The bandwidth of the interfering signal is located adjacently to the lower/upper BS RF bandwidth edge or subblock edge inside a subblock gap.

[2] This requirement applies only for a G-FRC mapped to the frequency range at the channel edge next to the interfering signals.

$P_{REFSENS}$ depends on the channel bandwidth and subcarrier spacing. Minimum requirements are specified in TS 38.104, tables 7.2.2-x (see Table 8-9).



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

8.8.11 Test case 7.8: in-channel selectivity

Test purpose

The purpose of this test is to verify the BS receiver ability to suppress the IQ leakage.

Required options

See Table 8-7.

Test setup

See Chapter 8.4.1.1, "Exemplary test setup - one path", on page 346.

For two paths measurements, see Chapter 8.4.1.2, "Exemplary test setup - two paths", on page 347.

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 ha to be an 5G NR signal with the same bandwidth as the wanted signal. The wanted and the interfering signal are allocated adjacently around the center frequency. To swap the position of the wanted and interfering signal, use the parameter "Frequency Allocation".

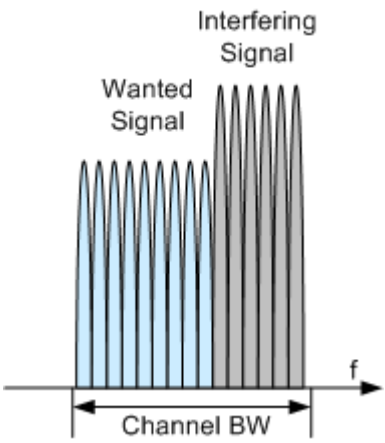


Figure 8-14: Example: In-channel selectivity, frequency allocation = lower frequency

In a one-path instrument, the wanted and the interfering 5G NR 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.

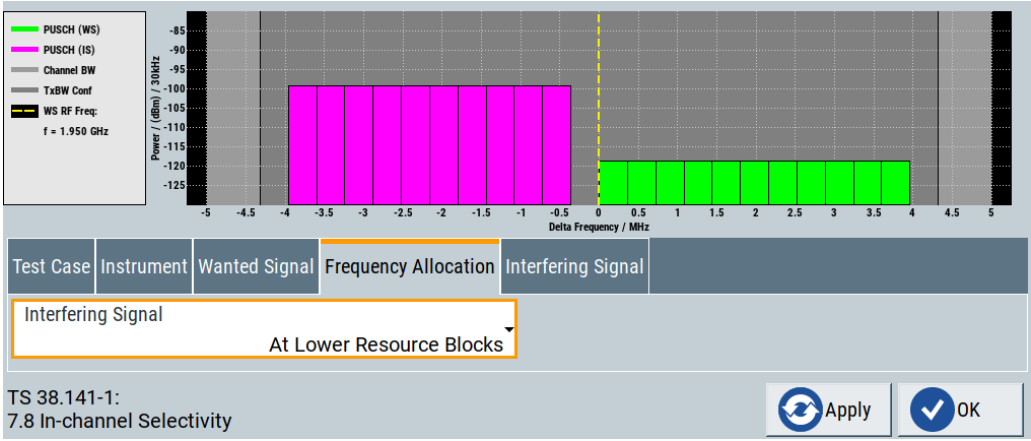
Perform the test on one channel (M).

For the parameter in the following table, the throughput has to be equal or greater than 95%.

Table 8-19: In-channel selectivity (NR wide area BS)

Channel bandwidth in MHz	Subcarrier spacing in kHz	FRC	Wanted signal: mean power in dBm			Interfering signal: mean power in dBm	Type of interfering signal
			f ≤ 3.0 GHz	3.0 GHz < f ≤ 4.2 GHz	4.2 GHz < f ≤ 6.0 GHz		
5	15	G-FR1-A1-7	-99.2	-98.8	-98.5	-81.4	5G NR signal, 15 kHz SCS, 10 RBs
10, 15, 20, 25, 30	15	G-FR1-A1-1	-97.3	-96.9	-96.6	-77.4	5G NR signal, 15 kHz SCS, 25 RBs
40, 50	15	G-FR1-A1-4	-90.9	-90.5	-90.2	-71.4	5G NR signal, 15 kHz SCS, 100 RBs
5	30	G-FR1-A1-8	-99.9	-99.5	-99.2	-81.4	5G NR signal, 30 kHz SCS, 5 RBs
10, 15, 20, 25, 30	30	G-FR1-A1-2	-97.4	-97	.96.7	-78.4	5G NR signal, 30 kHz SCS, 10 RBs
40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-91.2	-90.8	-90.5	-71.4	5G NR signal, 30 kHz SCS, 50 RBs
10, 15, 20, 25, 30	60	G-FR1-A1-9	-96.8	-96.4	-96.1	-78.4	5G NR signal, 60 kHz SCS, 5 RBs
40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-91.3	-90.9	-90.6	-71.6	5G NR signal, 60 kHz SCS, 24 RBs

For the parameters of the other base station classes (NR local area BS and NR medium area BS), refer to 3GPP TS 38.141-1.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

8.9 Conducted performance characteristics (TS 38.141-1, chapter 8)

The wizard supports 3GPP tests TS 38.141-1, chapter 8: Conducted performance characteristics.

Most of the performance tests can be performed with the signal generator only, i.e. without additional measurement equipment.

The performance requirements are divided into the following main categories, intended to:

- Performance requirements for PUSCH:
  - Test case 8.2.1: PUSCH transform precoding disabled
  - Test case 8.2.2: PUSCH transform precoding enabled
  - Test case 8.2.3: UCI multiplexed on PUSCH
  - Test case 8.2.4: Performance requirements for PUSCH for high speed train
  - Test case 8.2.5: Performance requirements for UL timing adjustment
  - Test case 8.2.6: Performance requirements for PUSCH with 0.001% BLER
  - Test case 8.2.7: Performance requirements for PUSCH repetition type A
  - Test case 8.2.8: Performance requirements for PUSCH Mapping type B with non-slot transmission
  - Test case 8.2.9: Performance requirements for PUSCH msgA for 2-step RA type
  - Test case 8.2.10: Performance requirements for interlaced PUSCH

  - Test case 8.2.11: Performance requirements for CG-UCI on interlaced PUSCH
- Performance requirements for PUCCH:
  - Test case 8.3.1: performance requirements for PUCCH format 0
  - Test case 8.3.2.1: NACK to ACK detection for PUCCH format 1
  - Test case 8.3.2.2: ACK missed detection for PUCCH format 1
  - Test case 8.3.3.1: ACK missed detection for PUCCH format 2
  - Test case 8.3.3.2: UCI BLER for PUCCH format 2
  - Test case 8.3.4: performance requirements for PUCCH format 3
  - Test case 8.3.5: performance requirements for PUCCH format 4
  - Test case 8.3.6.1A: NACK to ACK detection for multi-slot PUCCH format 1
  - Test case 8.3.6.1B: ACK missed detection for multi-slot PUCCH format 1
  - Test case 8.3.7: Performance requirements for interlaced PUCCH format 0
  - Test case 8.3.8.1: NACK to ACK detection for interlaced PUCCH format 1
  - Test case 8.3.8.2: ACK missed detection for interlaced PUCCH format 1
  - Test case 8.3.9: Performance requirements for interlaced PUCCH format 2
  - Test case 8.3.10: Performance requirements for interlaced PUCCH format 3
- Performance requirements for PRACH:
  - Test case 8.4.1: PRACH false alarm probability and missed detection

8.9.1 General

Conducted performance requirements specify the ability of the base station to demodulate signals in various conditions and configurations. Conducted performance requirements are specified at the antenna connectors (for BS type 1-C) and at the TAB connectors (for BS type 1-H).

Conducted performance requirements for the base stations are specified for the fixed reference channels and the propagation conditions defined in TS 38.141-1 annex A and annex H. The requirements only apply to those FRCs that are supported by the base station.

Performance requirements apply for a single carrier only, unless stated differently by the test case. Performance requirements for a base station supporting carrier aggregation are defined in terms of single carrier requirements.

For FDD operation, the requirements of TS 38.141-1 must be met with the transmitter units associated with antenna connectors (for BS type 1-C) or TAB connectors (for BS type 1-H) in the operating band turned ON.

8.9.2 General workflow for carrying out a performance 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 base station according to the corresponding test case setup.
   See also Chapter 8.4, "Exemplary test setups", on page 346.
2. Set the base station to the basic state:
   a) Initialize the base station.
   b) Set the frequency.
3. Preset the signal generator to ensure a defined instrument state.
4. Configure the test case wizard.
   a) Select "Baseband Block > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-1: "8.2.2 PUSCH Transform Precoding Disabled".
   c) Enter additional required parameters, e.g. base station class.
   d) Enter the test frequency of the wanted signal.
      The setting must match with the base station configuration.
   e) Select "Apply Settings" to activate the settings.

   The signal generator is now ready.
5. Switch on RF output.
6. If necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
   See also Chapter 8.5, "General considerations", on page 350.
7. Start the measurement.
   a) Send a start trigger impulse from the base station to the signal generator.

   The signal generator starts signal generation.
8. Calculate the results.

   The base station internally calculates the BER, BLER. or the probability of detection of preamble (Pd), depending on the test case. This value is compared to the required value.

8.9.3 Test case 8.2.1: PUSCH transform precoding disabled

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.1

Required options

Table 8-20: Required options for 8.2.1 PUSCH Transform Precoding Disabled

		1 Tx, 2 Rx	1 Tx, 4 Rx[1]	1 Tx, 8 Rx[2]	2 Tx, 2 Rx	2 Tx, 4 Rx[1]	2 Tx, 8 Rx[2]
RF path A	B100x	1	1	1	1	1	1
RF path B	B200x	1	1	1	1	1	1
BB generator	B9 / B10	1	2	2	2	2	2
Fading simulator	B14 / B15	2	4	4	2	4	4
AWGN	K62	2	2	2	2	2	2
Dyn. fading	K71						
MIMO fading	K74		1	1	1	1	1
5G NR	K144	1	1	1	2	2	2
Cl. loop	K145	1	1	1	2	2	2
5G NR Rel. 16	K148						
5G NR Rel. 17	K171						

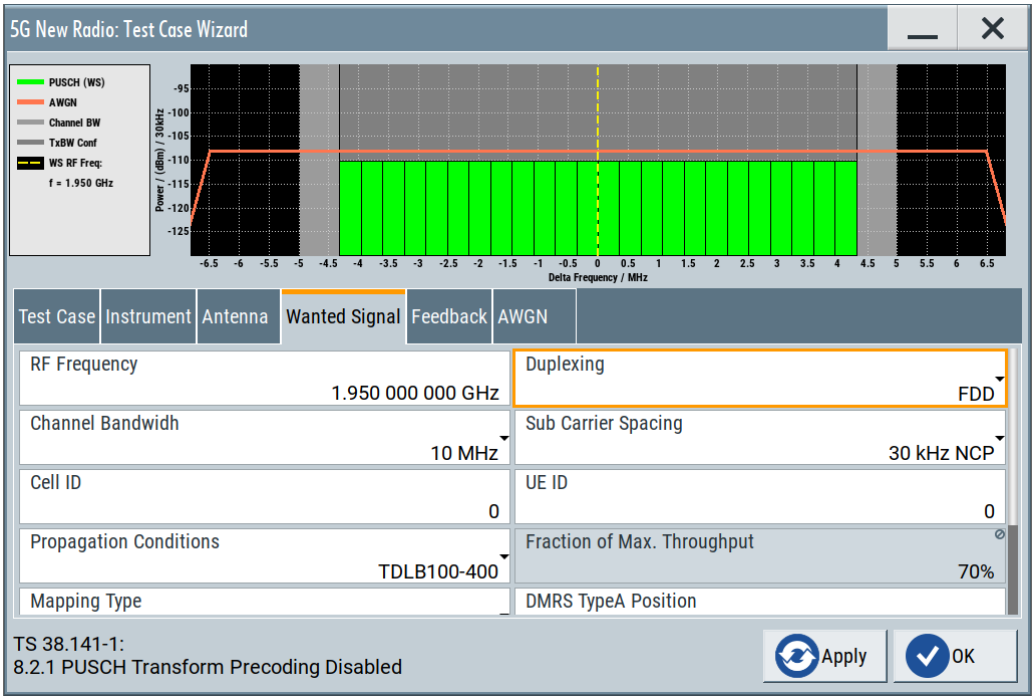
Note:
[1]Additional 2 Rx antenna with 6 SGT + 2 x SMWK19
[2]Additional 6 Rx antenna with 6 SGT + 2 x SMWK19

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1:The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. [...] The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.4 Test case 8.2.2: PUSCH transform precoding enabled

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.2

Required options

Table 8-21: Required options for 8.2.2 PUSCH Transform Precoding Enabled

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2

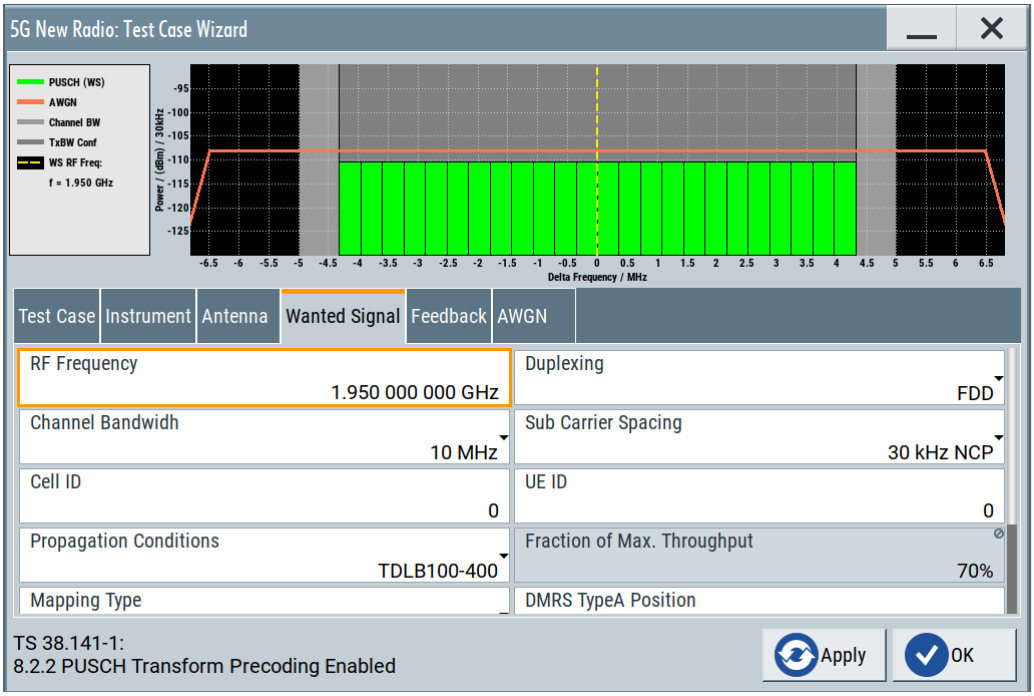
Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. [...] The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358

- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.5 Test case 8.2.3: UCI multiplexed on PUSCH

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI with CSI part 1 and CSI part 2 bits multiplexed on PUSCH under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.3

Required options

Table 8-22: Required options for 8.2.3 UCI multiplexed on PUSCH

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

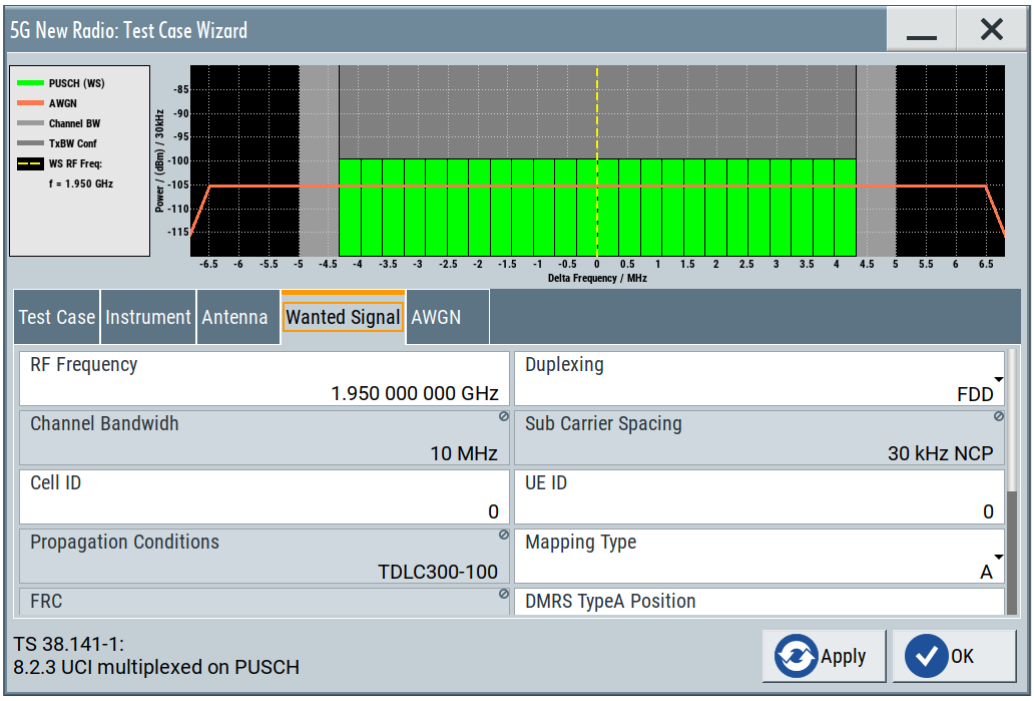
Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of UCI multiplexed on PUSCH is determined by two parameters: block error probability (BLER) of CSI part 1 and block error probability of CSI part 2. The performance is measured by the required SNR at block error probability of CSI part 1 not exceeding 0.1 %, and the required SNR at block error probability of CSI part 2 not exceeding 1 %.

Definitions and specifications for CSI part 1 and CSI part 2 are described in detail in 3GPP 38.141-1, chapter 8.2.3.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.6 Test case 8.2.4: Performance requirements for PUSCH for high speed train

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under high speed train conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.4

Required options

Table 8-23: Required options for 8.2.4 Performance requirements for PUSCH for high speed train

		1 Tx, 1 Rx	1 Tx, 2 Rx[1]	1 Tx, 8 Rx[2]
RF path A	B100x	1	1	1
RF path B	B200x		1	1
BB generator	B9 / B10	1	1	1
Fading simulator	B14 / B15	1	2	4
AWGN	K62	1	2	2
Dyn. fading	K71	1	2	2
MIMO fading	K74		1	1
5G NR	K144	1	1	1
Cl. loop	K145	1	1	1
5G NR Rel. 16	K148	1	1	1
5G NR Rel. 17	K171			

Note:
[1]Additional 2 Rx antenn a with 2 SGT + 2 x SMWK19
[2]Additional 6 Rx antenna with 6 SGT + 2 x SMWK19

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for selected FRCs. The performance requirements assume HARQ re-transmissions. The performance requirements for high speed train conditions are optional.

For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.7 Test case 8.2.5: Performance requirements for UL timing adjustment

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput measured for the moving UE at given SNR under moving propagation conditions.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.5

Required options

Table 8-24: Required options for 8.2.5 requirements for UL timing adjustment

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	2
MIMO fading	K74	1
5G NR	K144	2
Cl. loop	K145	2
5G NR Rel. 16	K148	2
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of UL timing adjustment is determined by a minimum required throughput measured for the moving UE at given SNR. The performance requirements assume HARQ retransmissions. In the tests for UL timing adjustment, two signals are configured, one being transmitted by a moving UE and the other being transmitted by a stationary UE. The transmission of SRS from UE is optional. FRC parameters are applied for both UEs. The received power for both UEs is the same. The resource blocks allocated for both UEs are consecutive.

For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.9, "Moving UE settings", on page 372
- Chapter 8.6.10, "Stationary UE settings", on page 374
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.8 Test case 8.2.6: Performance requirements for PUSCH with 0.001% BLER

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve 0.001% BLER under AWGN conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.6

Required options

Table 8-25: Required options for 8.2.6 requirements for PUSCH with 0.001% BLER

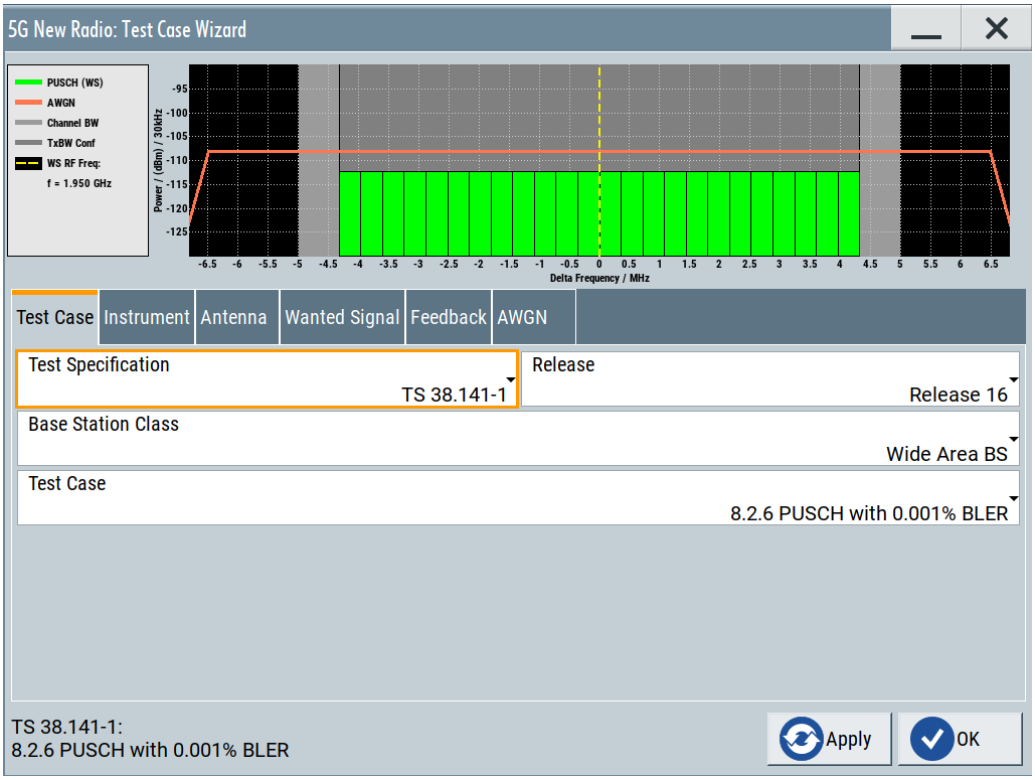
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH is determined by a maximum required transport block error rate (BLER) for a given SNR. The required BLER is defined as the probability of incorrectly decoding the transport block after reaching the maximum number of HARQ transmissions for selected FRCs.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.9 Test case 8.2.7: Performance requirements for PUSCH repetition type A

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve 1% BLER with PUSCH repetition Type A under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.7

Required options

Table 8-26: Required options for 8.2.7 Performance requirements for PUSCH repetition Type A

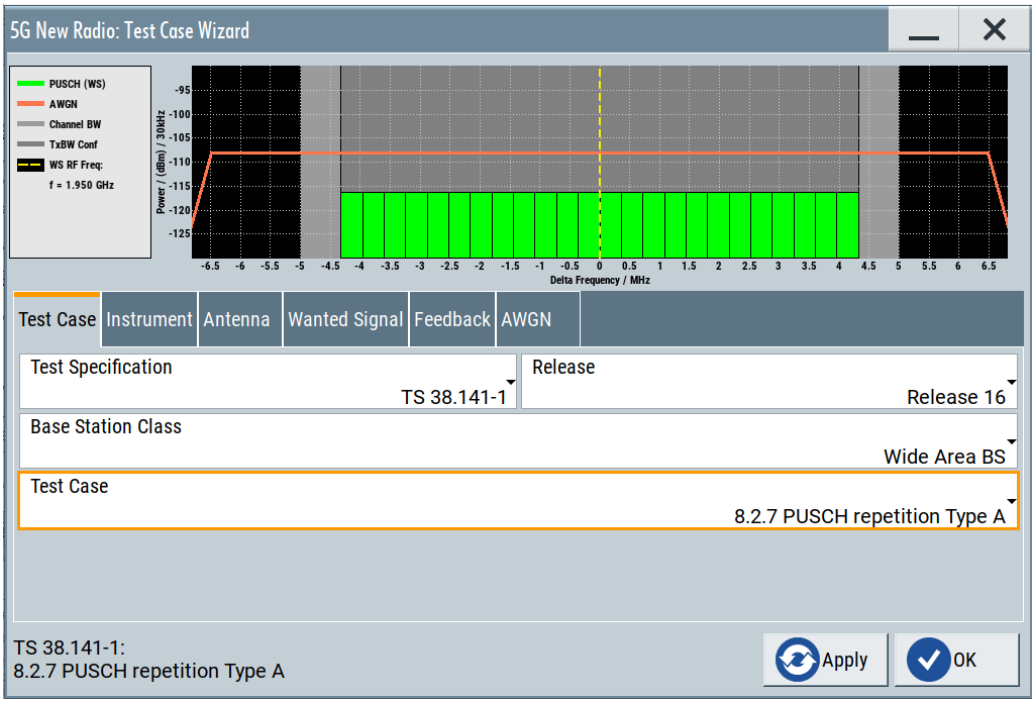
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH with slot aggregation factor configured is determined by a maximum target BLER for a given SNR. The required BLER is defined as the probability of incorrectly decoding the PUSCH information when the PUSCH information is sent for specific FRCs. The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.10 Test case 8.2.8: Performance requirements for PUSCH Mapping type B with non-slot transmission

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput for PUSCH mapping Type B with 2 symbol length allocated in time domain under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.8

Required options

Table 8-27: Required options for 8.2.8 Performance requirements for PUSCH Mapping Type B with nonslot transmission

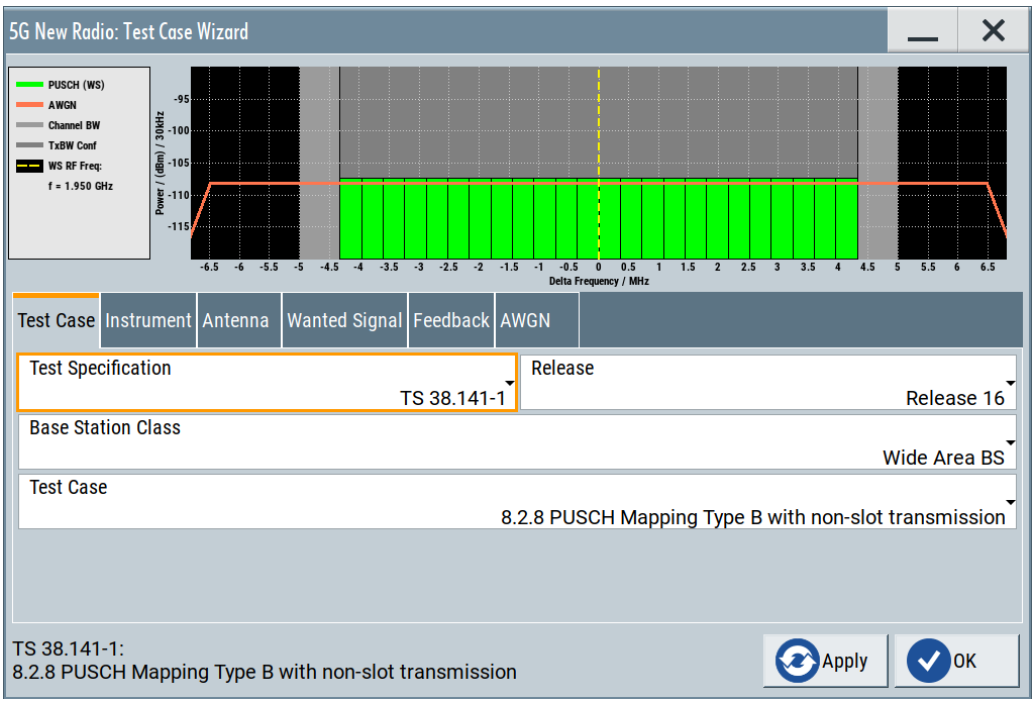
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH mapping Type B is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for selected FRCs.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.11 Test case 8.2.9: Performance requirements for PUSCH msgA for 2-step RA type

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve maximum BLER for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.9

Required options

Table 8-28: Required options for 8.2.9 Performance requirements for PUSCH msgA for 2- step RA type

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of MsgA PUSCH is determined by a minimum required block error rate of MsgA received by BS at given SNR for selected FRCs. The performance requirements assume that the precedent preamble of MsgA is correctly detected. The performance requirements assume no HARQ retransmission.

These requirements are applicable for wide area and medium range BS that support 2-step RA type. The requirements are not applied for a local area BS that supports 2-step RA type.

For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.12 Test case 8.2.10: Performance requirements for interlaced PUSCH

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.10.

Required options

Table 8-29: Required options for 8.2.10 Performance requirements for interlaced PUSCH

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

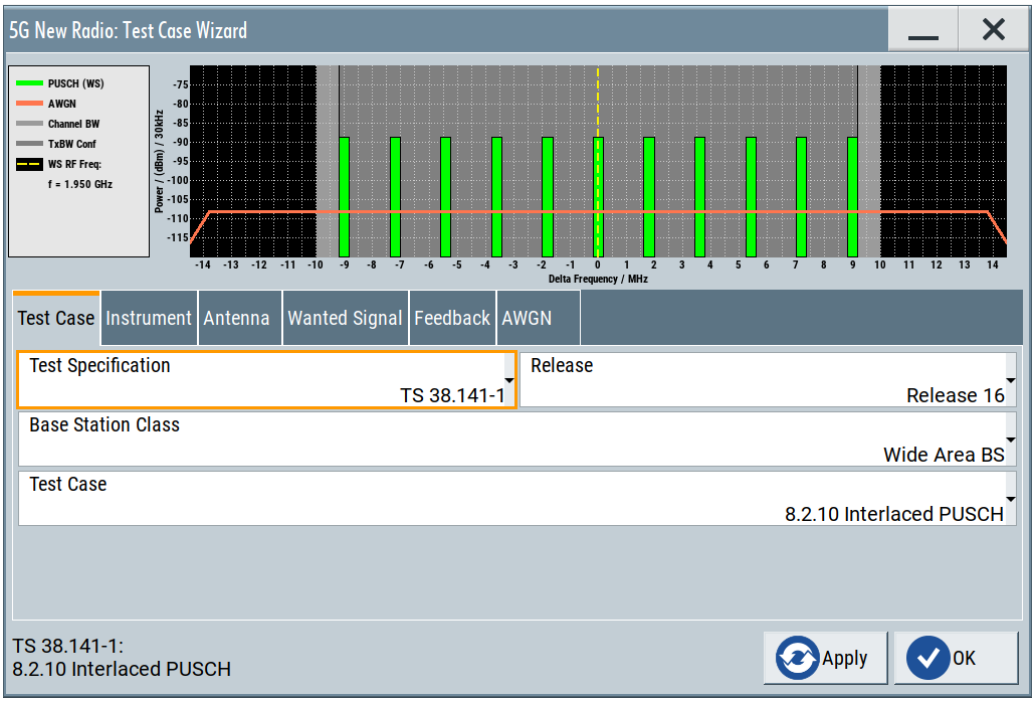
		1 Tx, 2 Rx
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH with interlace allocation is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361

- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.13 Test case 8.2.11: Performance requirements for CG-UCI on interlaced PUSCH

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect CG-UCI multiplexed on interlaced PUSCH under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.11.

Required options

Table 8-30: Required options for 8.2.11 Performance requirements for CG-UCI on interlaced PUSCH

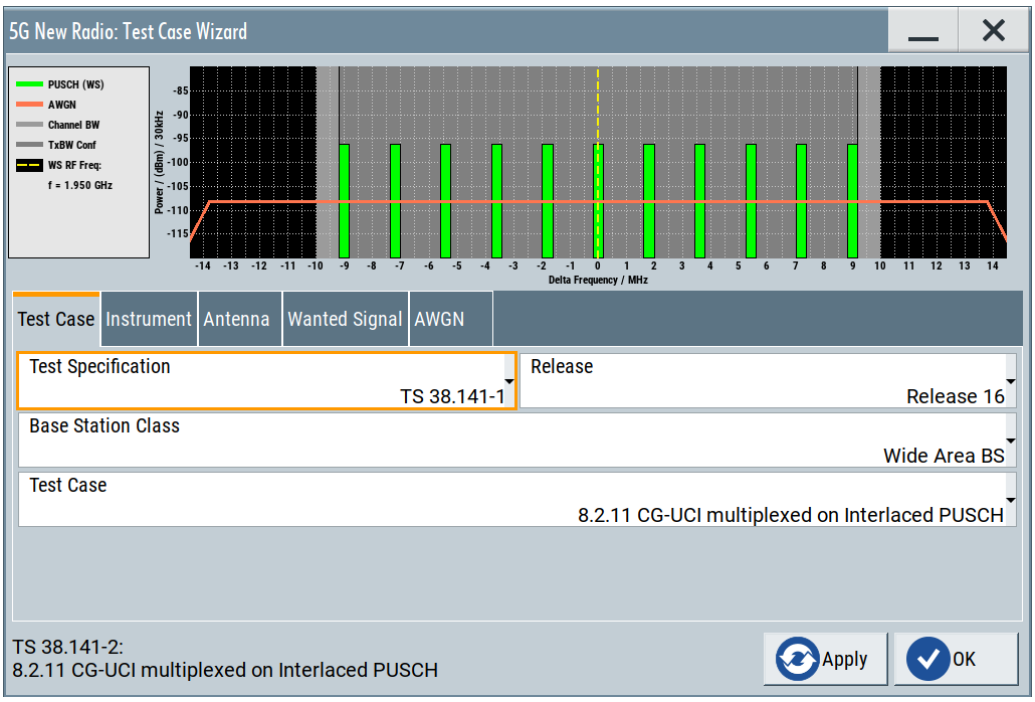
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of CG-UCI multiplexed on interlaced PUSCH is determined by the parameter: block error probability (BLER) of CG-UCI. The performance is measured by the required SNR at block error probability of CG-UCI not exceeding 1 %.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.14 Test case 8.2.12: Performance requirements for TB processing over multi-slot PUSCH (TBoMS)

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.12.

Required options

Table 8-31: Required options for 8.2.12 Performance requirements for TB processing over multi-slot PUSCH (TBoMS)

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1

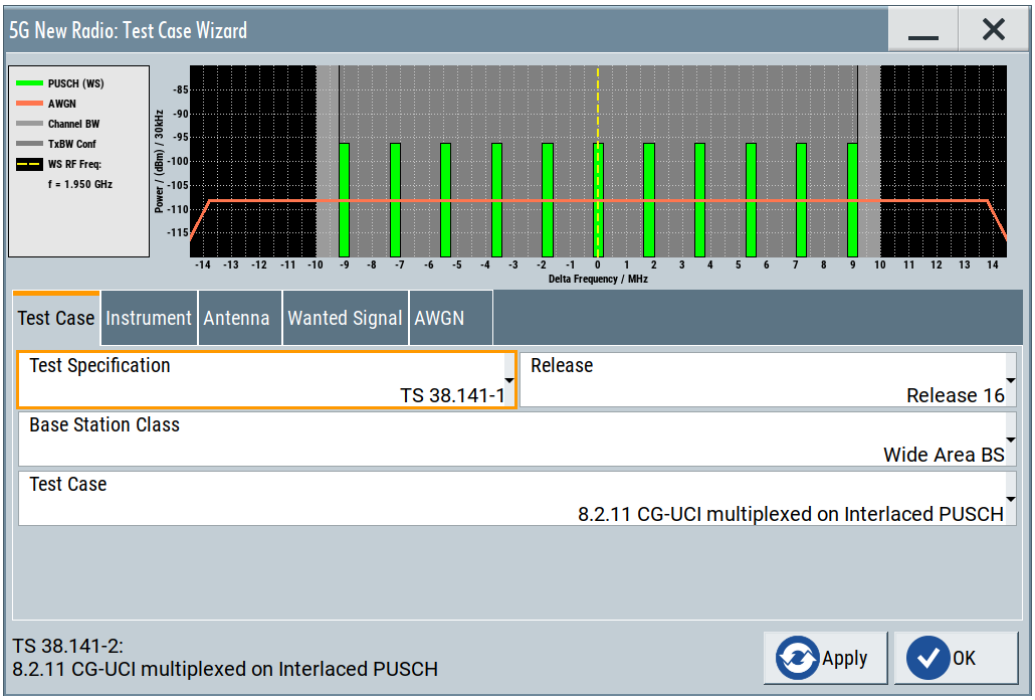
		1 Tx, 2 Rx
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH with DMRS bundling is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358

- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.15 Test case 8.2.13: Performance requirements for PUSCH with DMRS bundling

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR with DMRS bundling.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.2.13.

Required options

Table 8-32: Required options for 8.2.13 Performance requirements for PUSCH with DMRS bundling

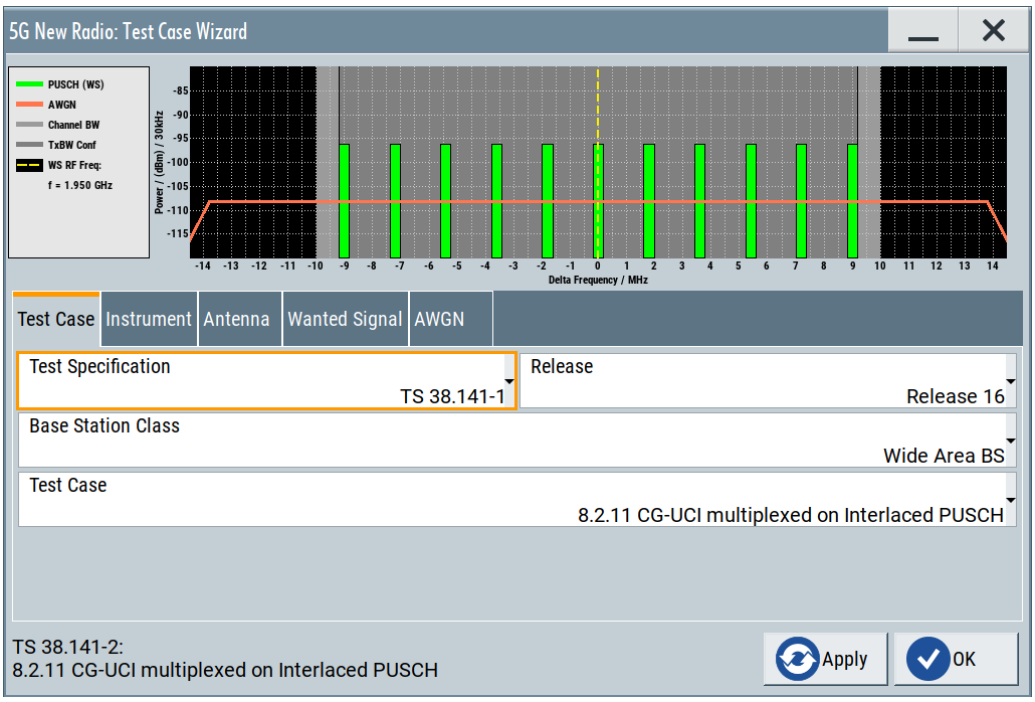
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUSCH TBoMS is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.16 Test case 8.3.1: performance requirements for PUCCH format 0

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.1

Required options

Table 8-33: Required options for 8.3.1 Performance requirements for PUCCH Format 0

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2

Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

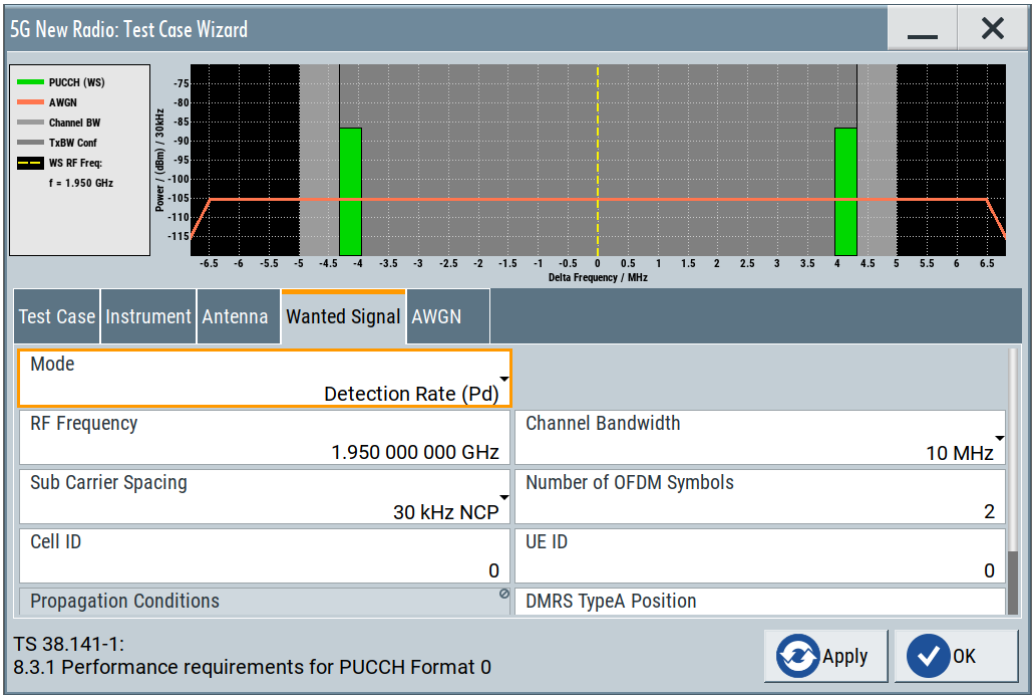
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of single user PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.17 Test case 8.3.2.1: NACK to ACK detection for PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.2.1.

Required options

Table 8-34: Required options for 8.3.2.1 NACK to ACK Detection for PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	4

AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT require d for 4/8 Rx		

Test setup

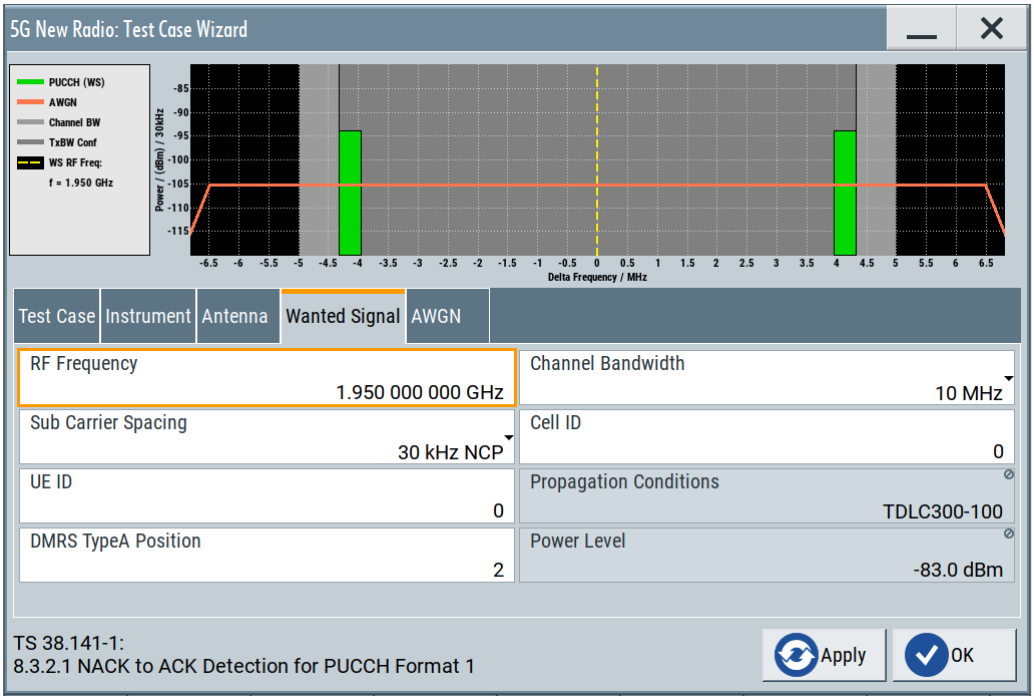
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK at particular bit position when input is only noise. Each false bit detection is counted as one error.

The NACK to ACK detection probability is the probability of detecting an ACK bit when an NACK bit was sent on particular bit position. Each NACK bit erroneously detected as ACK bit is counted as one error. Erroneously detected NACK bits in the definition do not contain the NACK bits which are mapped from DTX, i.e. NACK bits received when DTX is sent should not be considered.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.18 Test case 8.3.2.2: ACK missed detection for PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.2.2.

Required options

Table 8-35: Required options for 8.3.2.2 ACK Missed Detection for PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2

Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT require d for 4/8 Rx		

Test setup

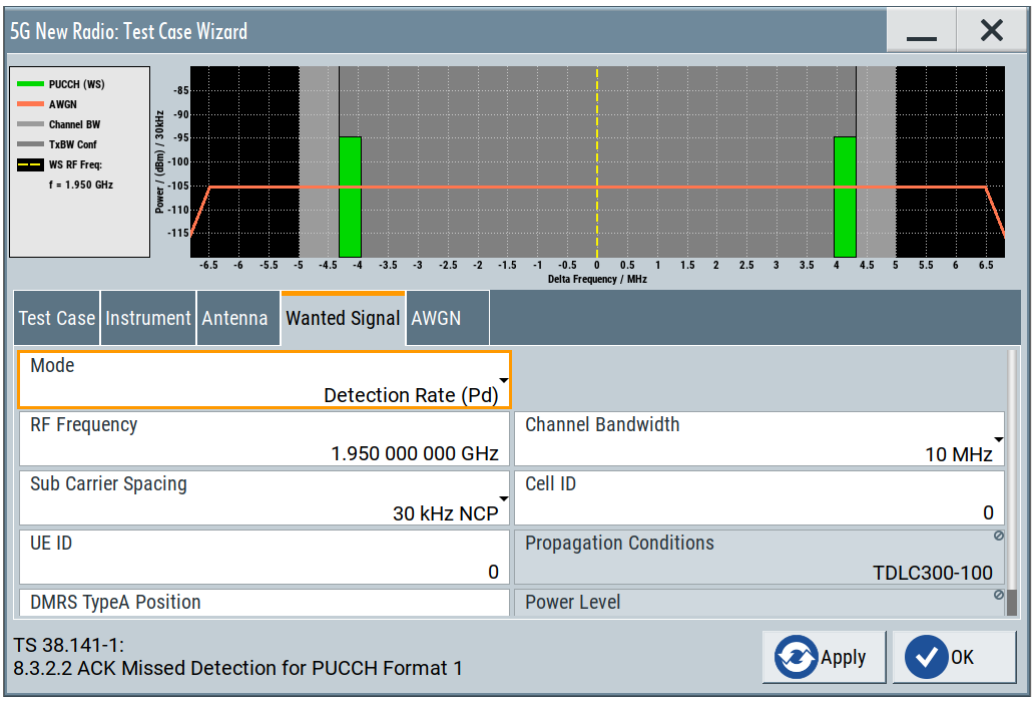
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.19 Test case 8.3.3.1: ACK missed detection for PUCCH format 2

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.3.1.

Required options

Table 8-36: Required options for 8.3.3.1 ACK Missed Detection for PUCCH Format 2

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2

Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

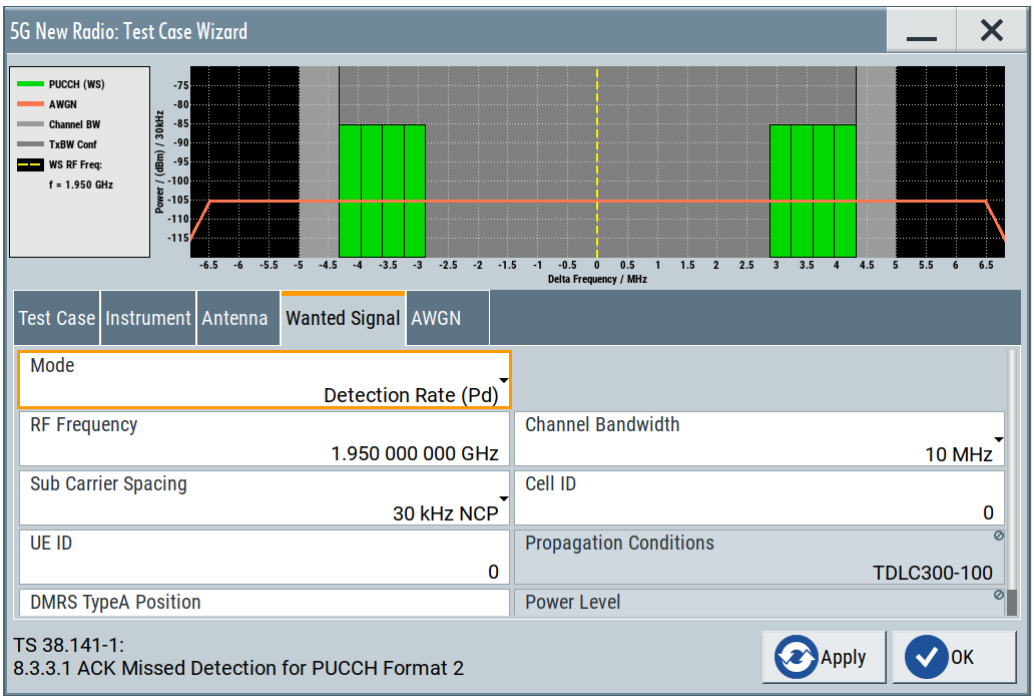
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUCCH format 2 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.20 Test case 8.3.3.2: UCI BLER for PUCCH format 2

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.3.2

Required options

Table 8-37: Required options for 8.3.3.2 UCI BLER for PUCCH Format 2

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	4

AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

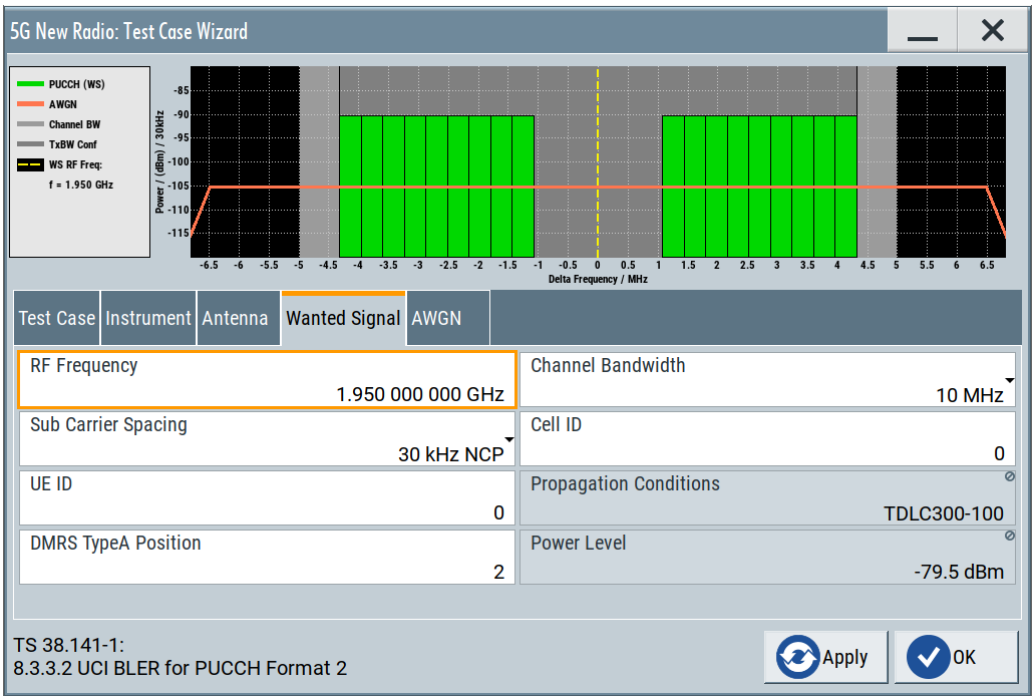
Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355

- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.21 Test case 8.3.4: performance requirements for PUCCH format 3

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.4.

Required options

Table 8-38: Required options for 8.3.4 Performance requirements for PUCCH Format 3

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT require d for 4/8 Rx		

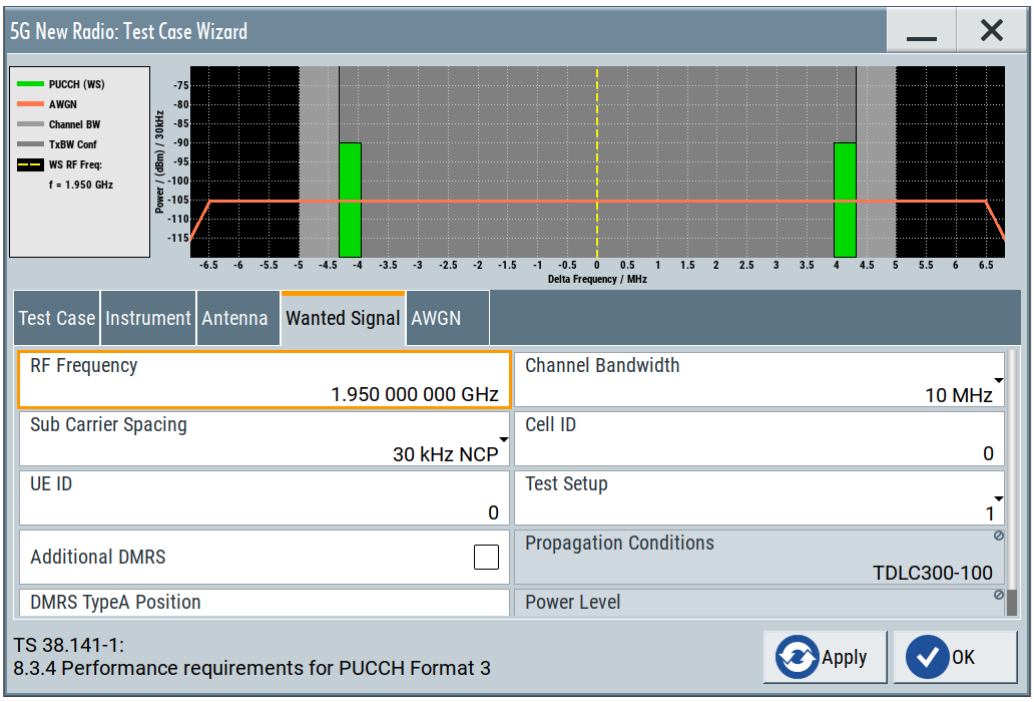
Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.22 Test case 8.3.5: performance requirements for PUCCH format 4

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.5

Required options

Table 8-39: Required options for 8.3.5 Performance requirements for PUCCH Format 4

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT require d for 4/8 Rx		

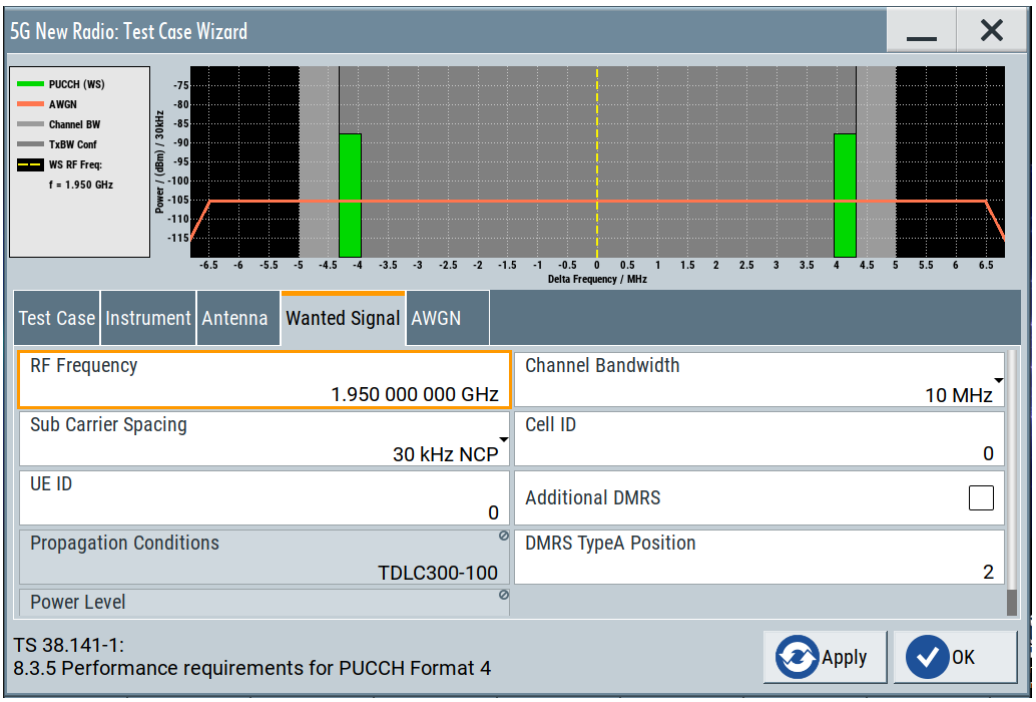
Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.23 Test case 8.3.6.1A: NACK to ACK detection for multi-slot PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.6.1.1

Required options

Table 8-40: Required options for 8.3.6.1A NACK to ACK Detection for Multi-Slot PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

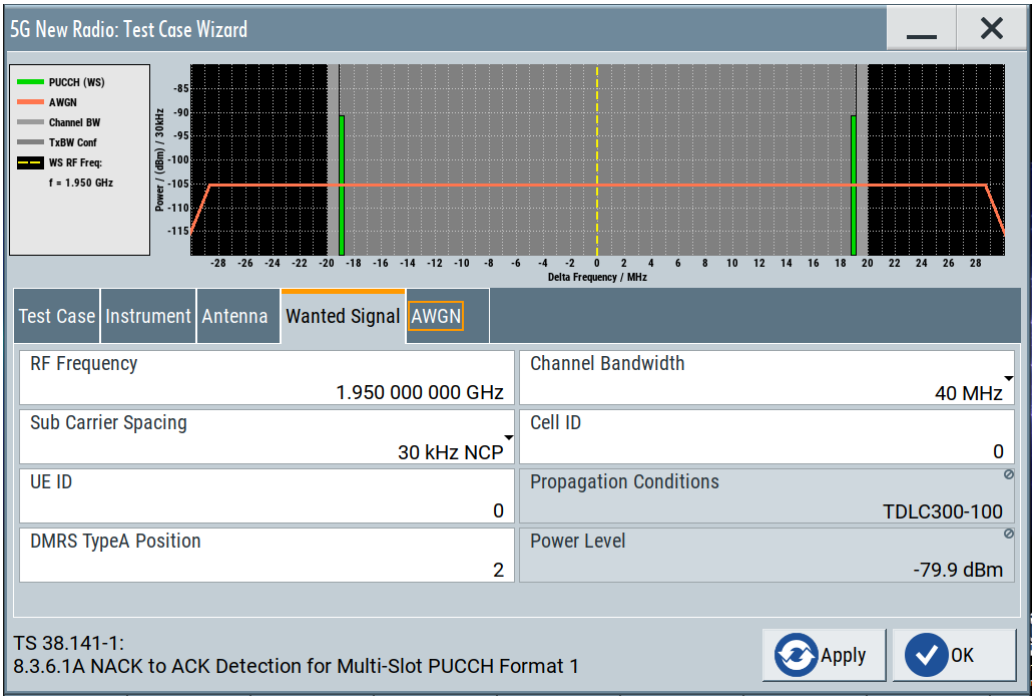
Short description

From 3GPP 38-141-1: The performance requirement of single user interlaced PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 0 with 1 UCI bits. The UCI information only contrains ACK information.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.24 Test case 8.3.6.1B: ACK missed detection for multi-slot PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.6.1.2

Required options

Table 8-41: Required options for 8.3.6.1B ACK Missed Detection for Multi-Slot PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

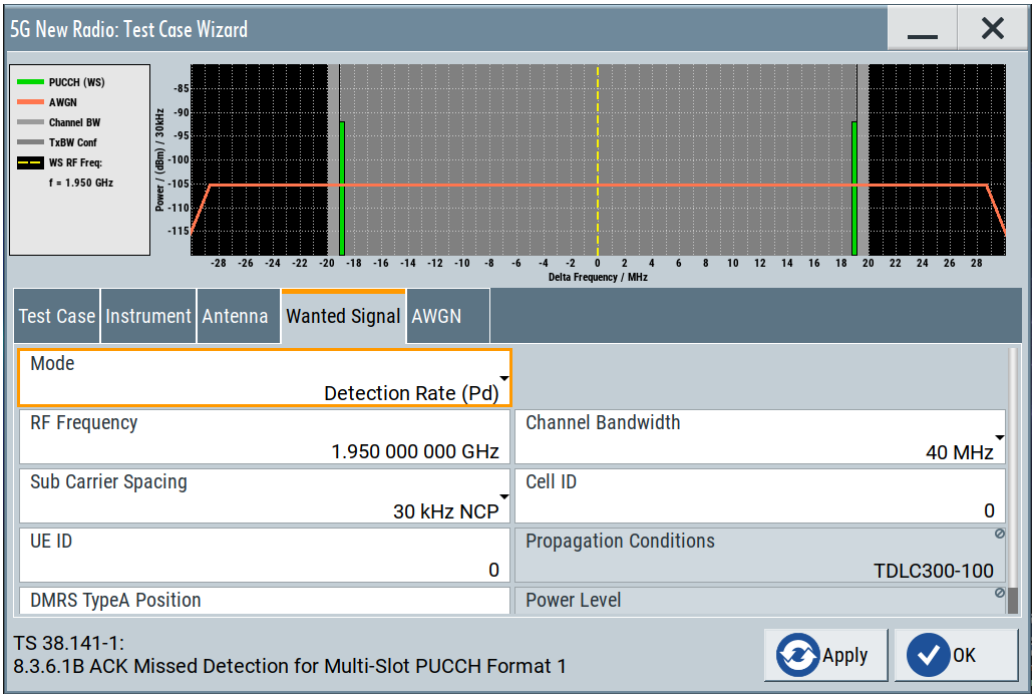
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38-141-1: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.25 Test case 8.3.7: Performance requirements for interlaced PUCCH format 0

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.7.

Required options

Table 8-42: Required options for 8.3.7: Performance requirements for interlaced PUCCH format 0

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

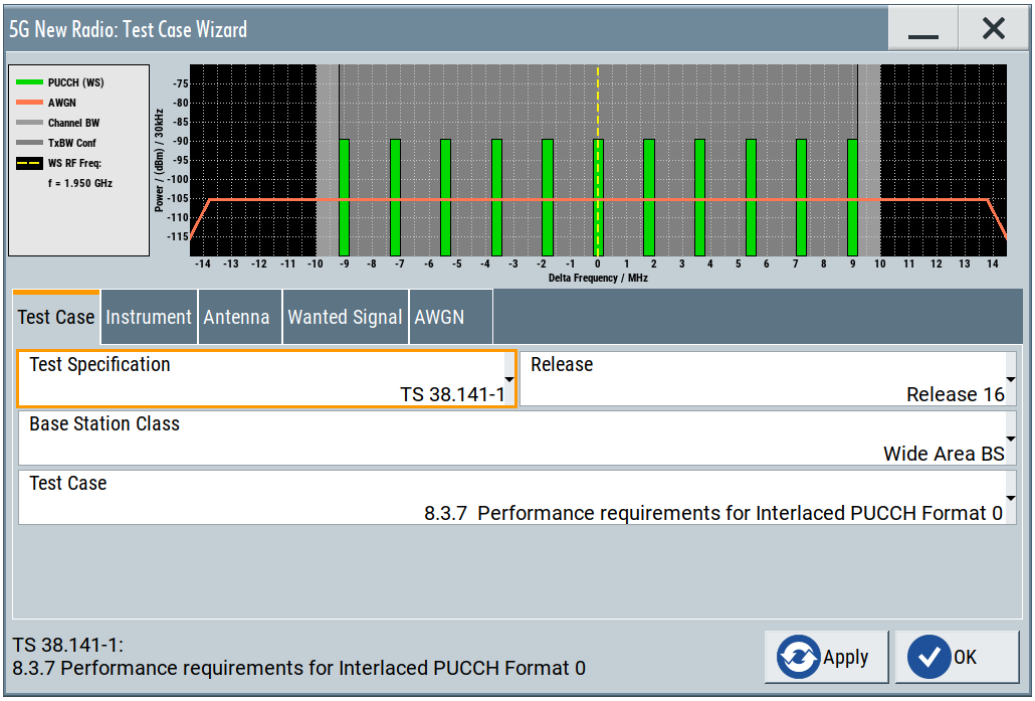
From 3GPP 38.141-1: The performance requirement of single user interlaced PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is

measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 0 with 1 UCI bits. The UCI information only contrains ACK information.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.26 Test case 8.3.8.1: NACK to ACK detection for interlaced PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.8.1

Required options

Table 8-43: Required options for 8.3.8.1 NACK to ACK detection for interlaced PUCCH format 1

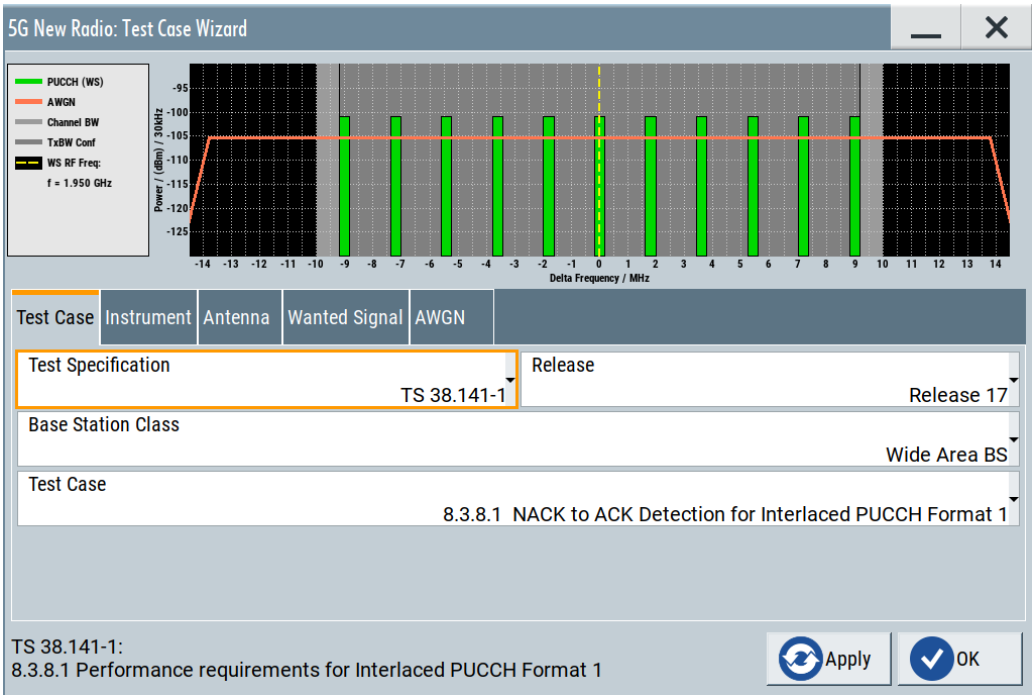
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of interlaced PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.27 Test case 8.3.8.2: ACK missed detection for interlaced PUCCH format 1

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.8.2

Required options

Table 8-44: Required options for 8.3.8.2 ACK missed detection for interlaced PUCCH format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

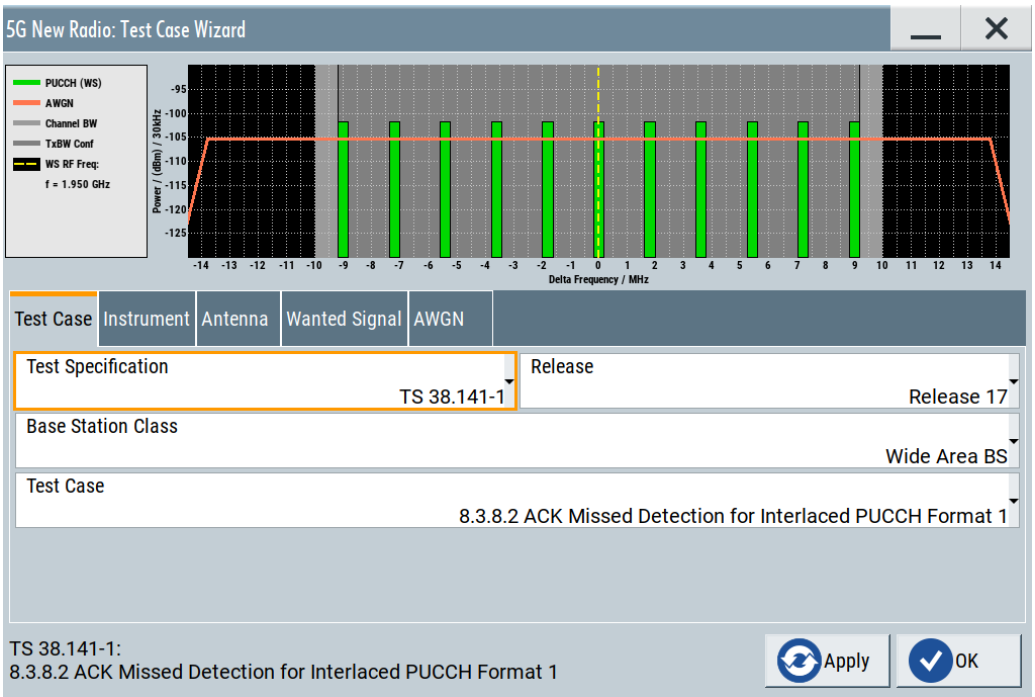
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of interlaced PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.28 Test case 8.3.9: Performance requirements for interlaced PUCCH format 2

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.9

Required options

Table 8-45: Required options for 8.3.9 Performance requirements for interlaced PUCCH format 2

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

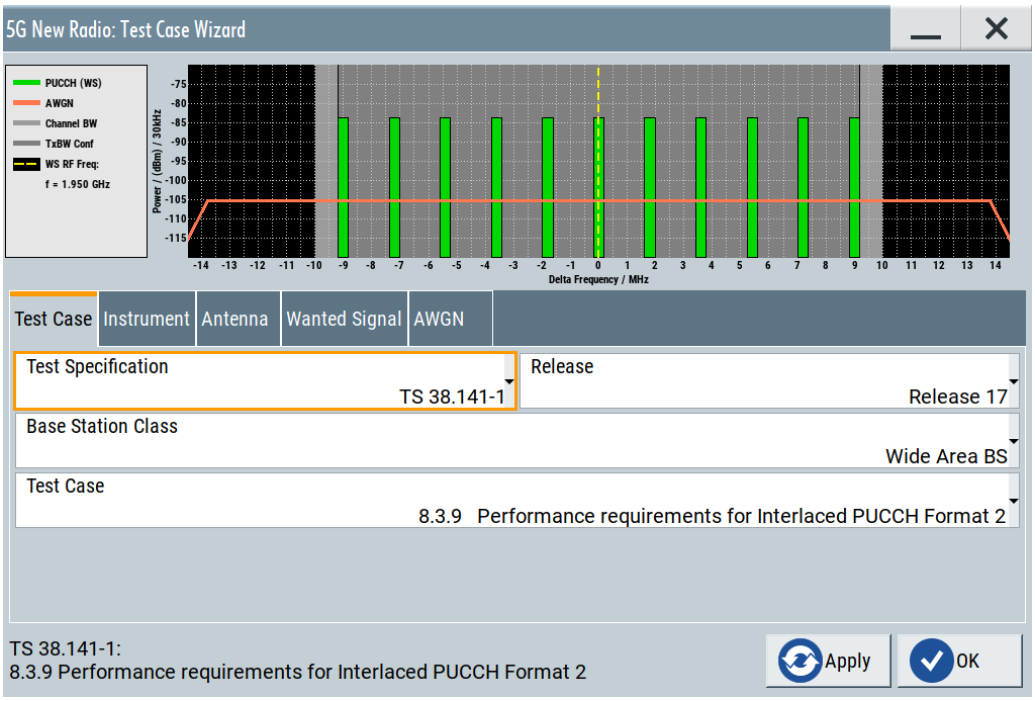
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.

The UCI block error probability performance requirement only applies to the PUCCH format 2 with 22 UCI bits.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.29 Test case 8.3.10: Performance requirements for interlaced PUCCH format 3

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.10

Required options

Table 8-46: Required options for 8.3.10 Performance requirements for interlaced PUCCH format 3

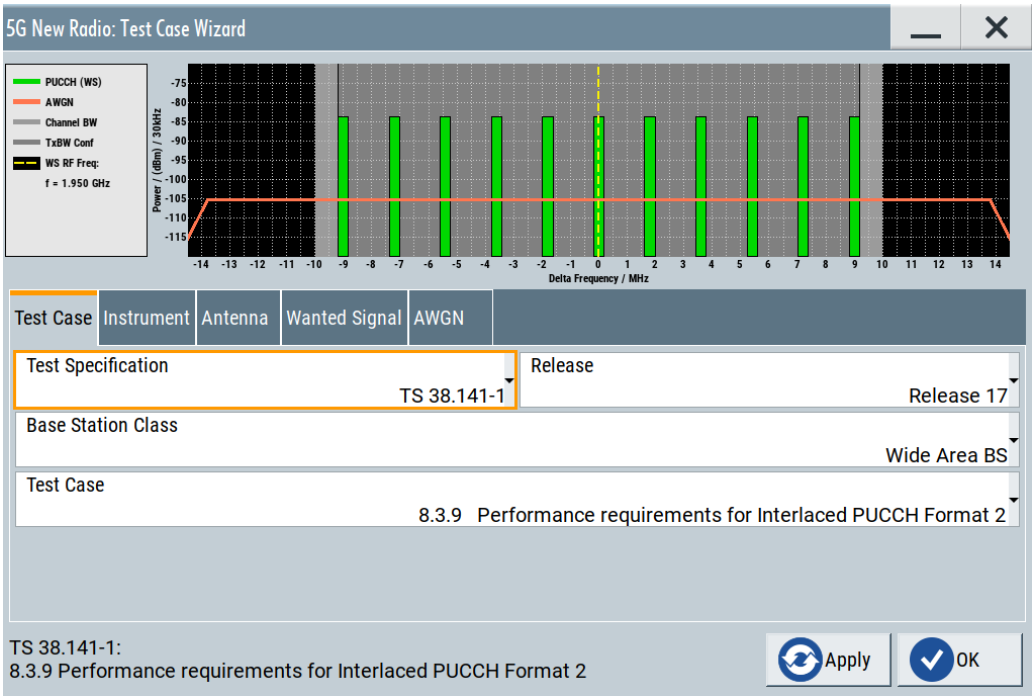
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of interlaced PUCCH format 3 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.30 Test case 8.3.11: Performance requirements for PUCCH sub-slot based repetition format 0

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.11

Required options

Table 8-47: Required options for 8.3.11 Performance requirements for PUCCH sub-slot based repetition format 0

RF path A	B100x	1
RF path B	B200x	1

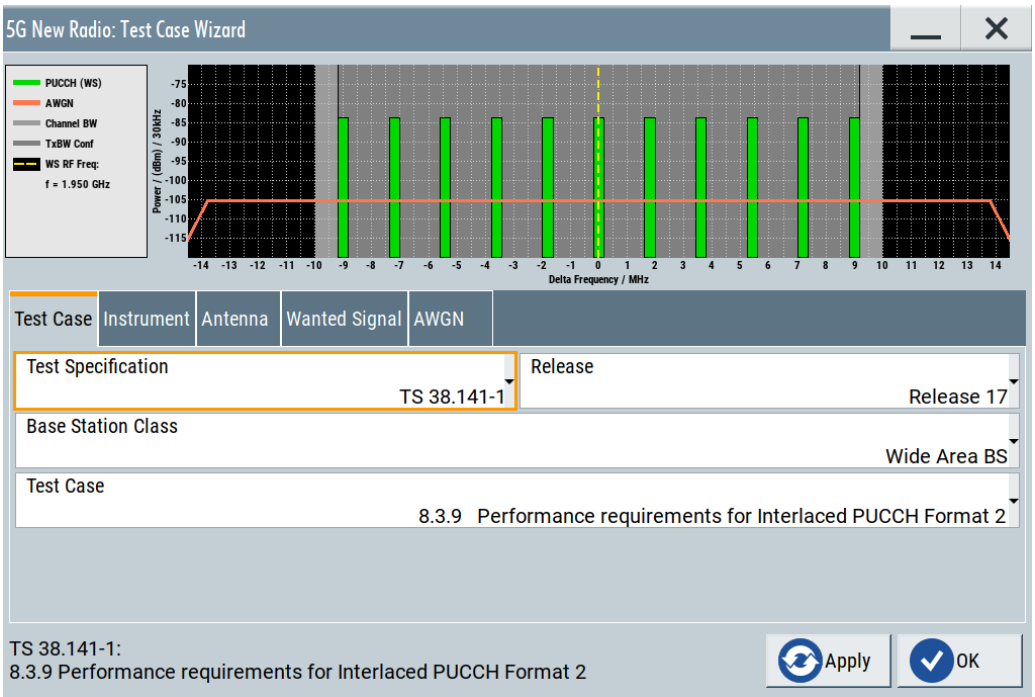
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of single user PUCCH sub-slot based repetition format 0 for ACK missed detection is determined by the parameters: probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.31 Test case 8.3.12.1: NACK to ACK detection for PUCCH format 1 with DM-RS bundling

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.12.1

Required options

Table 8-48: Required options for 8.3.12.1 NACK to ACK detection for PUCCH format 1 with DM-RS bundling

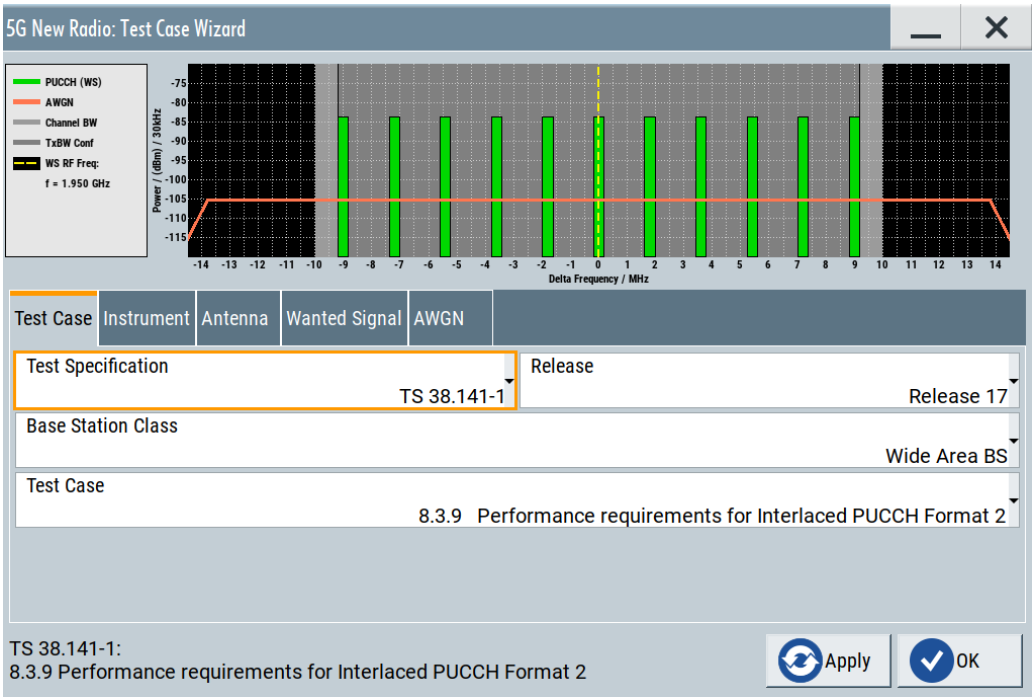
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUCCH format 1 with DM-RS bundling for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1 % or less. The probability of false detection of the ACK shall be 1 % or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.32 Test case 8.3.12.2: ACK missed detection for PUCCH format 1 with DM-RS bundling

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.12.2

Required options

Table 8-49: Required options for 8.3.12.2 ACK missed detection for PUCCH format 1 with DM-RS bundling

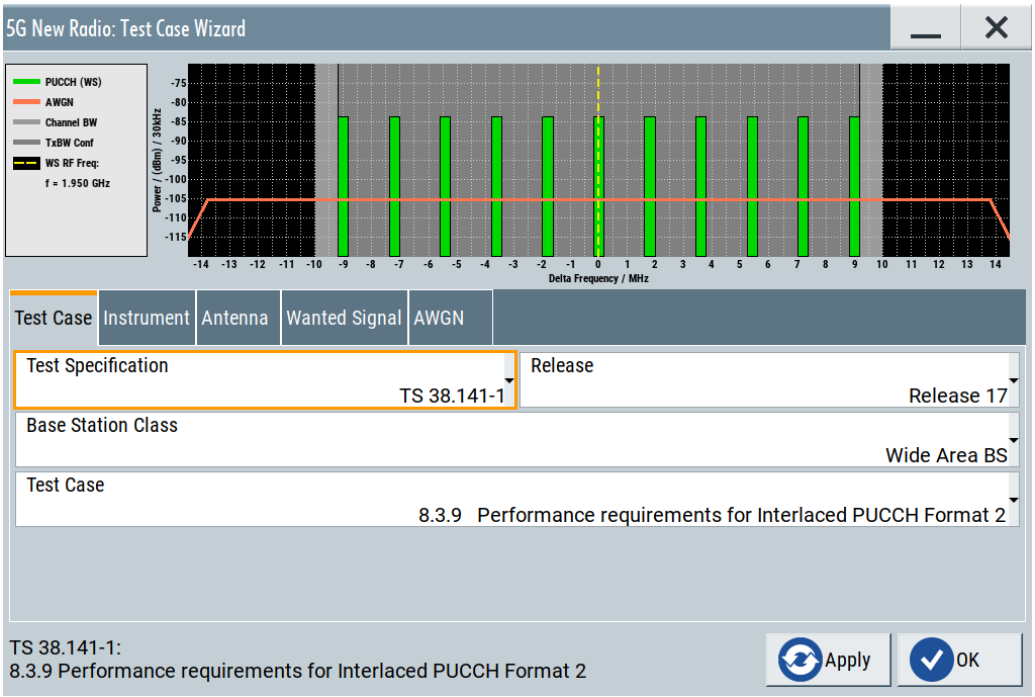
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.9.33 Test case 8.3.13: Performance requirements for PUCCH format 3 with DM-RS bundling

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.3.13

Required options

Table 8-50: Required options for 8.3.13 Performance requirements for PUCCH format 3 with DM-RS bundling

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

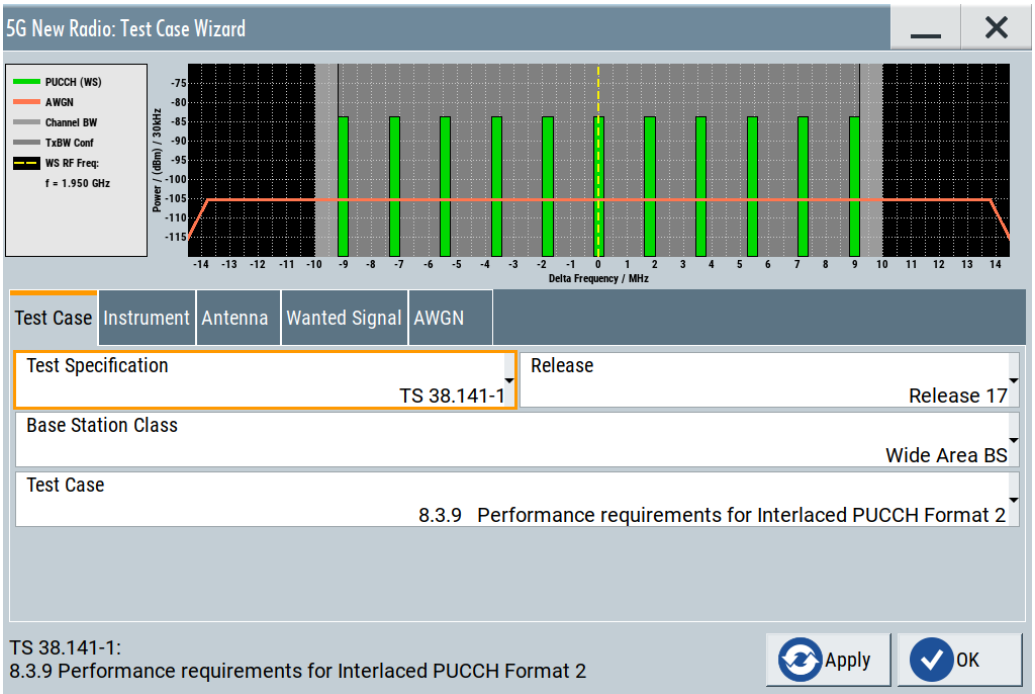
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-1: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361

- Chapter 8.6.12, "AWGN settings", on page 377

8.9.34 Test case 8.4.1: PRACH false alarm probability and missed detection

Test purpose

From 3GPP 38.141-1: To verify the receiver's ability to detect PRACH preamble under static conditions and multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-1, chapter 8.4.1

Required options

Table 8-51: Required options for 8.4.1 PRACH flase alarm propability and missed detection

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	2
Fading simulator	B14 / B15	4
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	1
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	
Note: Additional SGT require d for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Test requirement for BS type 2-O

Pfa must not exceed 0.1%. Pd must be 99% or better, for the SNRs in the following tables.

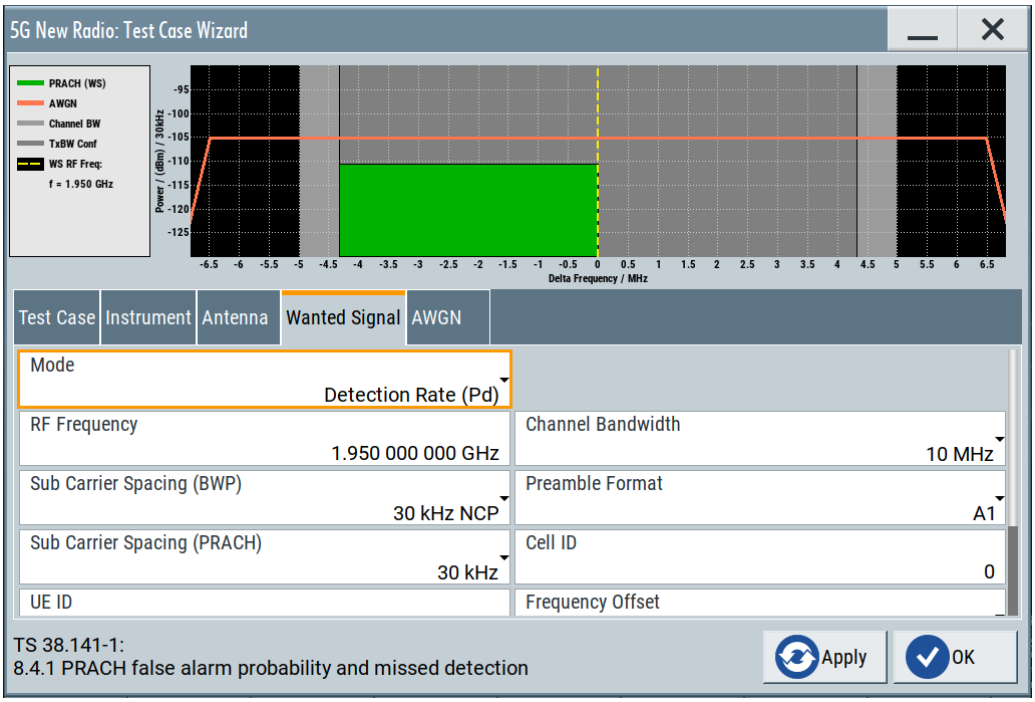
Short description

The performance requirement of PRACH for preamble detection is determined by the two parameters: total probability of false detection of the preamble (Pfa) and the proba-

bility of detection of preamble (Pd). The performance is measured by the required SNR at probability of detection, Pd of 99%. Pfa shall be 0.1% or less.

Pfa is defined as a conditional total probability of erroneous detection of the preamble (i.e. erroneous detection from any detector) when input is only noise.

Pd is defined as conditional probability of detection of the preamble when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.10 Radiated transmitter characteristics (TS 38.141-2, chapter 6)

The wizard supports 3GPP tests TS 38.141-2, chapter 6: Radiated transmitter characteristics.

The 3GPP TS 38.141-2 contains several test cases in chapter 6, but only one transmitter test requires a signal generator. Therefore only one test case is listed in this document.

The radiated transmitter requirements are divided into the following main categories, intended to:

- Prove the transmitters ability to transmit the wanted signal:
  - Test case 6.4: OTA output power dynamics
  - Test case 6.5: OTA transmit ON/OFF power
- Prove how susceptible the transmitter is to different types of interfering signals:
  - Test case 6.6: OTA transmitted signal quality
  - Test case 6.7: OTA unwanted emissions
- Prove the transmitter intermodulation:
  - Test case 6.8: OTA transmitter intermodulation

The tests cover a wide range of scenarios with different impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

8.10.1 Required options

The table below lists the required options for performing the transmitter tests according to 3GPP TS 38.141-2, chapter 6.

Table 8-52: Required options

Chapter in TS 38.141-2	**Hardware options**					**Software options**	
	RF path		**Baseband**		**BB generator**	**AWGN**	**5G NR**
	A	**B**	**1 path**	**2 paths**			
	B100x	**B200x**	**B13** **B13XT**	**B13T** **B13XT**	**B10** **B9**	**K62**	**K144**
6.8 OTA Transmitter Intermodulation					1		1

The following equipment and options are required, for **radiated transmitter characteristics tests**:

- 1x option baseband generator (R&S SMW-B10 or /-B9)
- 1x option digital standard 5G NR (R&S SMW-K144)
- Spectrum analyzer, e.g. an R&S FSW or R&S FSVA3000.
- OTA chamber, e.g. R&S ATS1800C or R&S PWC200

8.10.2 Prior considerations

General test conditions for radiated transmitter tests are given in TS 38.141-2. Test conditions include interpretation of measurement results and configurations for testing. Base stations configurations are also given in TS 38.141-2.

Radiated transmitter characteristics requirements apply on the BS type 1-H, BS type 1-O or BS type 2-O including all its functional components active and for all foreseen modes of operation of the BS unless otherwise stated.

8.10.3 General workflow for carrying out a radiated transmitter test

The following instruction lists the general steps for performing a transmitter 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 OTA chamber, refer to its user manual.

1. Select an antenna test system (OTA chamber) that covers the radiated transmitter requirements for the test that you want to perform.
   Note: Several antennas can be required to cover both the NR BS and the whole emission frequency range.
2. Connect the instrument to the selected antenna ports in the OTA chamber as specified for the corresponding test case setup.
   See also Chapter 8.4, "Exemplary test setups", on page 346.
3. Set the OTA chamber to the basic state:
   a) Initialize the OTA chamber.
   b) Set the frequency.
   c) Set the base station to transmit the downlink signal (for most transmitter test cases).
4. Preset the signal generator to ensure a defined instrument state.
5. Configure the test case wizard.
   a) Select "Baseband Block > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-2: "6.8 OTA Transmitter Intermodulation".
   c) Enter additional required parameters, e.g. base station class.
   d) Enter the test frequency of the wanted signal.
      The setting must match with the base station configuration.
   e) Select "Apply Settings" to activate the settings.

   The signal generator is now ready.
6. Switch on RF output.
7. If necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
   See also Chapter 8.5, "General considerations", on page 350.
8. Start the measurement.
   a) Send a start trigger impulse from the base station to the signal generator.

The signal generator starts signal generation.

9. Calculate the results.

8.10.4 Test case 6.8: OTA transmitter intermodulation

Test purpose

From 3GPP 38.141-2: The test purpose is to verify the ability of the transmitter units associated with the RIB under test to restrict the generation of intermodulation products in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station to below specified levels.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 6.8.

Required options

See also Chapter 8.10.1, "Required options", on page 463.

Test setup

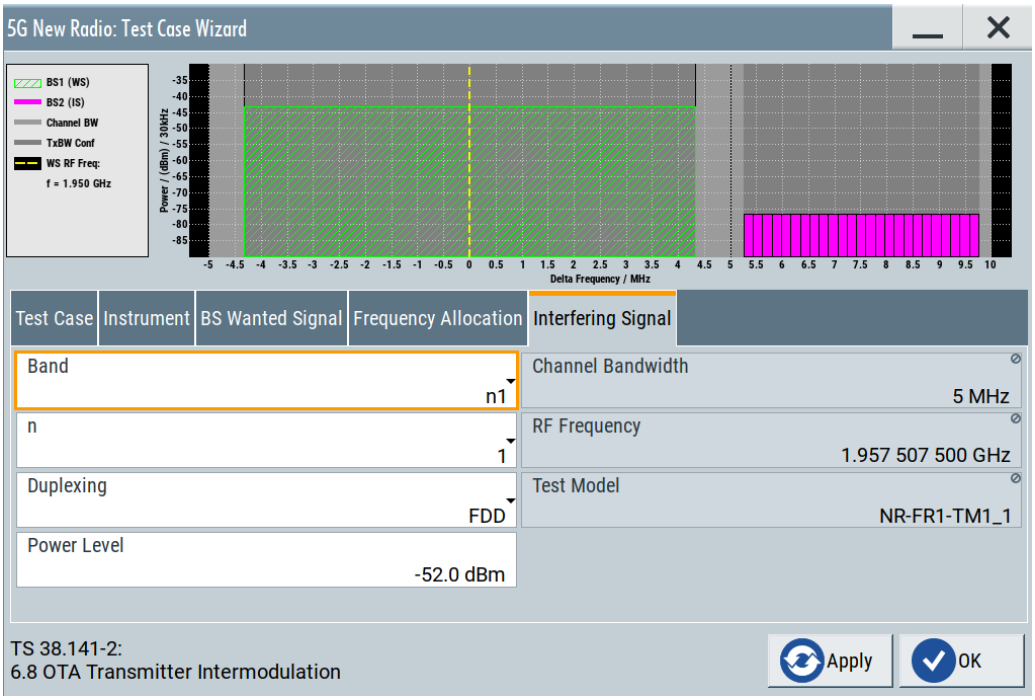
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The OTA transmitter intermodulation requirement applies during the transmitter ON period and the transmitter transient period. The transmitter intermodulation level is the total radiated power of the intermodulation products when an interfering signal is injected into the colocation test antenna (CLTA).

For BS type 1-O, the transmitter intermodulation requirement is captured by the colocation transmitter intermodulation scenario case, in which the interfering signal is injected into the CLTA.

This requirement is not applicable for BS type 2-O.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.7, "Frequency allocation settings", on page 367
- Chapter 8.6.8, "Interfering signal settings", on page 368

8.11 Radiated receiver characteristics (TS 38.141-2, chapter 7)

The wizard supports 3GPP tests TS 38.141-2, chapter 7: Radiated receiver characteristics.

Most of the receiver tests can be performed with the signal generator and the OTA chamber without additional measurement equipment.

Only four receiver tests can be performed with the signal generator and the OTA chamber 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:
  - Test case 7.2: OTA sensitivity
  - Test case 7.3: OTA reference sensitivity level
  - Test case 7.4: OTA dynamic range
- Prove how susceptible the receiver is to different types of interfering signals:

– Test case 7.5.1: OTA adjacent channel selectivity (ACS)
– Test case 7.5.2A: OTA in-band general blocking
– Test case 7.5.2B: OTA in-band narrowband blocking
– Test case 7.6: OTA out-of-band blocking
– Test case 7.8: OTA receiver intermodulation
– Test case 7.9: OTA in-channel selectivity

The tests cover a wide range of scenarios with different impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

8.11.1 Required options

Table 8-53 lists the required options for performing the receiver tests according to 3GPP TS 38.141-2, chapter 7.

Table 8-53: Required options

	Hardware options					Software options	
	RF path		Baseband		BB genera-tor	AWGN	5G NR
	A	B	1 path	2 paths			
Chapter in TS 38.141-2	e.g., B1003	e.g., B2003	B13 B13XT	B13T B13XT	B10 B9	K62	K144
7.2 OTA sensitivity	1		1		1		1
7.3 OTA reference sensitivity level	1		1		1		1
7.4 OTA dynamic range	1		1		1	1	1
7.5.1 OTA adjacent channel selectivity (ACS)	1	1		1	2		2
7.5.2A OTA in-band general blocking	1	1		1	2		2
7.5.2B OTA in-band narrowband blocking	1	1		1	2		2
7.6 OTA out-of-band blocking [1)]	1			1	1		1
7.7 OTA receiver spurious emissions [2)]							
7.8 OTA receiver intermodulation[1)]	1	1		1	2	1	2
7.9 OTA in-channel sensitivity	1	1		1	2		2

[1)] An additional R&S instrument required for CW/5GNR signal

[2)] No signal generator required

The following equipment and options are required, for **radiated receiver characteristics tests**:

- 2x option baseband generator (R&S SMW-B10 or /-B9)
- 1x option baseband main module (R&S SMW-B13T or /-B13XT)
- 1x option frequency (e.g. R&S SMW-B1003)

- 1x option frequency (e.g. R&S SMW-B2003)
- 1x option additive white Gaussian noise (AWGN) (R&S SMW-K62)
- 2x option digital standard 5G NR (R&S SMW-K144)
- For OTA out-of-band blocking (7.6) and OTA receiver intermodulation (7.8) tests: An additional R&S device required for interfering signal.

8.11.2 Prior considerations

Unless otherwise stated, the following arrangements apply for radiated receiver characteristics requirements according to TS 38.141-2:

- Requirements apply during the base station receive period
- Requirements must be met for any transmitter setting
- For FDD operation the requirements must be met with the transmitter units ON
- Throughput requirements defined for the radiated receiver characteristics do not assume HARQ retransmissions
- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower base station RF bandwidth edge or subblock edge inside a subblock gap, and the positive offsets of the interfering signal apply relative to the upper base station RF bandwidth edge or subblock edge inside a subblock gap

For FR1 requirements which are to be met over the OTA REFSENS RoAoA absolute requirement values are offset by the following terms:

- $\Delta_{OTAREFSENS} = 44.1 - 10 \cdot \log_{10}(BeW_{\theta,REFSENS} \cdot BeW_{\varphi,REFSENS})$ (dB), for the reference direction.
- $\Delta_{OTAREFSENS} = 41.1 - 10 \cdot \log_{10}(BeW_{\theta,REFSENS} \cdot BeW_{\varphi,REFSENS})$ (dB), for all other directions.

For requirements which are to be met over the minSENS RoAoA absolute requirement values are offset by the following term:

- $\Delta_{minSENS} = P_{REFSENS} - EIS_{minSENS}$

For FR2 requirements which are to be met over the OTA REFSENS RoAoA absolute requirement values are offset by the following terms:

- $\Delta_{FR2\_REFSENS} = -3$ dB (for the reference direction)
- $\Delta_{FR2\_REFSENS} = 0$ dB (for all other directions)

Fixed reference channels (FRC)

The receiver tests use fixed reference channels (FRC) as defined in TS 38.141-2, annex A "Reference measurement channels".

Table 8-54 shows the supported FRCs for receiver tests.

Table 8-54: Supported FRC

FRC	Description
G-FR1-A1-1 to G-FR1-A1-9	FRC for FR1 OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity (QPSK, R=1/3)
G-FR2-A1-1 to G-FR2-A1-5	FRC for FR2 OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity (QPSK, R=1/3)
G-FR1-A2-1 to G-FR1-A2-6	FRC for FR1 OTA dynamic range (16QAM, R=2/3)

Channels

According to the TS 38.141-2, 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 in a normal test environment. The RF channels to be tested in each requirement are shown in Table 8-55.

Table 8-55: RF channels to test radiated receiver as specified in 38.141-2

Test	RF channel
7.2 OTA sensitivity	M
7.3 OTA reference sensitivity level	B, M, T
7.4 OTA dynamic range	M
7.5.1 OTA adjacent channel selectivity (ACS)	M
7.5.2A OTA in-band general blocking	M
7.5.2B OTA in-band narrowband blocking	M
7.6 OTA out-of-band blocking	M
7.7 OTA receiver spurious emissions [1)]	B/T
7.8 OTA receiver intermodulation	M
7.9 OTA in-channel sensitivity	M

[1)] No signal generator required

Base station type

The test applicability for each base station type is shown in Table 8-56 as specified in TS 38.141-2.

Table 8-56: Requirement set applicability

Test	Requirement set		
	BS type 1-H	BS type 1-O	BS type 2-O
7.2 OTA sensitivity	✓	✓	✗
7.3 OTA reference sensitivity level	✗	✓	✓
7.4 OTA dynamic range	✗	✓	✗

Test	Requirement set		
	BS type 1-H	BS type 1-O	BS type 2-O
7.5.1 OTA adjacent channel selectivity (ACS)	✗	✓	✓
7.5.2A OTA in-band general blocking	✗	✓	✓
7.5.2B OTA in-band narrowband blocking	✗	✓	✓
7.6 OTA out-of-band blocking	✗	✓	✓
7.7 OTA receiver spurious emissions [1)]	✗	✓	✓
7.8 OTA receiver intermodulation	✗	✓	✓
7.9 OTA in-channel sensitivity	✗	✓	✓

[1)] No signal generator required

✓ Applicable

✗ Not applicable

Channel bandwidth of the 5G NR interfering signal

For all test cases using an interfering 5G NR signal, the bandwidth of the interfering signal must be the same as the wanted signal.

Equivalent isotropic sensitivity (EIS)

The EIS describes the sensitivity for an isotropic directivity device equivalent to the sensitivity of the DUT exposed to an incoming wave from a defined angle of arrival.

In general, the EIS can be expressed as:

$$EIS(\theta,\phi) = P_S/G_{X,DUT}(\theta,\phi)$$

Where:

P_S is the radiated sensitivity of the DUT receiver

$G_{X,DUT}(\theta,\phi)$ is the relative isotropic gain (in polarization x) of the DUT antenna.

The radiated sensitivity corresponds to the minimum signal power at the radio receiver's input (antenna's output) required to meet the airlink's minimum performance criterion (typically expressed in terms of bit, block or frame error rate).

OTA reference sensitivity ($EIS_{REFSENS}$)

The OTA reference sensitivity power level ($EIS_{REFSENS}$) is the minimum mean power received at the radiated interface (RIB) at which a reference performance requirement must be met for a specified reference measurement channel. The test purpose is to verify that the BS can meet the minimum throughput requirement for a specified measurement channel at the $EIS_{REFSENS}$ level.

Effective isotropic radiated power (EIRP)

The EIRP denotes the absolute output power in a given direction. If no direction is defined, the direction of maximum radiation intensity is implied. The EIRP is the power an ideal isotropic radiator requires as input power to achieve the same power density in the given direction. EIRP is the power accepted by the antenna (P_{in}) multiplied by the antenna gain (G), or radiated power multiplied by the directivity and can be expressed as:

$EIRP = P_{in}G$

$EIRPdBm = P_{in,dBm} + G_{dBi}$

Total radiated power (TRP)

The TRP or the radiated power is simply the total power radiated by a base station. It is defined as the radiation intensity at each angle in watts per Steradian I(θ,ϕ) integrated over the whole sphere around the antenna.

The power radiated by the antenna P_{rad} is also called the total radiated power (P_{TRP}). It is defined as the radiant intensity I(θ,ϕ) integrated over the whole sphere around the antenna:

8.11.3 General workflow for carrying out a receiver test

The following instruction lists the general steps for performing a BS radiated 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 OTA chamber, refer to the corresponding description.

1. Select an antenna test system (OTA chamber) that covers the radiated transmitter requirements for the test that you want to perform.
   Note: Several antennas can be required to cover both the NR BS and the whole emission frequency range.
2. Connect the instrument to the selected antenna ports in the OTA chamber as specified for the corresponding test case setup.
   See also Chapter 8.4, "Exemplary test setups", on page 346.
3. Place the base station at the positioner. Align the coordinate system.
4. Align the base station with the test antenna in the declared direction to be tested.
5. Configure beam peak direction according to the declared reference beam direction pair.
6. Set the BS to transmit beams of the same operational band as the OTA REFSENS RoAoA or OSDD being tested.

7. Configure the test case wizard.
   a) Select "Baseband Block > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-2: "7.4 OTA Dynamic Range".
   c) Enter additional required parameters, e.g. base station class, OTA declarations, etc.
   d) Enter the test frequency of the wanted/interfering signal.
      The setting must match with the base station configuration.
   e) Select "Apply Settings" to activate the settings.

   The signal generator is now ready to start signal generation.
8. Switch on RF output.
9. If necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
   See also Chapter 8.5, "General considerations", on page 350.
10. Start the measurement for each supported polarization.
    a) Send a start trigger impulse from the base station to the signal generator.

    The signal generator starts signal generation.
11. Calculate the results.
12. Repeat the measurement for all OSDDs declared for the BS and supported polarizations.

8.11.4 Test case 7.2: OTA sensitivity

Test purpose

To verify that the BS can meet the throughput requirement for a specified measurement channel at the EIS level and the range of angles of arrival declared in the OSDD.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

The OTA sensitivity requirement is based on the declaration of one or more OTA sensitivity direction declarations (OSDD).

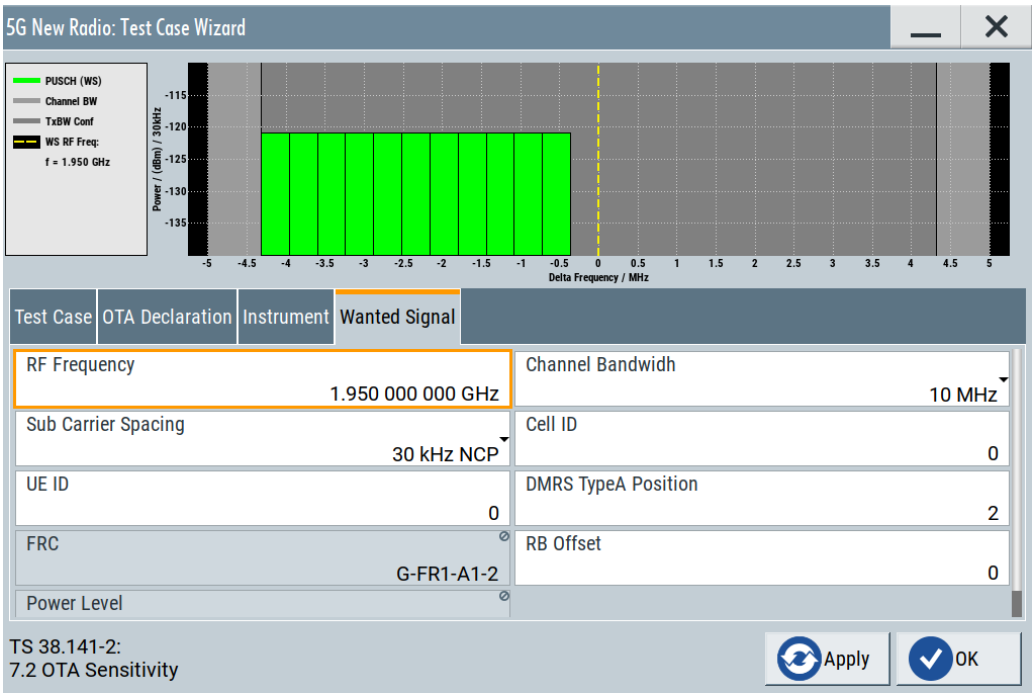
Perform the test on the channel M as indicated in Table 8-55.

Perform the test on the following directions:

- Directions receiver target reference direction

- Conformance test directions

The selected "Channel Bandwidth" and "Sub Carrier Spacing" determine 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 "RB Offset".



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA sensitivity for BS type 1-H and BS type 1-O.

The minimum EIS level is a declared figure for each OSDD. The test requirement is calculated from the declared value offset by the EIS test tolerance specified in TS 38.141-2.

Refer to the specification TS 38.141-2, chapter 7.2 OTA sensitivity for more information on the test requirements.

This test is not applicable for BS type 2-O. For a BS type 2-O, the OTA sensitivity is the same as the Test case 7.3: OTA reference sensitivity level.

8.11.5 Test case 7.3: OTA reference sensitivity level

Test purpose

To verify that the BS can meet the throughput requirement for a specified measurement channel at the $EIS_{REFSENS}$ level and the range of angles of arrival within the OTA REFSENS RoAoA.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

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 OTA reference sensitivity (REFSENS) requirement is a directional requirement and is intended to ensure the minimum OTA reference sensitivity level for a declared OTA REFSENS RoAoA. The OTA reference sensitivity power level $EIS_{REFSENS}$ is the minimum mean power received at the RIB at which a reference performance requirement must be met for a specified reference measurement channel.

The OTA REFSENS EIS level declaration must apply to all supported polarizations, under the assumption of polarization match.

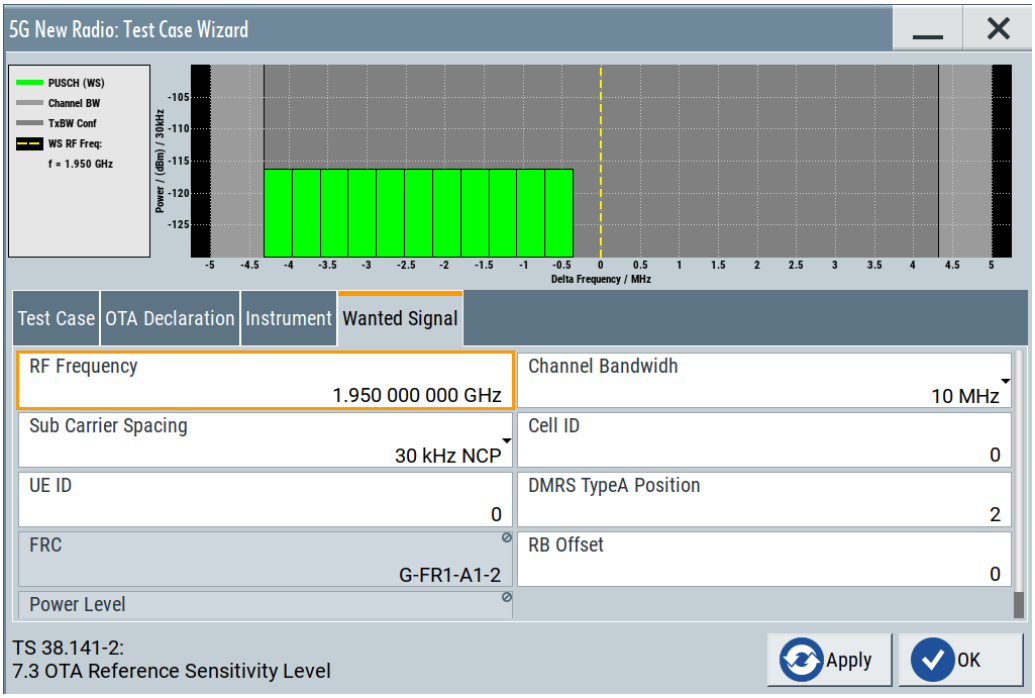
Perform the test on the channels B, M and T as indicated in Table 8-55.

Perform the test on the following directions:

- OTA REFSENS receiver target reference direction
- OTA REFSENS conformance test directions

The selected "Channel Bandwidth" and "Sub Carrier Spacing" determine 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 "RB Offset".

The test requirements depend on the BS class and type.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA reference sensitivity level for BS type 1-O and BS type 2-O.

For a BS type 1-O, the FR1 $EIS_{REFSENS}$ level is the conducted REFSENS requirement value offset by $\Delta_{OTAREFSENS}$.

For a BS type 2-O, the $EIS_{REFSENS}$ levels are derived from a single declared basis level $EIS_{REFSENS\_50M}$, which is based on a reference measurement channel with 50 MHz BS channel bandwidth.

The test requirement is calculated from the $EIS_{REFSENS}$ level offset by the $EIS_{REFSENS}$ test tolerance specified in TS 38.141-2.

Refer to the specification TS 38.141-2, chapter 7.3 OTA reference sensitivity level for more information on the test requirements.

8.11.6 Test case 7.4: OTA dynamic range

Test purpose

To verify that at the BS receiver dynamic range, the relative throughput fulfills the specified limit.

Required options

- See Chapter 8.11.1, "Required options", on page 467.
- Option additive white Gaussian noise AWGN (R&S SMW-K62)

Test setup

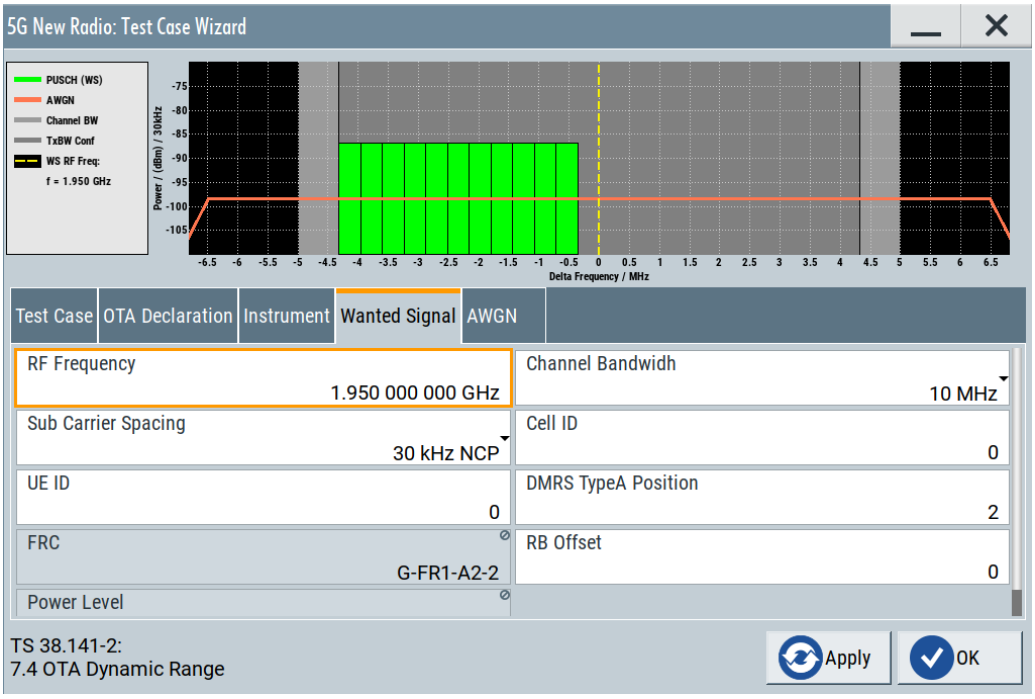
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

The OTA dynamic range is a measure of the capability of the receiver unit to receive a wanted signal in the presence of an interfering signal inside the received BS channel bandwidth. The requirement must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the OTA REFSENS RoAoA. The test purpose is to verify that at the BS receiver dynamic range, the relative throughput must fulfill the specified limit.

The interfering signal is an AWGN signal.

This test applies for BS type 1-O only. The dynamic range value depends on the BS class.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA dynamic range for BS type 1-O only.

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA dynamic range test tolerance specified in TS 38.141-2.

Refer to the specification TS 38.141-2, chapter 7.4 OTA dynamic range for more information on the test requirements.

8.11.7 Test case 7.5.1: OTA adjacent channel selectivity (ACS)

Test purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels next to the wanted channel.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

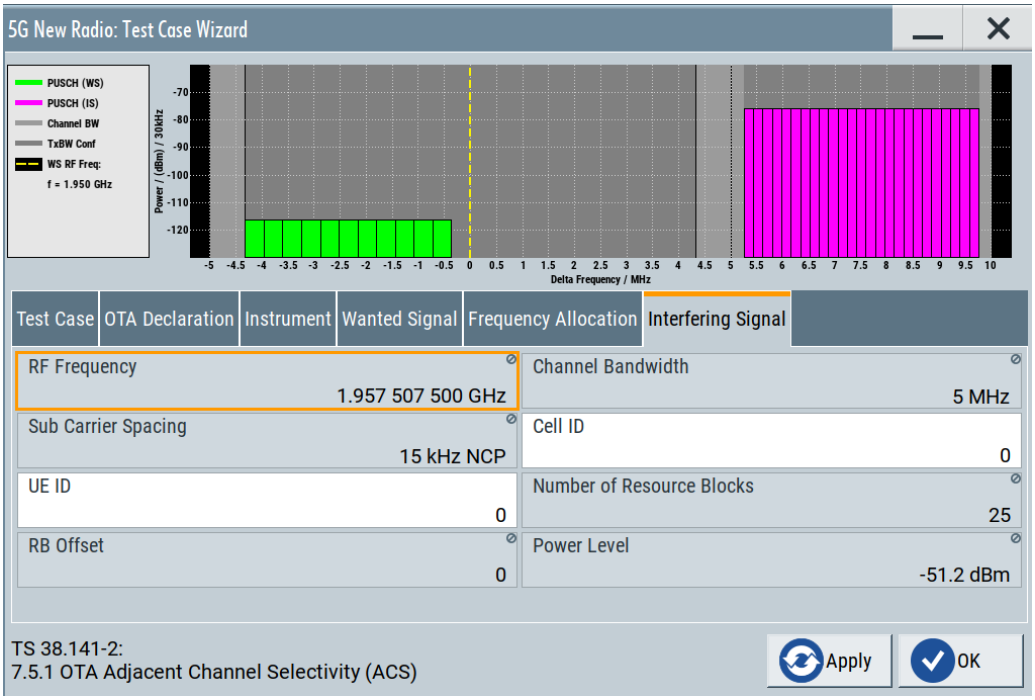
OTA adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive an OTA wanted signal at its assigned channel frequency in the presence of an OTA adjacent channel signal with a specified center frequency offset of the interfering signal to the band edge of a victim system. The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match. The test purpose is to verify the ability of the BS receiver filter to suppress interfering signals in the channels next to the wanted channel.

Perform the test on the channel M as indicated in Table 8-55.

Perform the test on the following directions:

- For BS type 1-O, receiver target reference direction
- For BS type 2-O, OTA REFSENS receiver target reference direction

This requirement applies to BS type 1-O and BS type 2-O.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA adjacent channel selectivity (ACS) for BS type 1-O and BS type 2-O.

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA ACS test tolerance specified in TS 38.141-2.

The requirement for BS type 1-O must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and the AoA of the incident wave of a received signal and the interfering signal are within the minSENS RoAoA.

The requirement for BS type 2-O must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the OTA REFSENS RoAoA.

The wanted and interfering signals apply to each supported polarization, under the assumption of polarization match.

Refer to the specification TS 38.141-2, chapter 7.5.1 OTA adjacent channel selectivity for more information on the test requirements.

8.11.8 Test case 7.5.2A: OTA in-band general blocking

Test purpose

To verify the ability of the BS receiver to withstand high-levels of in-band interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

The blocking test using a 5G NR interfering signal can be performed with one instrument, see Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349. This setup can also be used for the CW interfering signal up to 3 GHz or 6 GHz carrier, depending on the installed option. For tests with CW with frequency greater than 6 GHz a second signal generator is necessary, e.g. R&S SMF.

Short description

In in-band blocking tests, the NR interfering signal center frequency is swept with a step size of 1 MHz starting from the minimum offset to the channel edge of the wanted signals.

The reference measurement channel for the wanted signal is identified in Chapter 8.11.5, "Test case 7.3: OTA reference sensitivity level", on page 474. The interfering signal is a 5G NR QPSK signal (PUSCH) allocated selectable at higher or lower frequencies (see Figure 8-10).

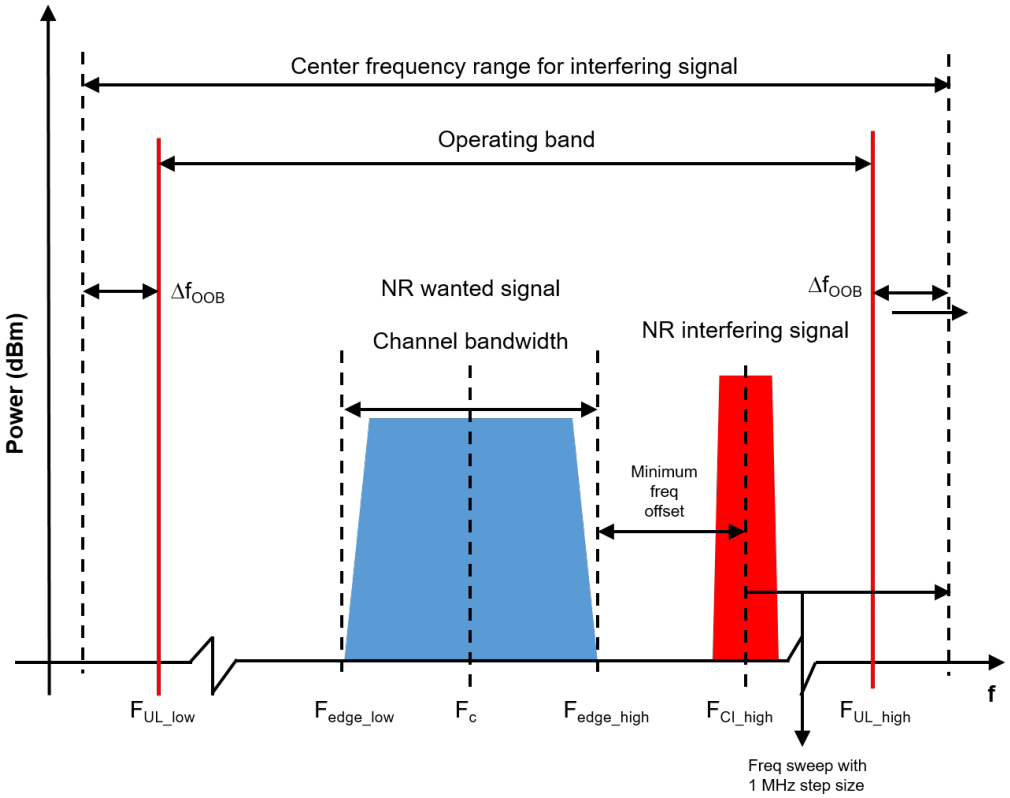


Figure 8-15: Example: OTA band blocking

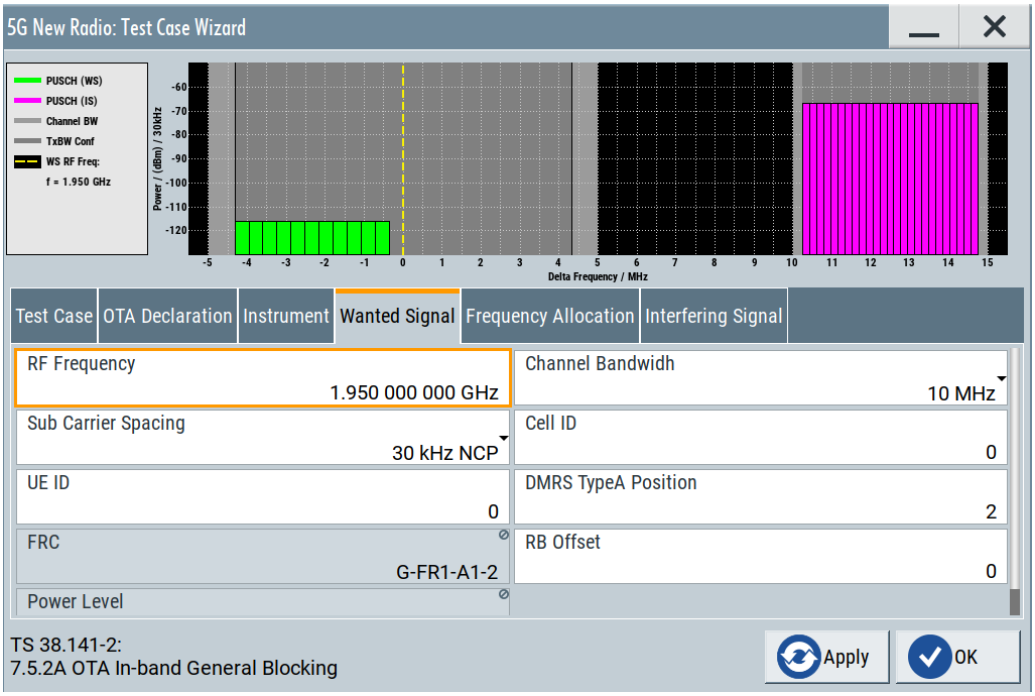
The test of in-band blocking is performed with an 5G NR interfering signal inside one of the operating bands defined in TS 38.104, tables 5.2-1 and 5.2-2, but not next to the wanted signal.

Perform the test on the channel M as indicated in Table 8-55.

This requirement applies to BS type 1-O and BS type 2-O.

Perform the test on the following directions:

- For BS type 1-O:
  - Receiver target reference direction for the minSENS OSDD
  - OTA REFSENS conformance test directions
- For BS type 2-O:
  - OTA REFSENS receiver target reference direction
  - OTA REFSENS conformance test directions



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA in-band general blocking for BS type 1-O and BS type 2-O.

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA in-band blocking test tolerance specified in TS 38.141-2.

The requirement for BS type 1-O must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and also in the following cases:

- If the wanted signal is based on $EIS_{REFSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the OTA REFSENS RoAoA.
- If the wanted signal is based on $EIS_{minSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the minSENS RoAoA.

For BS type 1-O, the OTA in-band blocking requirement must apply in the in-band blocking frequency range, which is defined within frequency range from $F_{UL\_low} - \Delta f_{OOB}$ to $F_{UL\_high} + \Delta f_{OOB}$, excluding the downlink frequency range of the FDD operating band. See Figure 8-15.

The requirement for BS type 2-O must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the OTA REFSENS RoAoA.

For BS type 2-O, the OTA in-band blocking requirement must apply in the in-band blocking frequency range, which is defined within frequency range from F_{UL_low} - Δf_{OOB} to F_{UL_high} + Δf_{OOB}. See Figure 8-15.

The wanted and interfering signals apply to each supported polarization, under the assumption of polarization match.

Refer to the specification TS 38.141-2, chapter 7.5.2 OTA in-band blocking for more information on the test requirements.

8.11.9 Test case 7.5.2B: OTA in-band narrowband blocking

Test purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels next to the wanted channel.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

The narrow-band blocking test verifies that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" narrow-band interfering signal in the adjacent channel.

The interfering signal is a single resource block 5G NR signal in a channel with the same bandwidth as the wanted signal. The interfering signal is at a specified center frequency offset and adjacently to the lower (upper) channel edge of the wanted signal as shown in Figure 8-16.

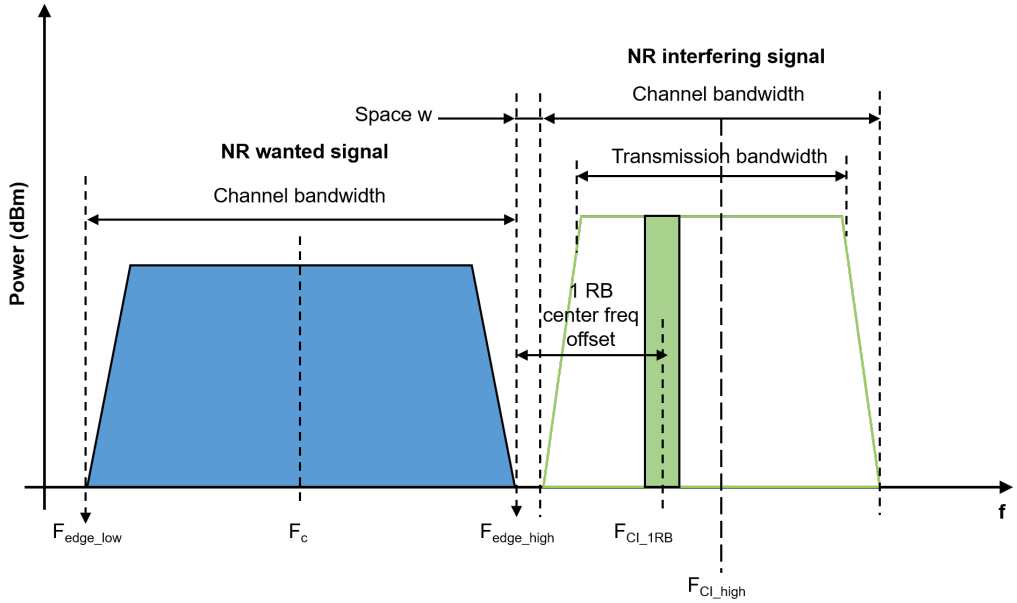
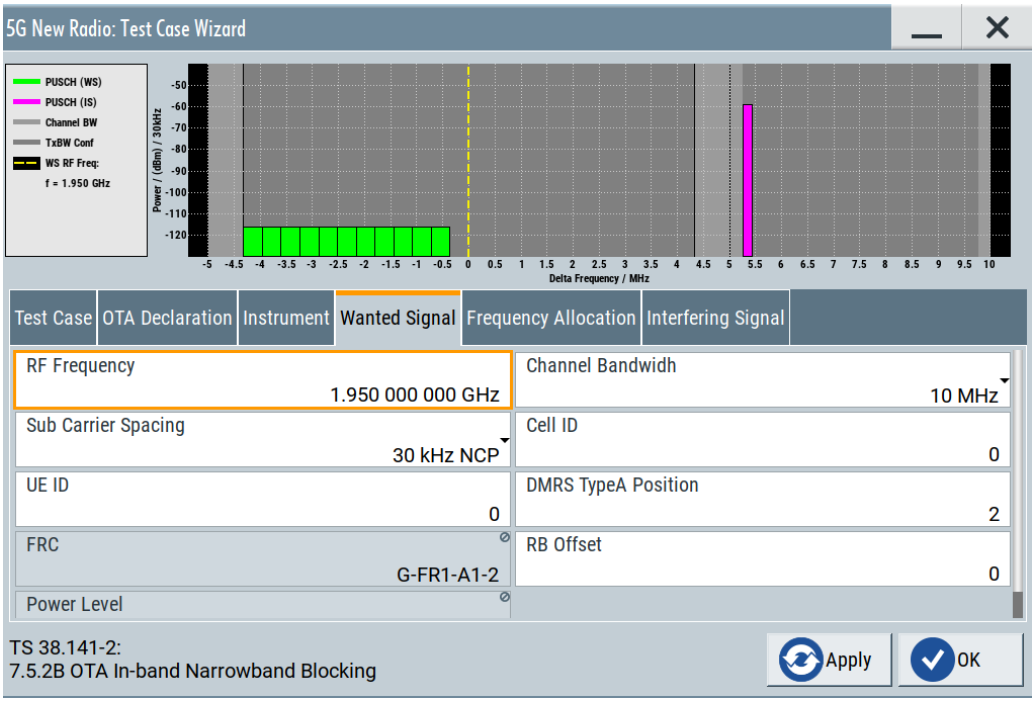


Figure 8-16: Example: OTA narrowband blocking

Perform the test on the channel M as indicated in Table 8-55.

This requirement applies to BS type 1-O only.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

Test requirement

The specification TS 38.141-2 defines requirements to test the OTA in-band narrow-band blocking for BS type 1-O only.

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA in-band blocking test tolerance specified in TS 38.141-2.

The requirement for a BS type 1-O must apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and also in the following cases:

- If the wanted signal is based on $EIS_{REFSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the OTA REFSENS RoAoA.
- If the wanted signal is based on $EIS_{minSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the minSENS RoAoA.

The wanted and interfering signals apply to each supported polarization, under the assumption of polarization match.

Refer to the specification TS 38.141-2, chapter 7.5.2 OTA in-band blocking for more information on the test requirements.

8.11.10 Test case 7.6: OTA out-of-band blocking

Test purpose

The test stresses the ability of the receiver unit associated with the RIB under test to withstand high-level interference from unwanted signals at specified frequency bands, without undue degradation of its sensitivity.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

For tests with CW with frequency greater than 6 GHz a second signal generator is necessary, like R&S SMF for instance.

Short description

The OTA out-of-band blocking characteristics are a measure of the receiver unit ability to receive a wanted signal at the RIB at its assigned channel in the presence of an unwanted interferer.

Test of out-of-band blocking is performed with a CW interfering signal with 30 MHz up to 60 GHz.

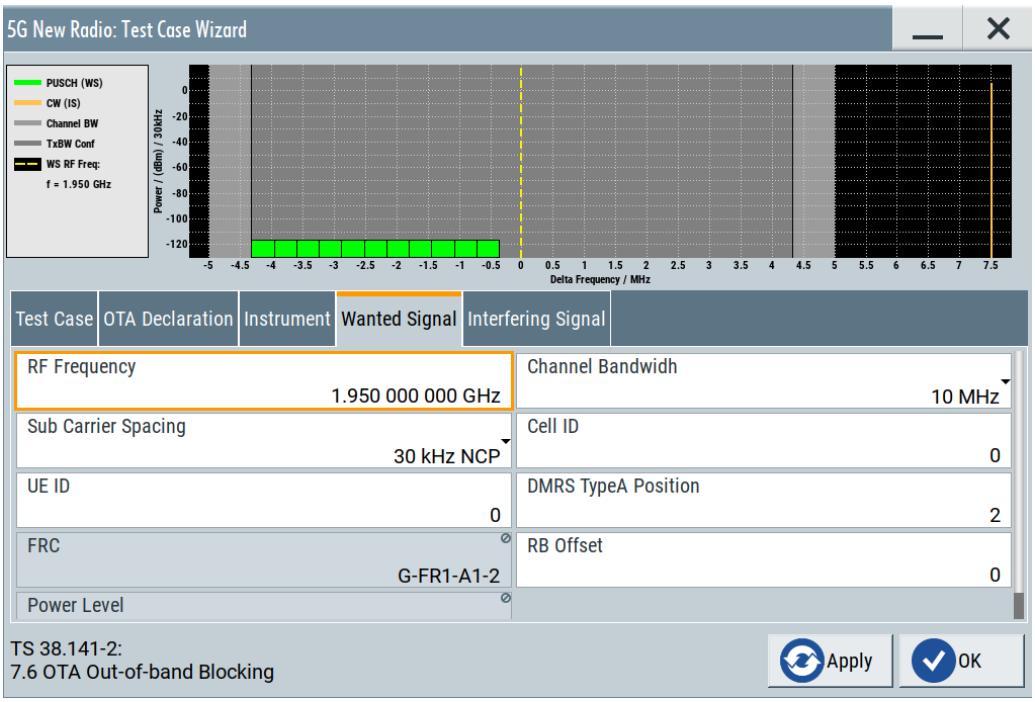
There is an additional (optional) blocking requirement for co-location with other base station.

Perform the test on the channel M as indicated in Table 8-55.

This requirement applies to BS type 1-O and BS type 2-O.

Perform the test on the following directions:

- For BS type 1-O: receiver target reference direction.
- For BS type 2-O: OTA REFSENS receiver target reference direction.



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA out-of-band blocking for BS type 1-O and BS type 2-O.

Refer to the specification TS 38.141-2, chapter 7.6 OTA out-of-band blocking for more information on the test requirements.

8.11.11 Test case 7.8: OTA receiver intermodulation

Test purpose

To verify that the BS receiver dynamic range, the relative throughput must fulfill the specified limit.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

Intermodulation response rejection is a measure of the capability of the receiver unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal. Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Interfering signals are a CW signal and a 5G NR signal as shown in Figure 8-17.

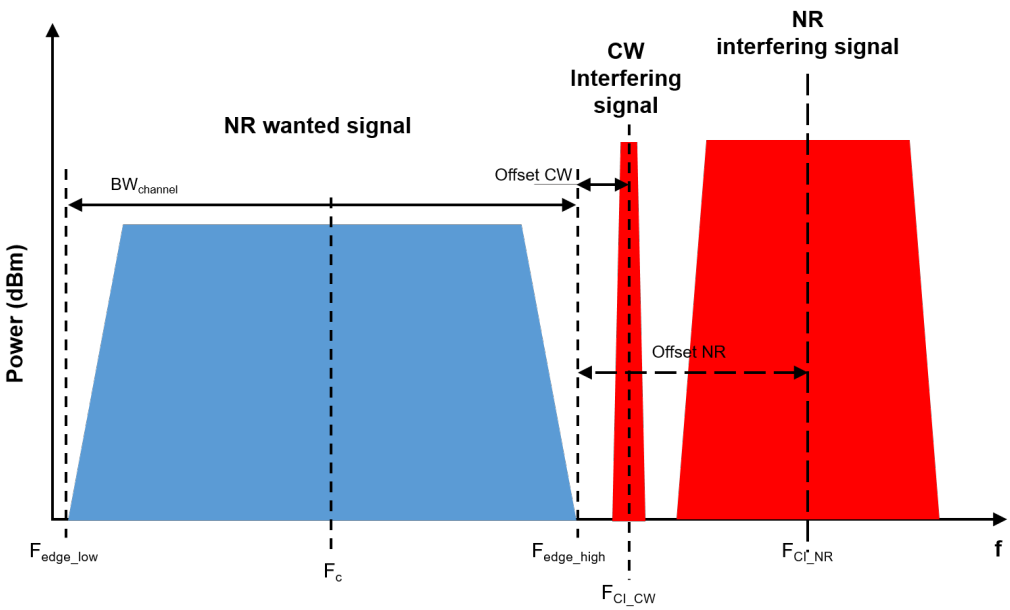


Figure 8-17: General intermodulation

The 5G NR interfering signal is provided through the second channel of the R&S SMW. The CW signal is generated with an additional instrument with the R&S SMW-K62 (additive white Gaussian noise (AWGN) option).

Perform the test on the channel M as indicated in Table 8-55.

This requirement applies to BS type 1-O and BS type 2-O.

Perform the test on the following directions:

- OTA REFSENS receiver target reference direction
- In addition, for BS type 1-O, receiver target reference direction

The "Test Case Wizard" allows you to perform narrowband intermodulation tests. Set the "Interferer Type" in the "Interfering Signal 1" tab to "Narrowband NR" to set the pre-define settings. Figure 8-18.

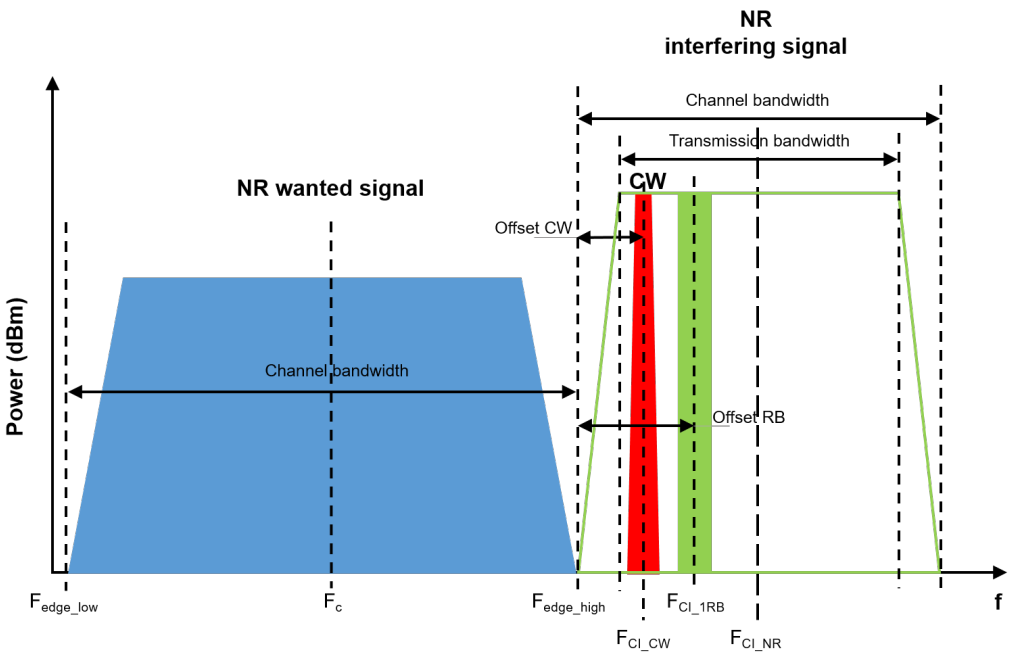
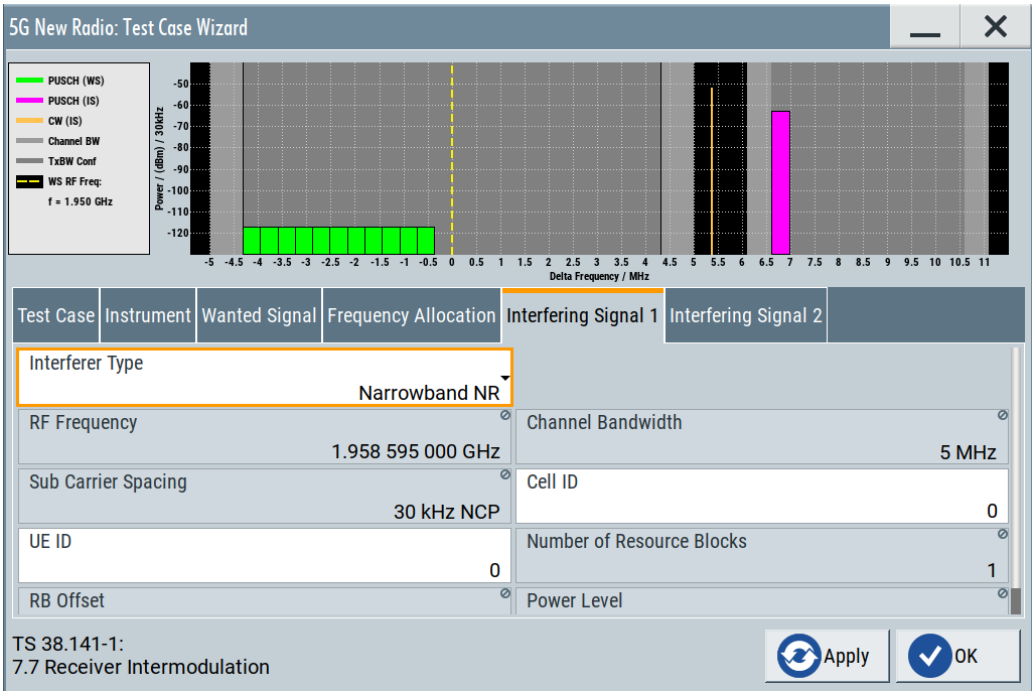


Figure 8-18: Narrowband intermodulation



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA receiver intermodulation for BS type 1-O and BS type 2-O.

For a BS type 1-O, the requirement applies at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and in the following cases:

- If the wanted signal is based on $EIS_{REFSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the FR1 OTA REFSENS RoAoA
- If the wanted signal is based on $EIS_{minSENS}$, the AoA of the incident wave of a received signal and the interfering signal are within the minSENS RoAoA.

For a BS type 2-O the throughput must be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted signal at the assigned channel frequency and two OTA interfering signals provided at the RIB as defined in TS 38.141-2. All of the OTA test signals arrive from the same direction, and the requirement is valid if the signals arrive from any direction within the FR2 OTA REFSENS RoAoA.

Refer to the specification TS 38.141-2, chapter 7.8 OTA receiver intermodulation for more information on the test requirements.

8.11.12 Test case 7.9: OTA in-channel selectivity

Test purpose

To verify the BS receiver ability to suppress the IQ leakage.

Required options

See Chapter 8.11.1, "Required options", on page 467.

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

For two paths measurements, see Chapter 8.4.2.2, "Exemplary test setup - two paths", on page 349.

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 ha to be an 5G NR signal with the same bandwidth as the wanted signal. The wanted and the interfering signal are allocated adjacently around the center frequency. To swap the position of the wanted and interfering signal, use the parameter "Frequency Allocation".

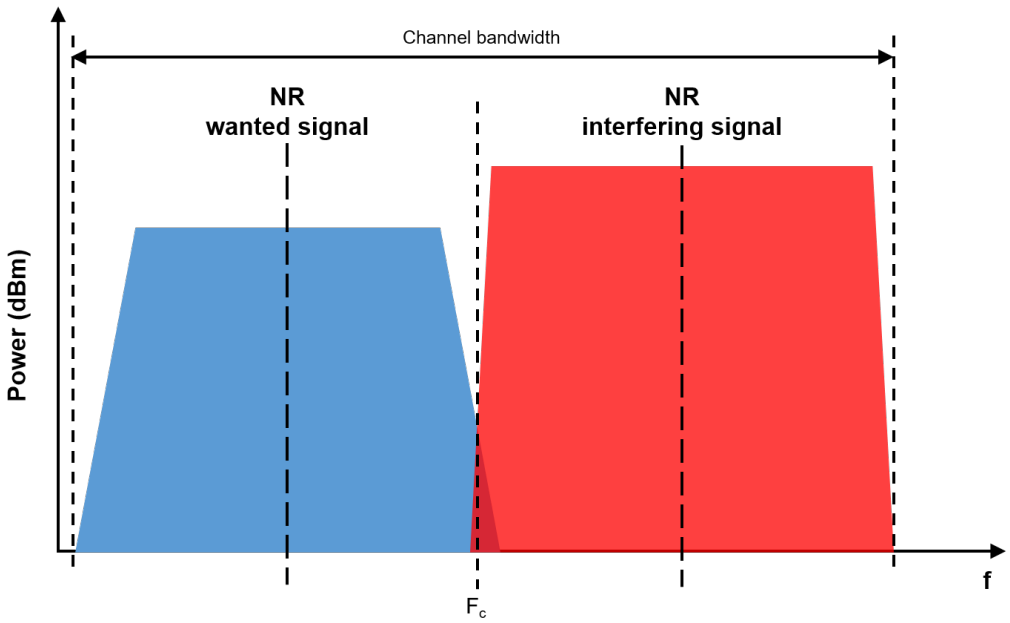


Figure 8-19: OTA in-channel selectivity

In a one-path instrument, the wanted and the interfering 5G NR 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

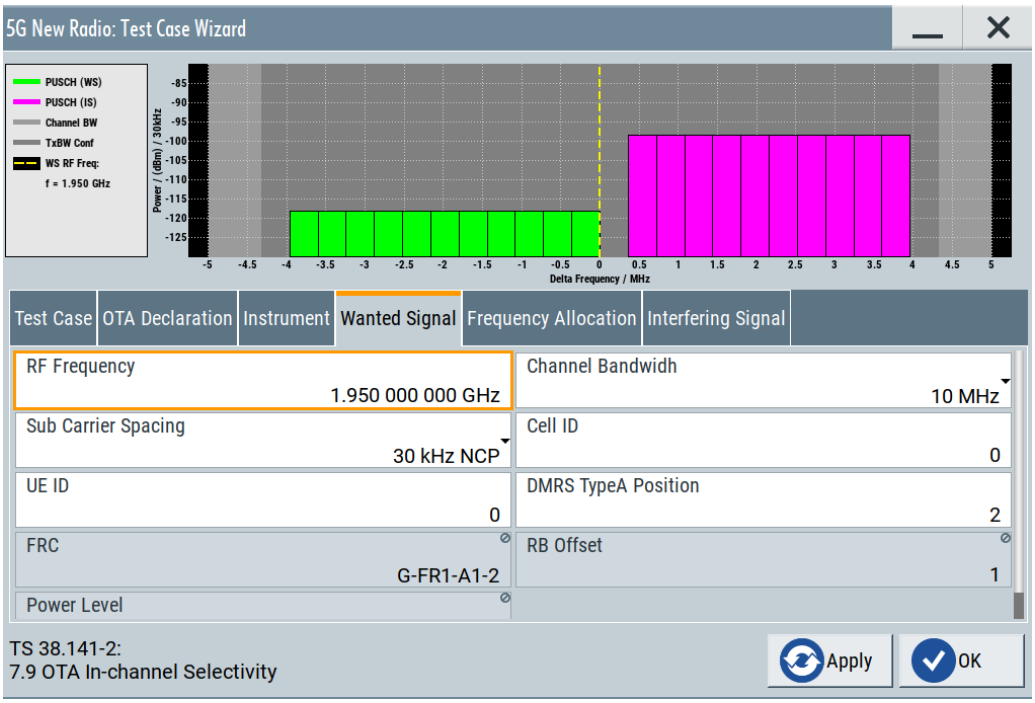
handled in the baseband. As the interferer level is higher, it is used as a reference; the level of the wanted signal is set relatively lower to the interferer.

Perform the test on the channel M as indicated in Table 8-55.

This requirement applies to BS type 1-O and BS type 2-O.

Perform the test on the following directions:

- For BS type 1-O: receiver target reference direction
- For BS type 2-O: OTA REFSENS receiver target reference direction



The general and instrument-related settings are described in Chapter 8.6, "User interface", on page 353.

The settings of the wanted signal are described in Chapter 8.6.6, "Wanted signal settings", on page 361.

Refer to Chapter 8.6.8, "Interfering signal settings", on page 368 for description of the corresponding settings.

Test requirement

The specification TS 38.141-2 defines the requirement to test the OTA in-channel selectivity for BS type 1-O and BS type 2-O.

For a BS type 1-O, the requirement applies at the RIB when the AoA of the incident wave of the received signal and the interfering signal are the same direction and are within the minSENS RoAoA.

For a BS type 2-O the throughput must be ≥ 95% of the maximum throughput of the reference measurement channel as defined in TS 38.141-2.

The wanted and interfering signals applies to each supported polarization, under the assumption of polarization match.

Refer to the specification TS 38.141-2, chapter 7.9 OTA in-channel selectivity for more information on the test requirements.

8.12 Radiated performance characteristics (TS 38.141-2, chapter 8)

The wizard supports 3GPP tests TS 38.141-2, chapter 8: Radiated performance characteristics.

Most of the performance tests can be performed with the signal generator only, i.e. without additional measurement equipment.

The performance requirements are divided into the following main categories, intended to:

- Performance requirements for PUSCH:
  - Test case 8.2.1: OTA PUSCH transform precoding disabled
  - Test case 8.2.2: OTA PUSCH transform precoding enabled
  - Test case 8.2.3: OTA UCI multiplexed on PUSCH
  - Test case 8.2.4: OTA performance requirements for PUSCH for high speed train
  - Test case 8.2.5: OTA performance requirements for UL timing adjustment
  - Test case 8.2.6: OTA performance requirements for PUSCH with 0.001% BLER
  - Test case 8.2.7: OTA performance requirements for PUSCH repetition type A
  - Test case 8.2.8: OTA performance requirements for PUSCH Mapping type B with non-slot transmission
  - Test case 8.2.9: OTA performance requirements for PUSCH msgA for 2-step RA type
  - Test case 8.2.10: OTA performance requirements for interlaced PUSCH
  - Test case 8.2.11: OTA performance requirements for CG-UCI on interlaced PUSCH
- Performance requirements for PUCCH:
  - Test case 8.3.1: OTA performance requirements for PUCCH format 0
  - Test case 8.3.2.1: OTA NACK to ACK detection for PUCCH format 1
  - Test case 8.3.2.2: OTA ACK missed detection for PUCCH format 1
  - Test case 8.3.3.1: OTA ACK missed detection for PUCCH format 2
  - Test case 8.3.3.2: OTA UCI BLER for PUCCH format 2
  - Test case 8.3.4: OTA performance requirements for PUCCH format 3
  - Test case 8.3.5: OTA performance requirements for PUCCH format 4
  - Test case 8.3.6.1A: OTA NACK to ACK detection for multi-slot PUCCH format 1
  - Test case 8.3.6.1B: OTA ACK missed detection for multi-slot PUCCH format 1

- Chapter 8.12.25, "Test case 8.3.7: OTA performance requirements for interlaced PUCCH format 0", on page 532
- Test case 8.3.8.1: OTA NACK to ACK detection for interlaced PUCCH format 1
- Test case 8.3.8.2: OTA ACK missed detection for interlaced PUCCH format 1
- Test case 8.3.9: OTA performance requirements for interlaced PUCCH format 2
- Test case 8.3.10: OTA performance requirements for interlaced PUCCH format 3

- Performance requirements for PRACH:
  - Test case 8.4.1: OTA PRACH false alarm probability and missed detection

8.12.1 General

Radiated performance requirements specify the ability of the BS type 1-O or BS type 2-O to correctly demodulate radiated signals in various conditions and configurations. Radiated performance requirements are specified at the RIB.

Radiated performance requirements for the BS are specified for the fixed reference channels and propagation conditions defined in TS 38.104 annex A and annex J, respectively. The requirements only apply to those FRCs that are supported by the base station.

The radiated performance requirements for BS type 1-O and for the BS type 2-O are limited to two OTA demodulations branches.

Conformance requirements can only be tested for 1 or 2 demodulation branches depending on the number of polarizations supported by the BS, with the required SNR applied separately per polarization.

Unless stated differently, radiated performance requirements apply for a single carrier only. Radiated performance requirements for a base station supporting carrier aggregation are defined in terms of single carrier requirements.

For BS type 1-O in FDD operation, the requirements in TS 38.141-2 chapter 8 must be met with the transmitter units associated with the RIB in the operating band turned ON.

In tests performed with signal generators, a synchronization signal may be provided from the base station to the signal generator, to enable correct timing of the wanted signal.

The SNR is specified based on a single carrier and defined as follows:

SNR = S / N.

Where:

S = the total signal energy in a slot on a RIB.

N = the noise energy in a bandwidth corresponding to the transmission bandwidth over the duration of a slot.

OTA demodulation branches

Radiated performance requirements are only specified for up to 2 demodulation branches.

If the BS type 1-O or the BS type 2-O uses polarization diversity and can maintain isolation between the signals for each of the demodulation branches, then radiated performance requirements can be tested for up to two demodulation branches, i.e. 1Rx or 2Rx test setups.

When tested for two demodulation branches, each demodulation branch maps to one polarization. If the base station does not use polarization diversity, then radiated performance requirements can only be tested for only a single demodulation branch, i.e. 1Rx test setup.

8.12.2 General workflow for carrying out a radiated performance test

The following instruction lists the general steps for performing a BS radiated 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 OTA chamber, refer to the corresponding description.

1. Select an antenna test system (OTA chamber) that covers the radiated transmitter requirements for the test that you want to perform.
   Note: Several antennas can be required to cover both the NR BS and the whole emission frequency range.
2. Connect the instrument to the selected antenna ports in the OTA chamber as specified for the corresponding test case setup.
   See also Chapter 8.4, "Exemplary test setups", on page 346.
3. Place the base station at the positioner. Align the coordinate system.
4. Align the base station with the test antenna in the declared direction to be tested.
5. Configure beam peak direction according to the declared reference beam direction pair.
6. Set the BS to transmit beams of the same operational band as the OTA REFSENS RoAoA or OSDD being tested.
7. Configure the test case wizard.
   a) Select "Baseband Block > 5G NR > General > Test Case Wizard".
   b) Select a test case, e.g. TS 38.141-2: "8.2.2 OTA PUSCH Transform Precoding Disabled".
   c) Enter additional required parameters, e.g. base station class, OTA declarations, etc.

d) Enter the test frequency of the wanted/interfering signal.
The setting must match with the base station configuration.
e) Select "Apply Settings" to activate the settings.

The signal generator is now ready.

8. Switch on RF output.
9. If necessary, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
See also Chapter 8.5, "General considerations", on page 350.
10. Start the measurement for each supported polarization.
a) Send a start trigger impulse from the base station to the signal generator.

The signal generator starts signal generation.

11. Calculate the results.
12. Repeat the measurement for all OSDDs declared for the BS and supported polarizations.

8.12.3 Test case 8.2.1: OTA PUSCH transform precoding disabled

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.1.

Required options

Table 8-57: Required options for 8.2.1 OTA PUSCH transform precoding disabled

		1 Tx, 2 Rx	2 Tx, 2 Rx[1]
RF path A	B100x	1	1
RF path B	B200x	1	1
BB generator	B9 / B10	1	2
Fading simulator	B14 / B15	2	2
AWGN	K62	1	2
Dyn. fading	K71		
MIMO fading	K74		1
5G NR	K144	1	2
Cl. loop	K145	1	1
5G NR Rel. 16	K148		

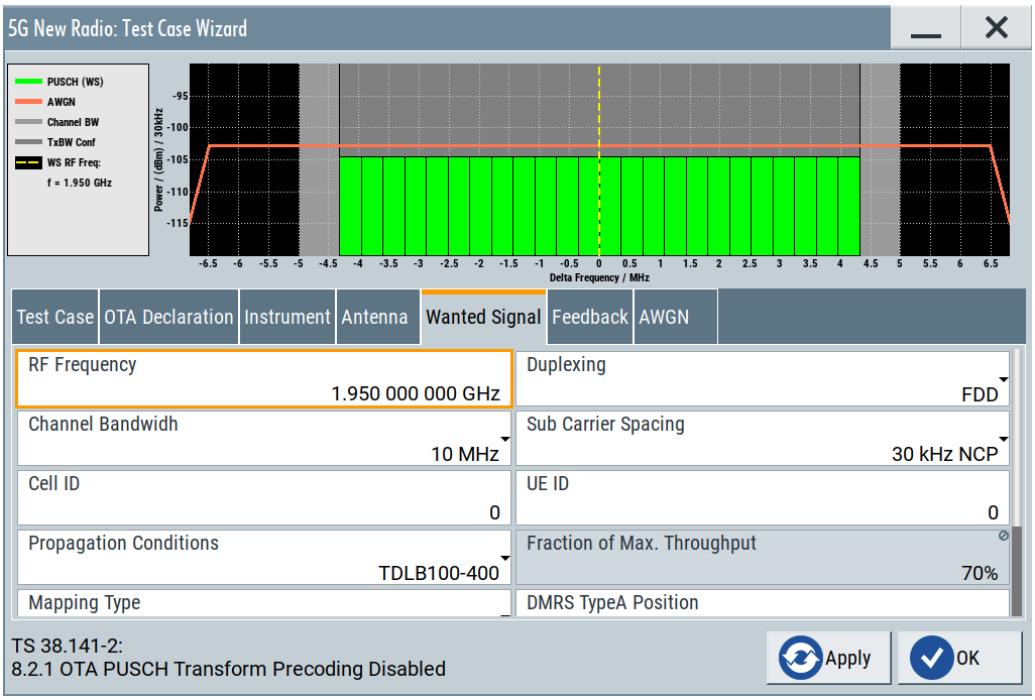
		1 Tx, 2 Rx	2 Tx, 2 Rx[1]
5G NR Rel. 17	K171		
Note: [1]Additional RF port with SGS/SGU or additional R&S SMW (SMW-K19)			

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. [...] The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.4 Test case 8.2.2: OTA PUSCH transform precoding enabled

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.2.

Required options

Table 8-58: Required options for 8.2.2 OTA PUSCH transform precoding enabled

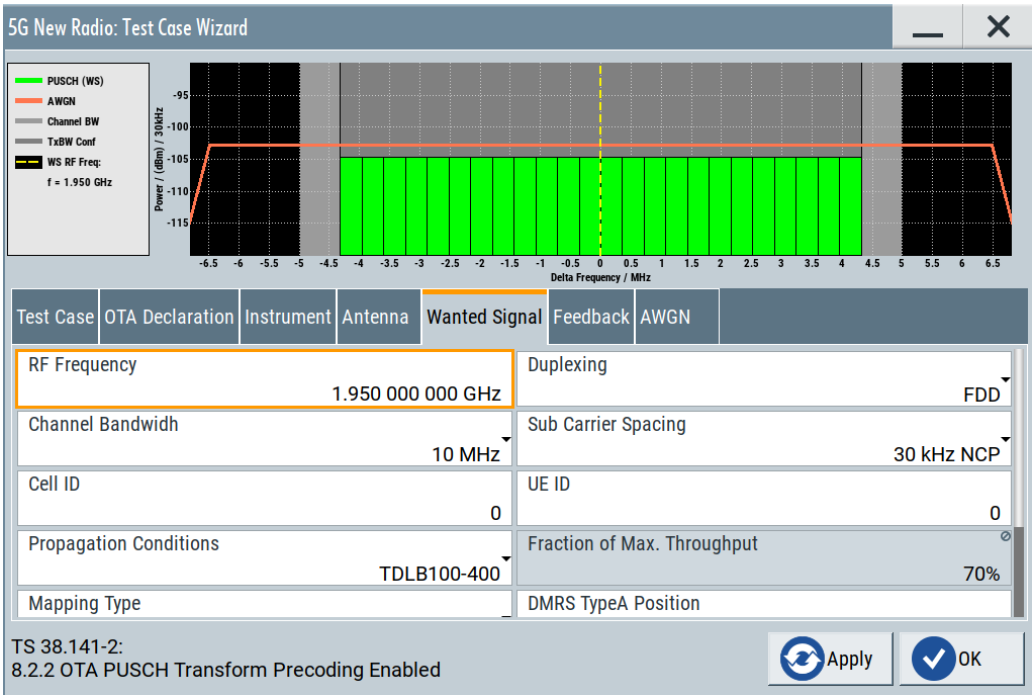
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. [...] The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.5 Test case 8.2.3: OTA UCI multiplexed on PUSCH

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI with CSI part 1 and CSI part 2 bits multiplexed on PUSCH under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.3.

Required options

Table 8-59: Required options for 8.2.3 OTA UCI multiplexed on PUSCH

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

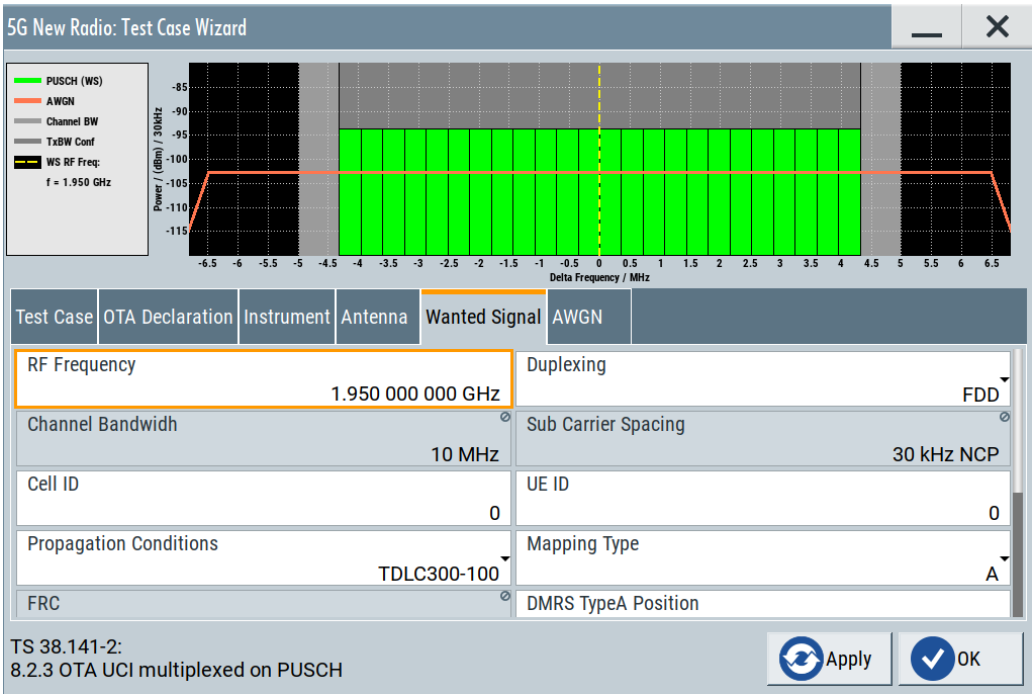
Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of UCI multiplexed on PUSCH is determined by two parameters: block error probability (BLER) of CSI part 1 and block error probability of CSI part 2. The performance is measured by the required SNR at block error probability of CSI part 1 not exceeding 0.1 %, and the required SNR at block error probability of CSI part 2 not exceeding 1 %.

Definitions and specifications for CSI part 1 and CSI part 2 are described in detail in 3GPP 38.141-2, chapter 8.2.3.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.6 Test case 8.2.4: OTA performance requirements for PUSCH for high speed train

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under high speed train and multipath fading propogation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.4.

Required options

Table 8-60: Required options for 8.2.4 OTA performance requirements for PUSCH for high speed train

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1

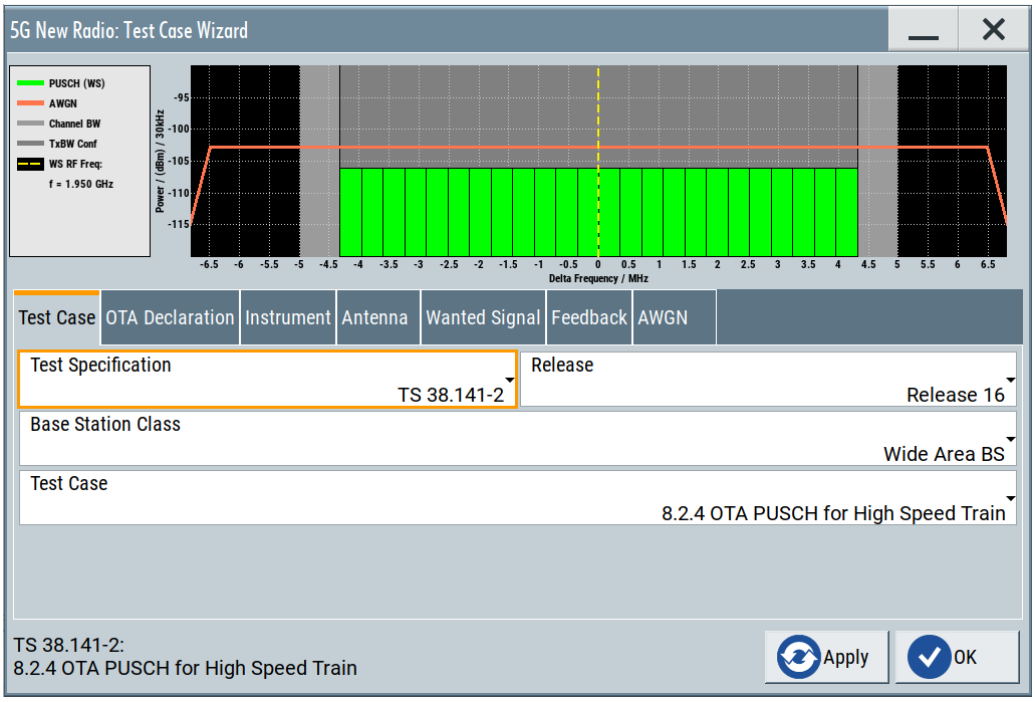
		1 Tx, 2 Rx
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	2
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. [...] The performance requirements assume HARQ re-transmissions. The performance requirements for high speed train conditions are optional.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355

- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.7 Test case 8.2.5: OTA performance requirements for UL timing adjustment

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput measured for the moving UE at given SNR under moving propagation conditions.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.5.

Required options

Table 8-61: Required options for 8.2.5 OTA performance requirements for UL timing adjustment

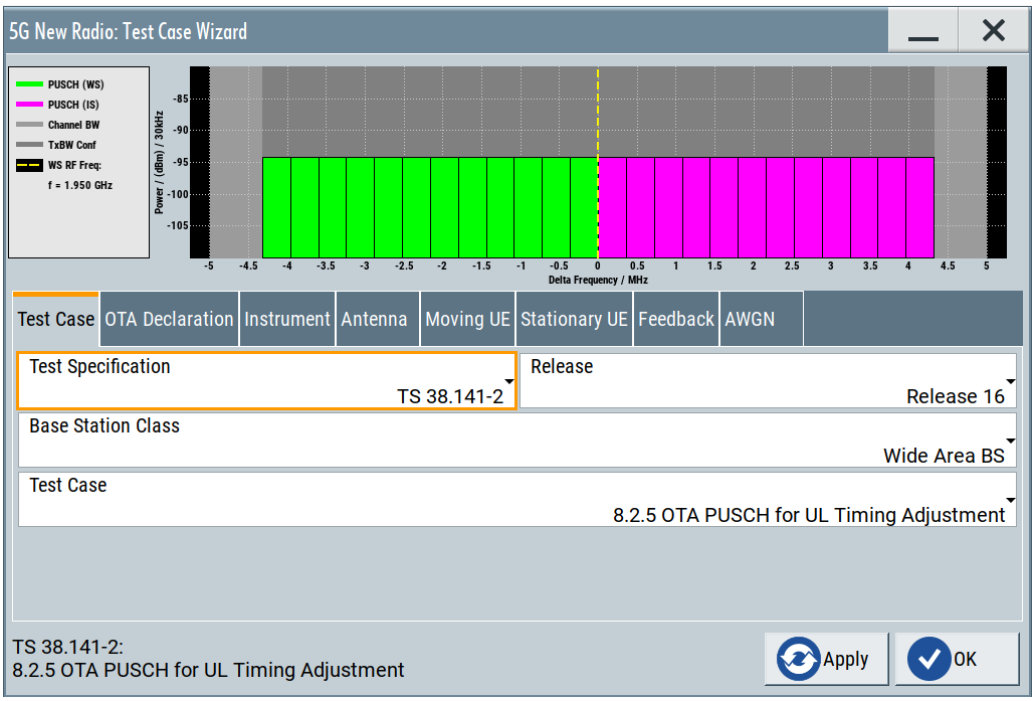
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	1
MIMO fading	K74	1
5G NR	K144	2
Cl. loop	K145	2
5G NR Rel. 16	K148	2
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of UL timing adjustment is determined by a minimum required throughput for the moving UE at given SNR. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.9, "Moving UE settings", on page 372
- Chapter 8.6.10, "Stationary UE settings", on page 374
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.8 Test case 8.2.6: OTA performance requirements for PUSCH with 0.001% BLER

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve 0.001% BLER under AWGN conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.6.

Required options

Table 8-62: Required options for 8.2.6 OTA performance requirements for PUSCH with 0.001% BLER

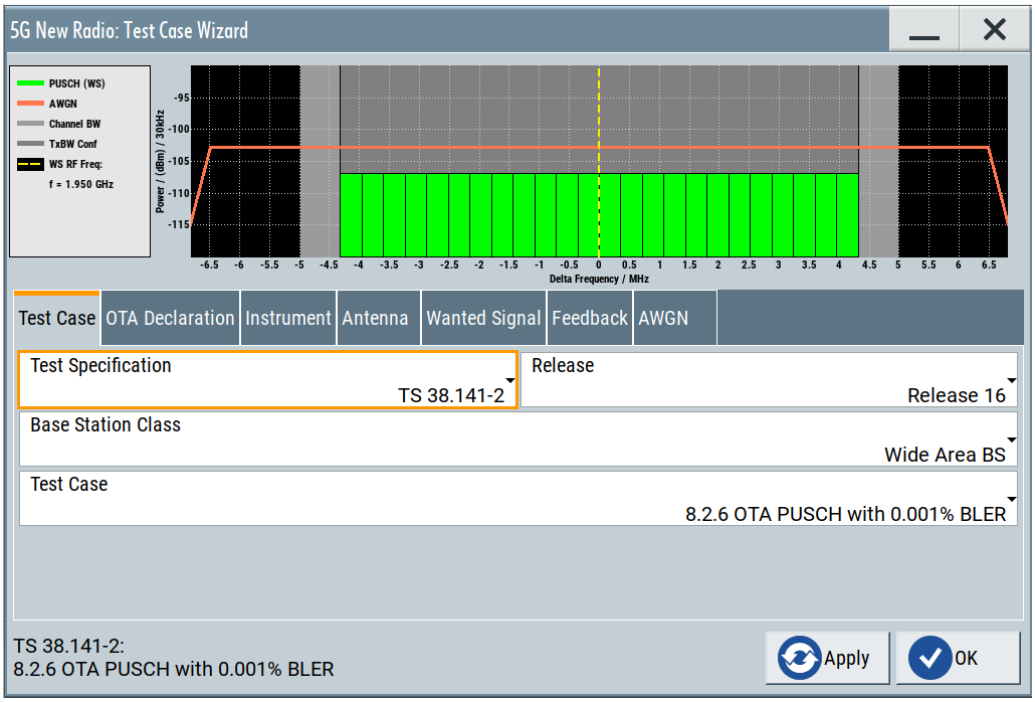
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH is determined by a maximum required transport block error rate (BLER) for a given SNR.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.9 Test case 8.2.7: OTA performance requirements for PUSCH repetition type A

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve target block error probability of PUSCH repetition Type A under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.7

Required options

Table 8-63: Required options for 8.2.7 OTA performance requirements for PUSCH repetition type A

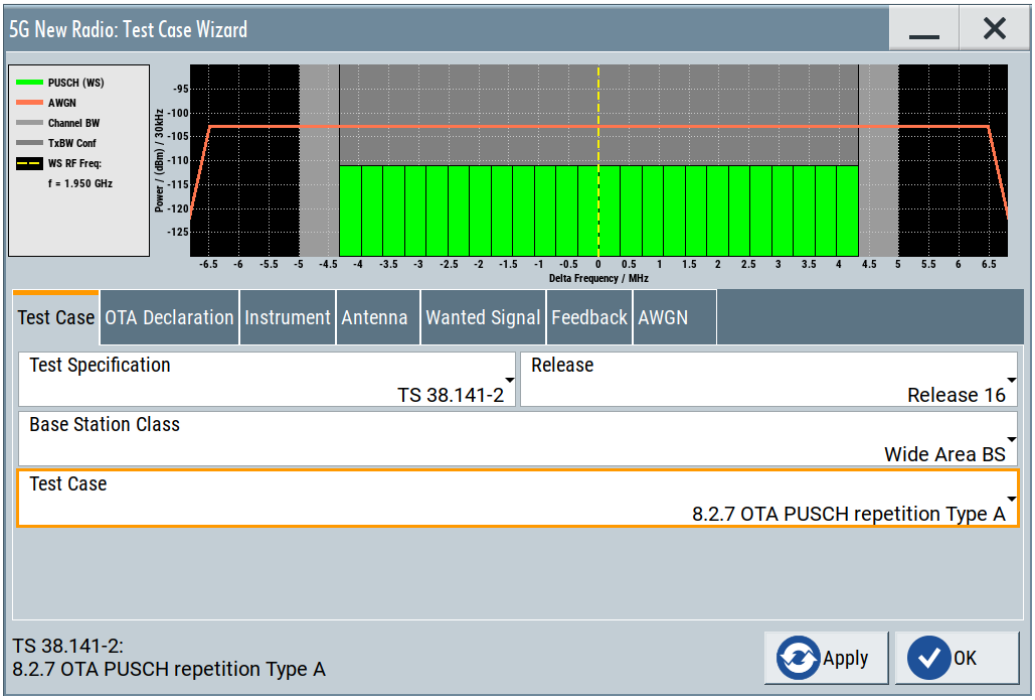
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH repetition Type A is determined by block error probability (BLER). The performance is measured by the required SNR at block error probability of PUSCH data not exceeding 1 %. The performance requirements assume HARQ re-transmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.10 Test case 8.2.8: OTA performance requirements for PUSCH Mapping type B with non-slot transmission

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under scenarios with non-slot PUSCH Type B transmission for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.8.

Required options

Table 8-64: Required options for 8.2.8 OTA performance requirements for PUSCH Mapping type B with non-slot transmission

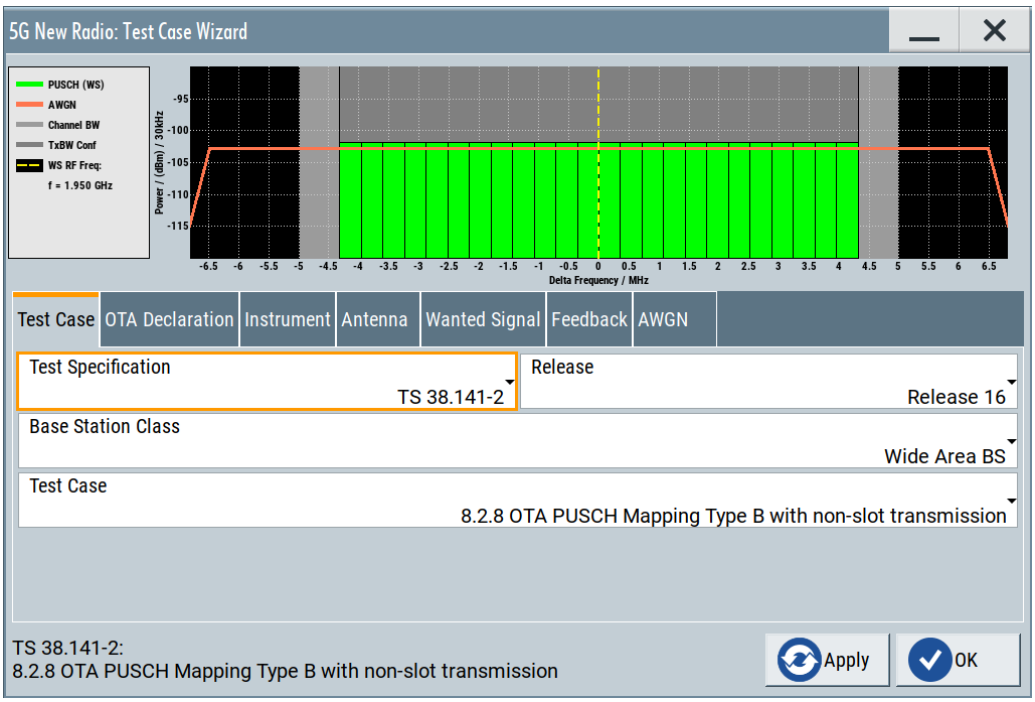
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH mapping type B with non-slot transmission is determined by a minimum required throughput for a given SNR.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.11 Test case 8.2.9: OTA performance requirements for PUSCH msgA for 2-step RA type

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect MsgA PUSCH under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.9.

Required options

Table 8-65: Required options for 8.2.9 OTA performance requirements for PUSCH msgA for 2-step RA type

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

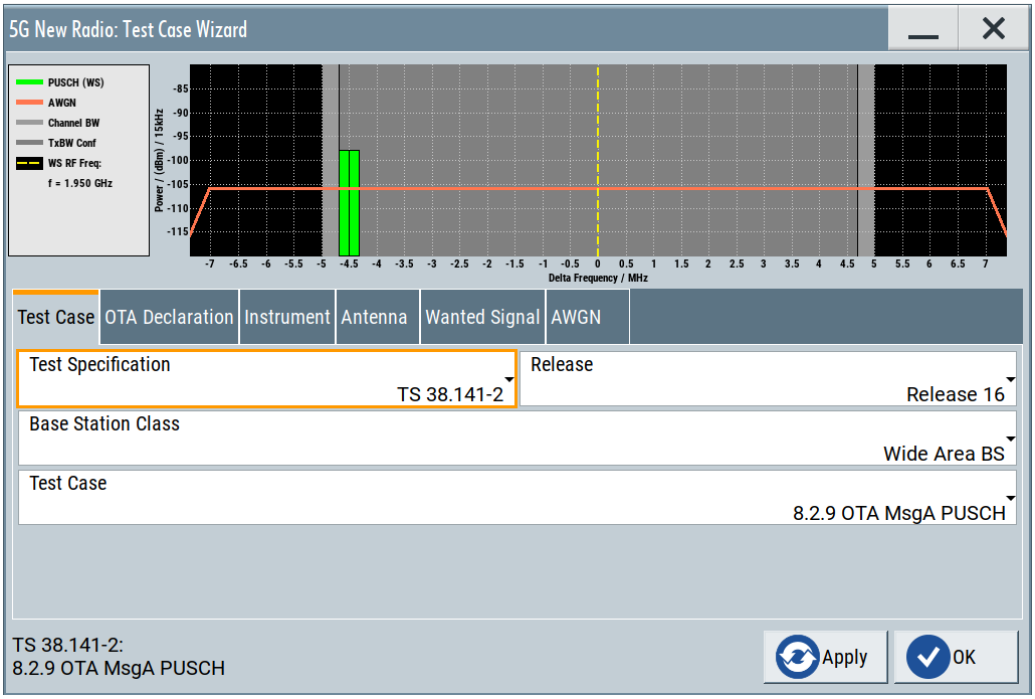
Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of MsgA PUSCH is determined by a minimum required block error rate of MsgA received by BS at given SNR for selected FRCs. The performance requirements assume that the precedent preamble of MsgA is correctly detected. The performance requirements of assume no HARQ retransmission.

These requirements are applicable for wide area and medium range BS that support 2-step RA type. The requirements are not applied for a local area BS that supports 2-step RA type.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.12 Test case 8.2.10: OTA performance requirements for interlaced PUSCH

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.10.

Required options

Table 8-66: Required options for 8.2.10 OTA performance requirements for interlaced PUSCH

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1

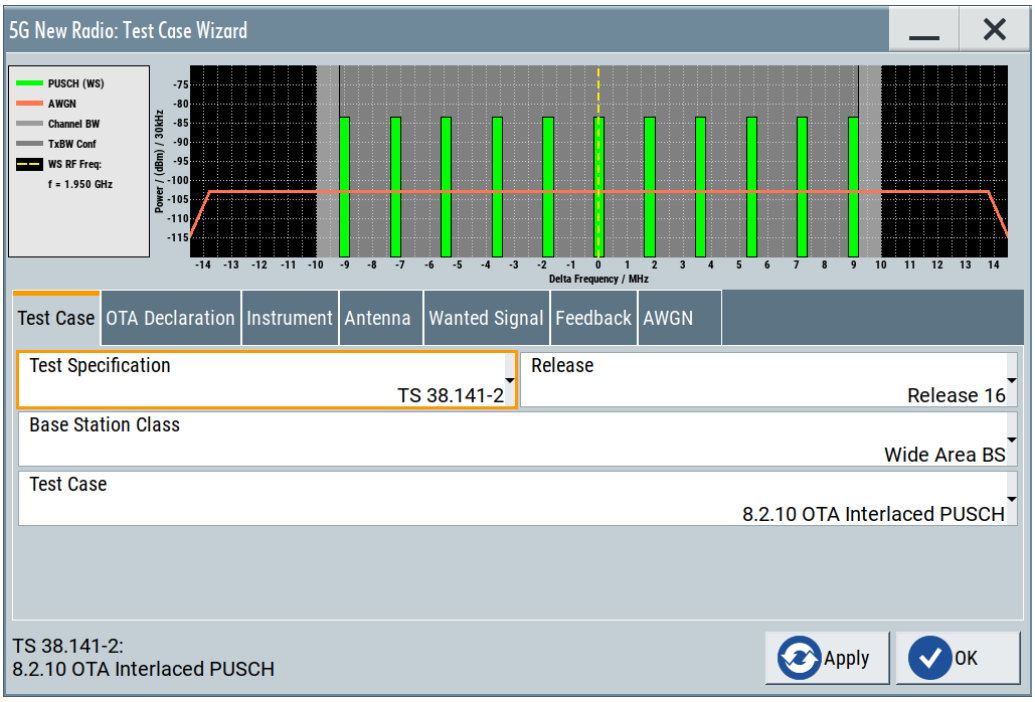
		1 Tx, 2 Rx
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH with interlace allocation is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357

- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.13 Test case 8.2.11: OTA performance requirements for CG-UCI on interlaced PUSCH

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect CG-UCI multiplexed on interlaced PUSCH under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.11.

Required options

Table 8-67: Required options for 8.2.11 OTA performance requirements for CG-UCI on interlaced PUSCH

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	

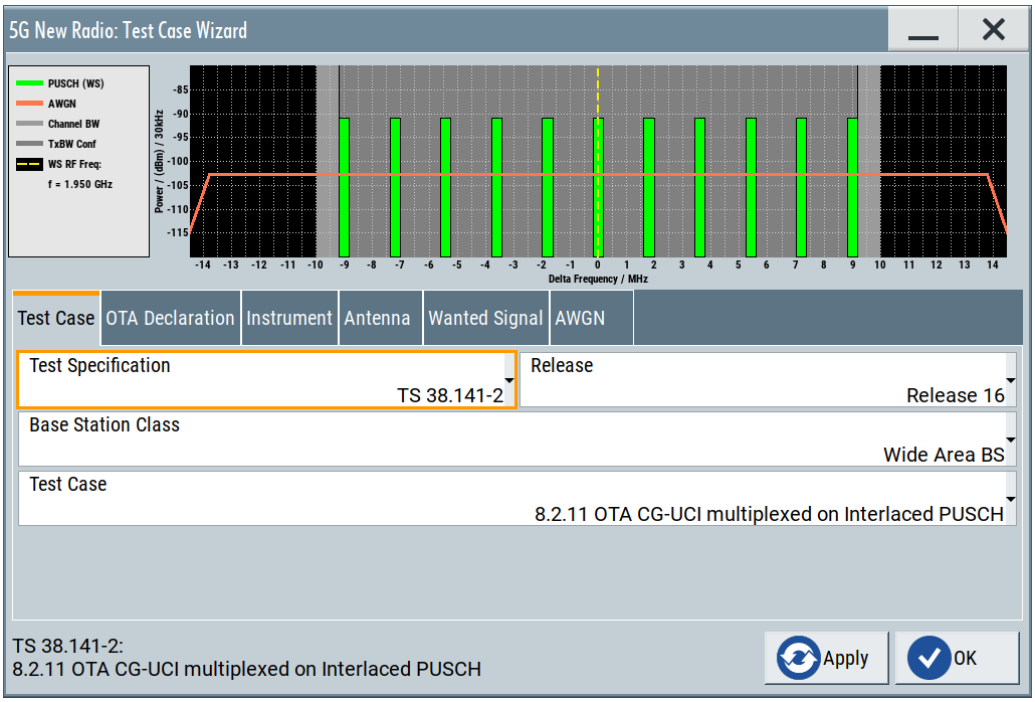
Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of CG-UCI multiplexed on interlaced PUSCH is determined by the parameter: block error probability (BLER) of CG-UCI. The performance is measured by the required SNR at block error probability of CG-UCI not exceeding 1 %.

The CG-UCI BLER is defined as the probability of incorrectly decoding the CG-UCI information when the CG-UCI information is sent.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.14 Test case 8.2.12: OTA performance requirements for TB processing over multi-slot PUSCH (TBoMS)

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.12.

Required options

Table 8-68: Required options for 8.2.12 Performance requirements for TB processing over multi-slot PUSCH (TBoMS)

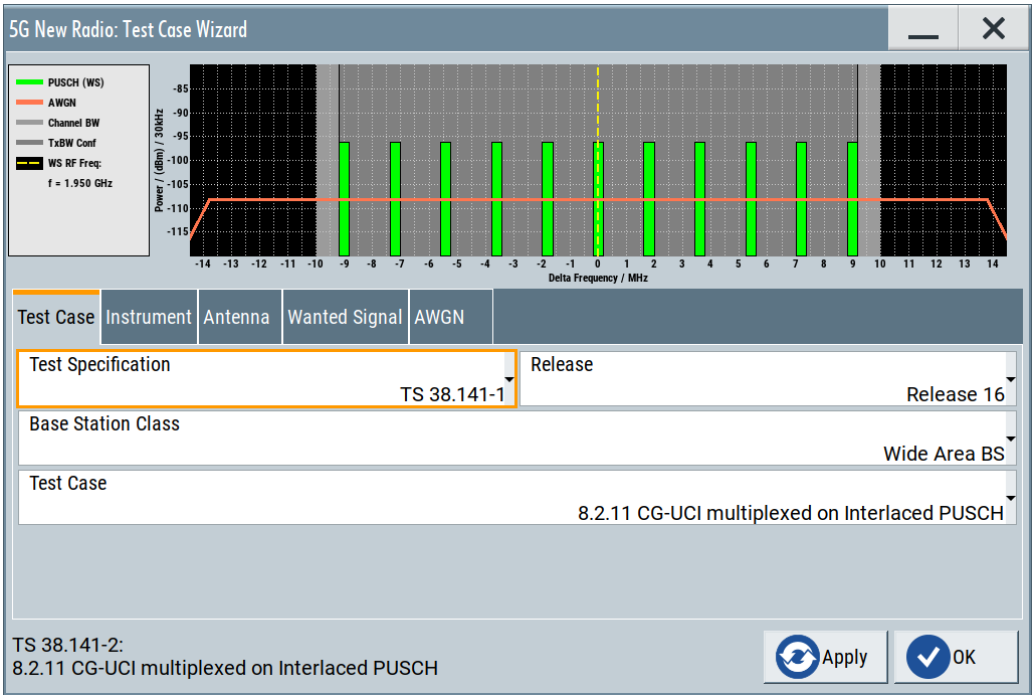
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH with DMRS bundling is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.15 Test case 8.2.13: OTA performance requirements for PUSCH with DMRS bundling

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to achieve throughput under multi-path fading propagation conditions for a given SNR with DMRS bundling.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.2.13.

Required options

Table 8-69: Required options for 8.2.13 Performance requirements for PUSCH with DMRS bundling

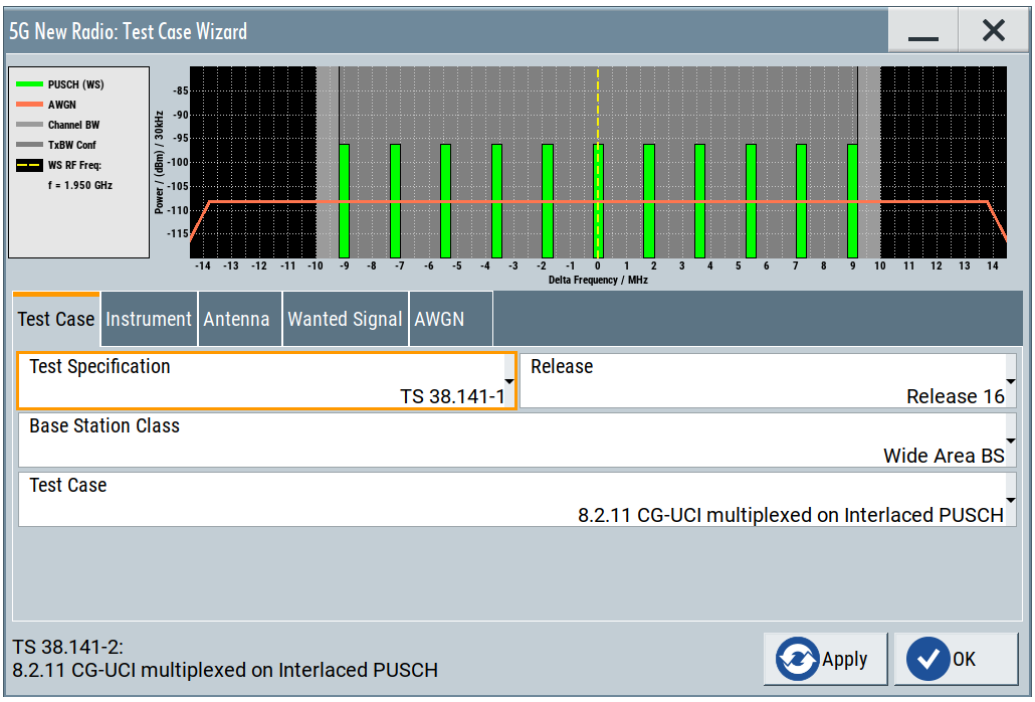
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	1
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUSCH TBoMS is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs. The performance requirements assume HARQ retransmissions.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.11, "Feedback settings", on page 375
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.16 Test case 8.3.1: OTA performance requirements for PUCCH format 0

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.1.

Required options

Table 8-70: Required options for 8.3.1 OTA performance requirements for PUCCH format 0

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

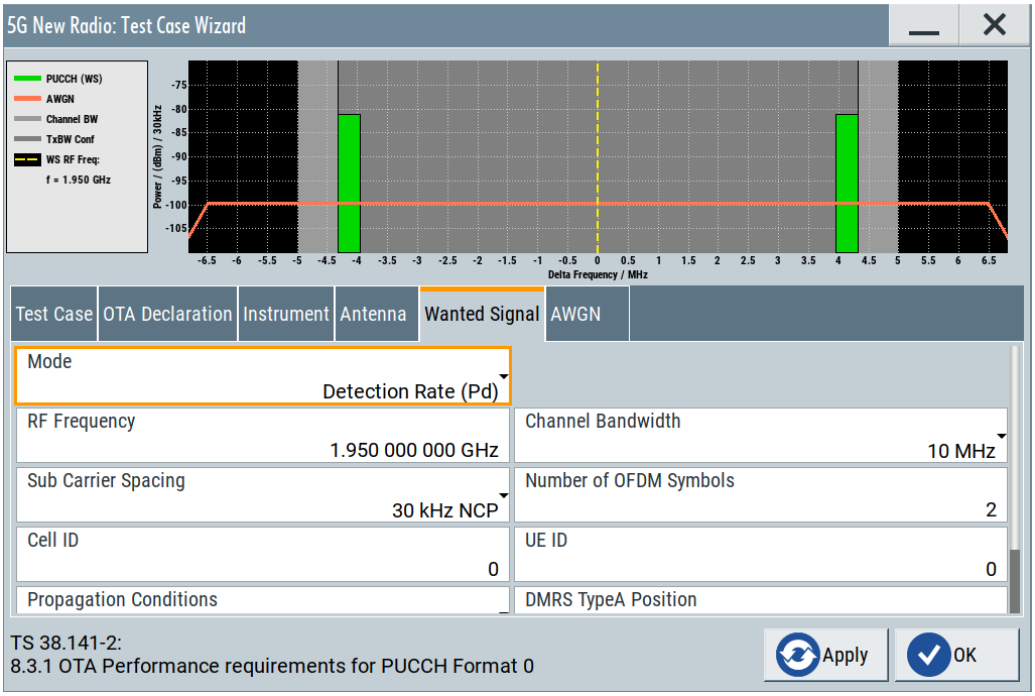
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of single user PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.17 Test case 8.3.2.1: OTA NACK to ACK detection for PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.2.1.

Required options

Table 8-71: Required options for 8.3.2.1 OTA NACK to ACK detection for PUCCH format 1

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

		1 Tx, 2 Rx
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

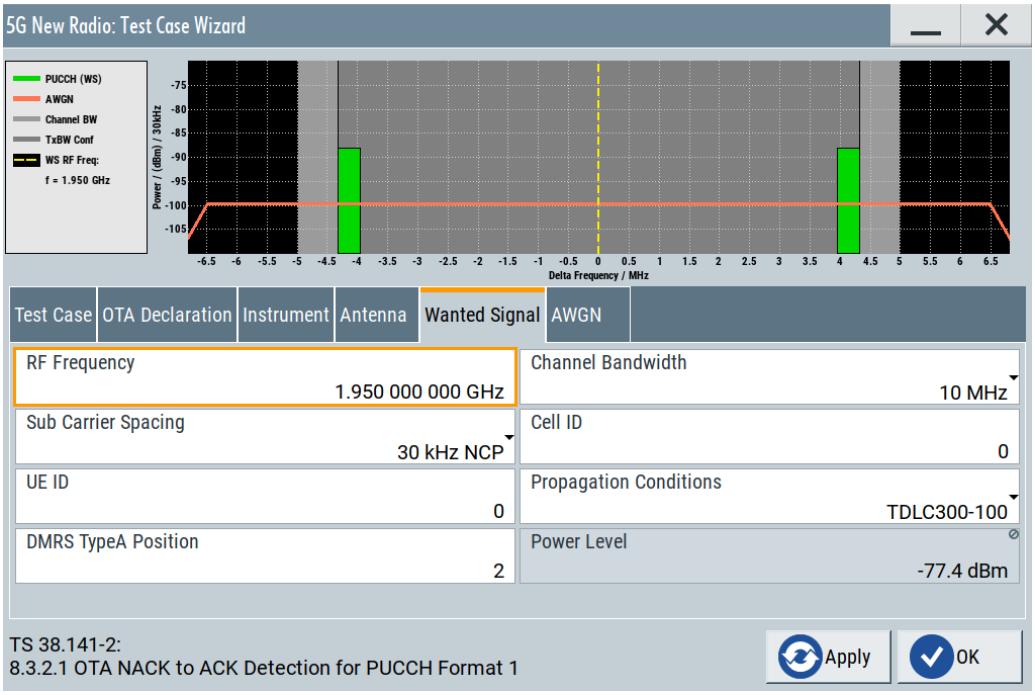
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK at particular bit position when input is only noise. Each false bit detection is counted as one error.

The NACK to ACK detection probability is the probability of detecting an ACK bit when an NACK bit was sent on particular bit position. Each NACK bit erroneously detected as ACK bit is counted as one error.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.18 Test case 8.3.2.2: OTA ACK missed detection for PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.2.2.

Required options

Table 8-72: Required options for 8.3.2.2 OTA ACK missed detection for PUCCH format 1

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

		1 Tx, 2 Rx
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

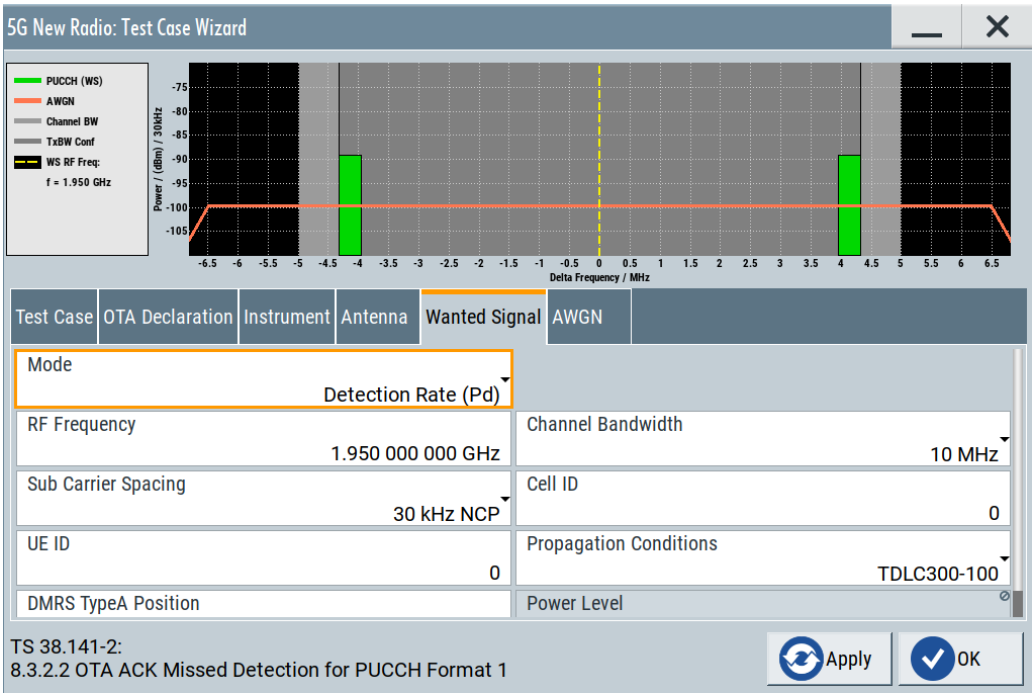
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.19 Test case 8.3.3.1: OTA ACK missed detection for PUCCH format 2

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.3.1.

Required options

Table 8-73: Required options for 8.3.3.1 OTA ACK missed detection for PUCCH format 2

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1

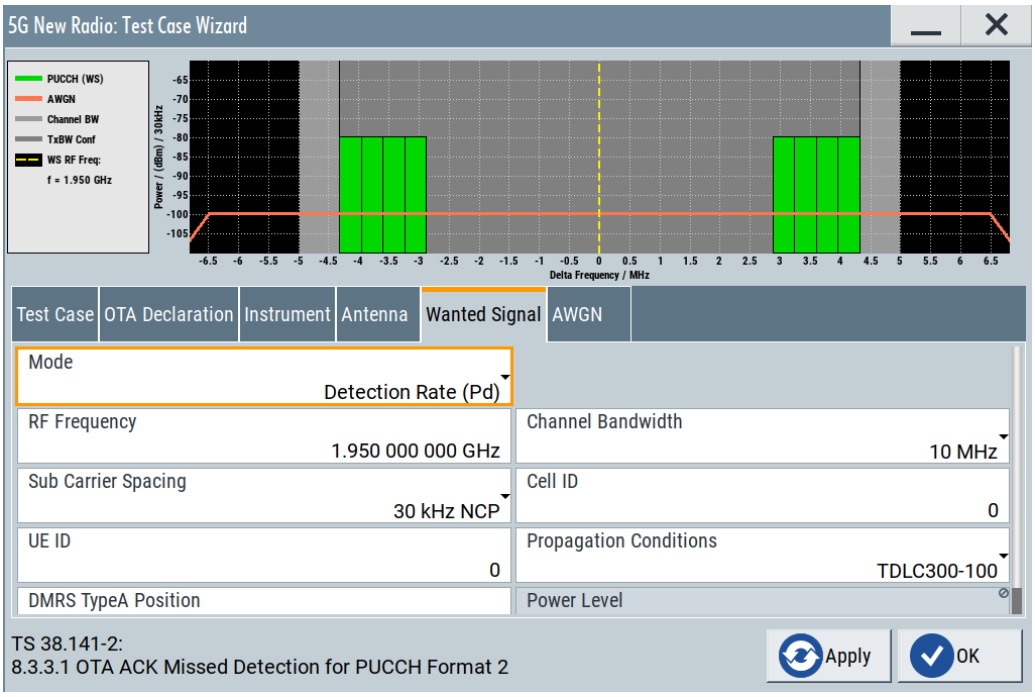
		1 Tx, 2 Rx
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH format 2 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK on the wanted signal. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357

- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.20 Test case 8.3.3.2: OTA UCI BLER for PUCCH format 2

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.3.2.

Required options

Table 8-74: Required options for 8.3.3.2 OTA UCI BLER for PUCCH format 2

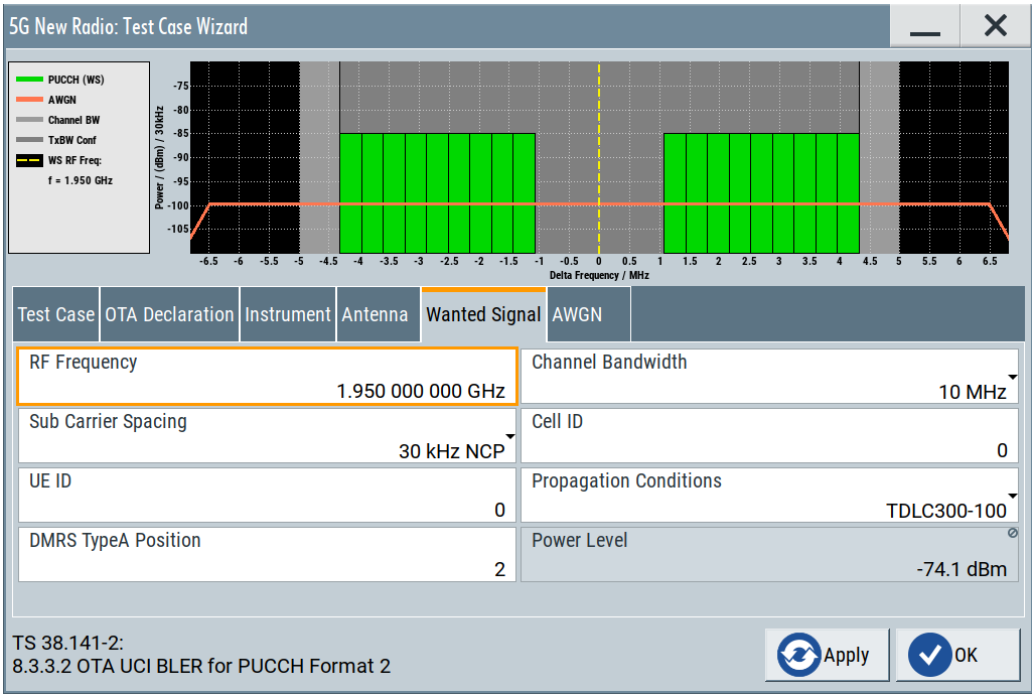
		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The UCI block error probability is defined as the probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.21 Test case 8.3.4: OTA performance requirements for PUCCH format 3

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.4.

Required options

Table 8-75: Required options for 8.3.4 OTA performance requirements for PUCCH format 3

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1

		1 Tx, 2 Rx
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

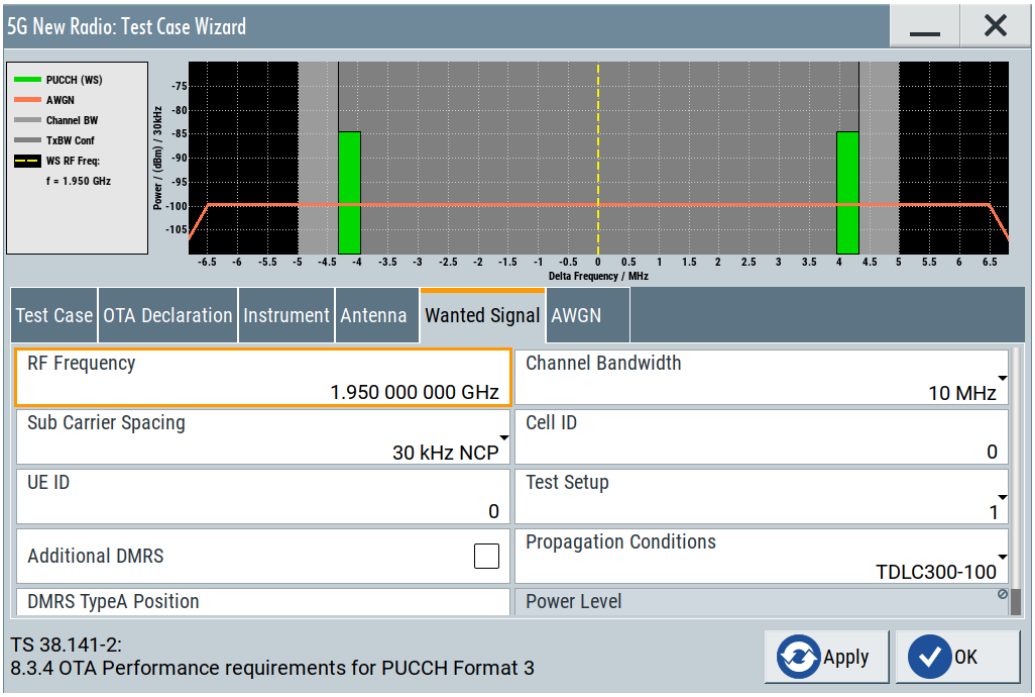
Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.22 Test case 8.3.5: OTA performance requirements for PUCCH format 4

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.5.

Required options

Table 8-76: Required options for 8.3.5 OTA performance requirements for PUCCH format 4

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

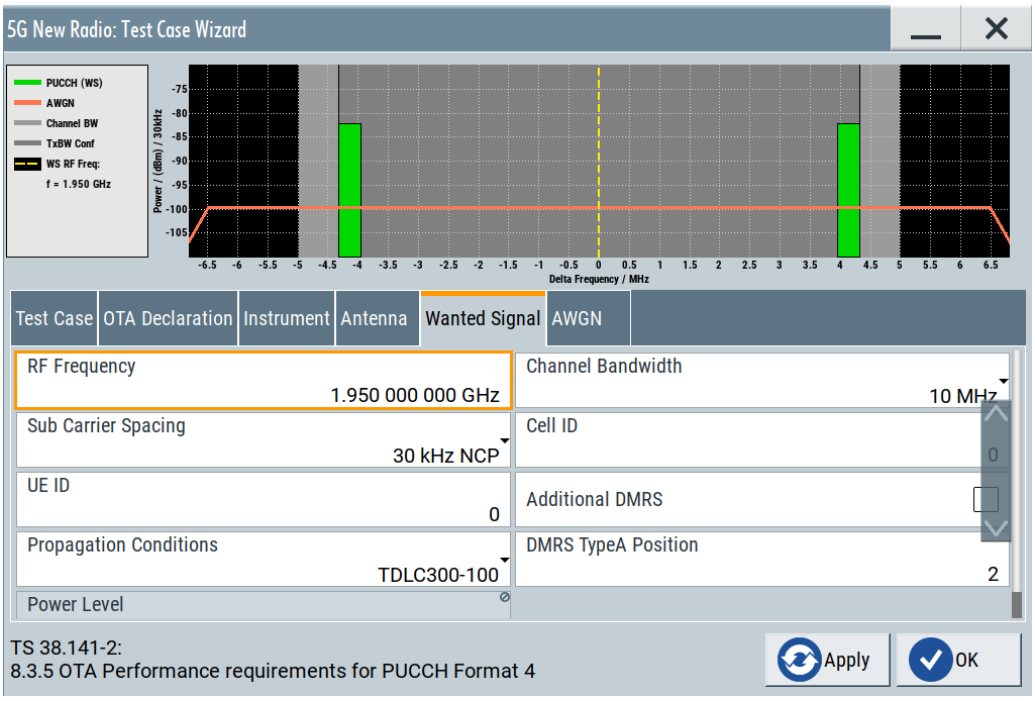
Test setup

See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.23 Test case 8.3.6.1A: OTA NACK to ACK detection for multi-slot PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.6.1.1

Required options

Table 8-77: Required options for 8.3.6.1A NACK to ACK Detection for Multi-Slot PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

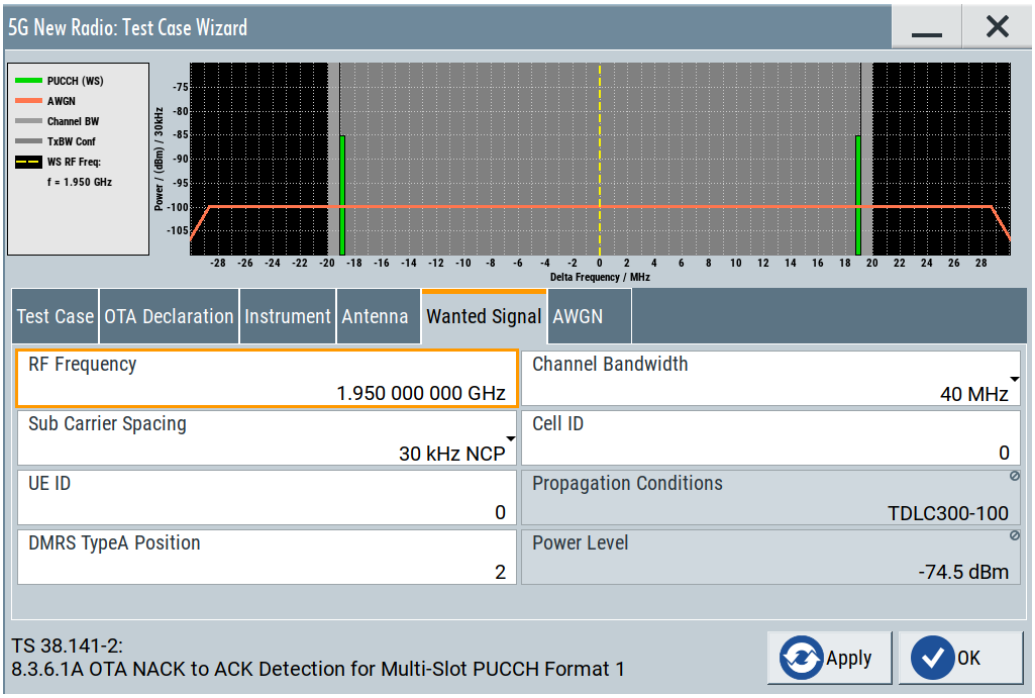
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38-141-2: The performance requirement of PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK at particular bit position when input is only noise. Each false bit detection is counted as one error.

The NACK to ACK detection probability is the probability of detecting an ACK bit when an NACK bit was sent on particular bit position.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.24 Test case 8.3.6.1B: OTA ACK missed detection for multi-slot PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.6.1.2.

Required options

Table 8-78: Required options for 8.3.6.1B ACK Missed Detection for Multi-Slot PUCCH Format 1

RF path A	B100x	1
RF path B	B200x	1

BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

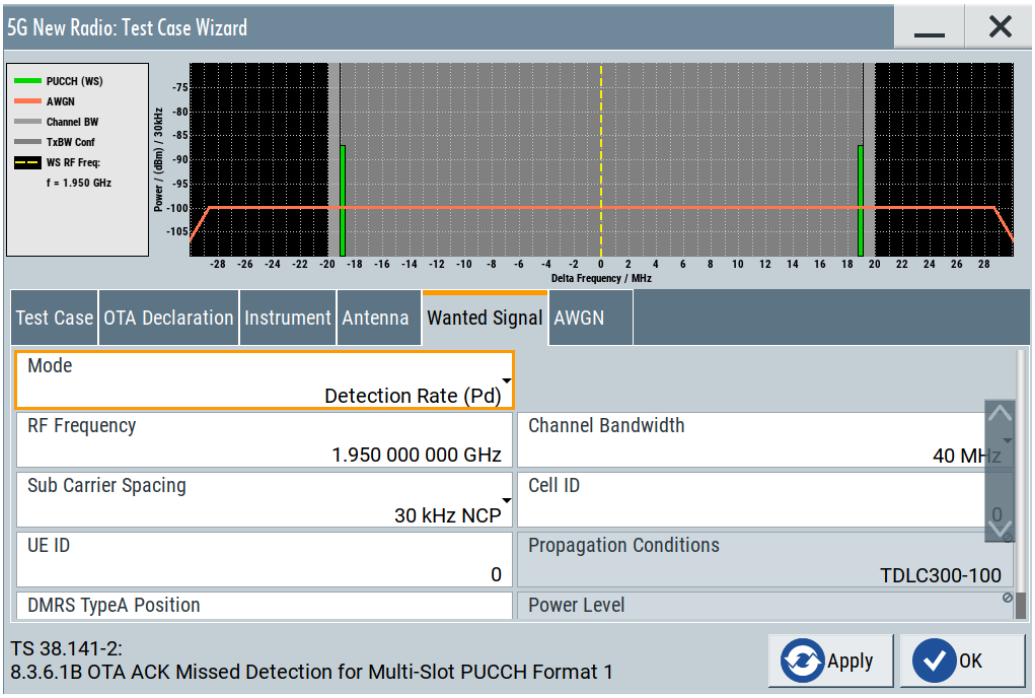
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38-141-2: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.25 Test case 8.3.7: OTA performance requirements for interlaced PUCCH format 0

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.7.

Required options

Table 8-79: Required options for 8.3.7 performance requirements for interlaced PUCCH format 0

RF path A	B100x	1
RF path B	B200x	1

BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

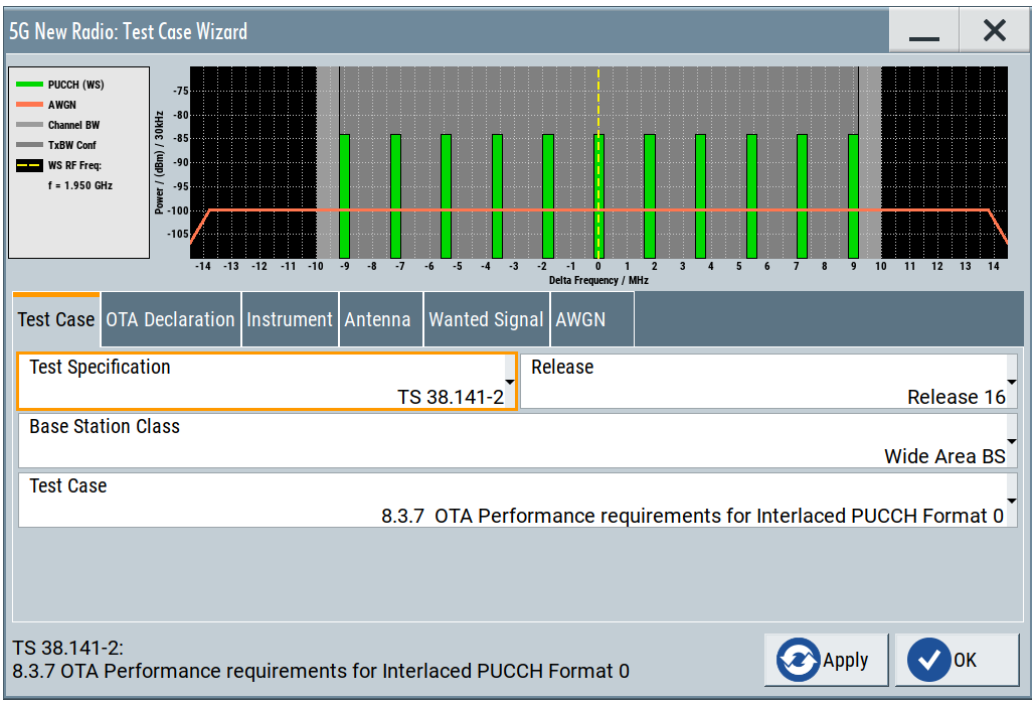
Short description

From 3GPP 38.141-2: The performance requirement of single user interlaced PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 0 with 1 UCI bits. The UCI information only contrains ACK information.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.26 Test case 8.3.8.1: OTA NACK to ACK detection for interlaced PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.8.1.

Required options

Table 8-80: Required options for 8.3.8.1 NACK to ACK detection for interlaced PUCCH format 1

RF path A	B100x	1
RF path B	B200x	1

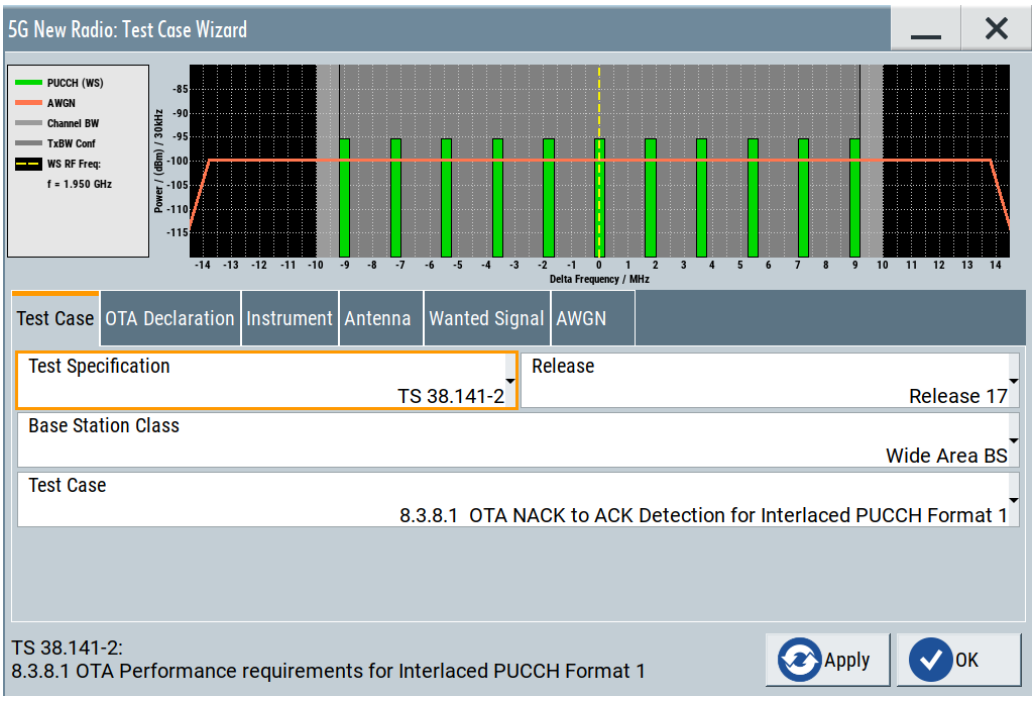
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of interlaced PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.27 Test case 8.3.8.2: OTA ACK missed detection for interlaced PUCCH format 1

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.8.2.

Required options

Table 8-81: Required options for 8.3.8.2 ACK missed detection for interlaced PUCCH format 1

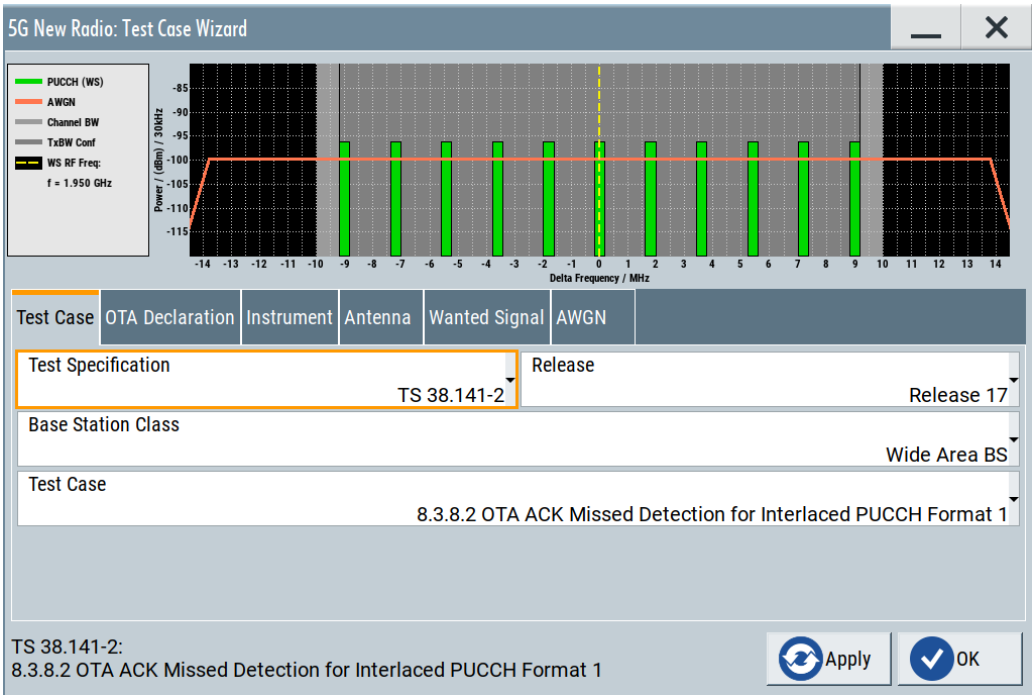
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of interlaced PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.28 Test case 8.3.9: OTA performance requirements for interlaced PUCCH format 2

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.9

Required options

Table 8-82: Required options for 8.3.9 Performance requirements for interlaced PUCCH format 2

RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

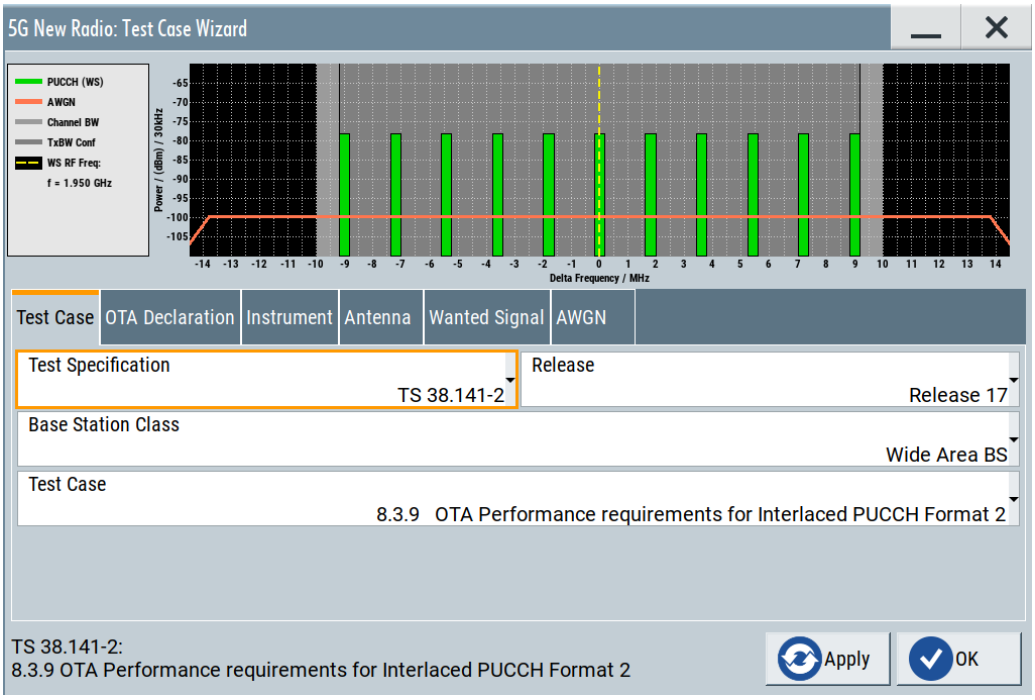
See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

The UCI block error probability is defined as the probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.

The UCI block error probability performance requirement only applies to the PUCCH format 2 with 22 UCI bits.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.29 Test case 8.3.10: OTA performance requirements for interlaced PUCCH format 3

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.10.

Required options

Table 8-83: Required options for 8.3.10 Performance requirements for interlaced PUCCH format 3

RF path A	B100x	1
RF path B	B200x	1

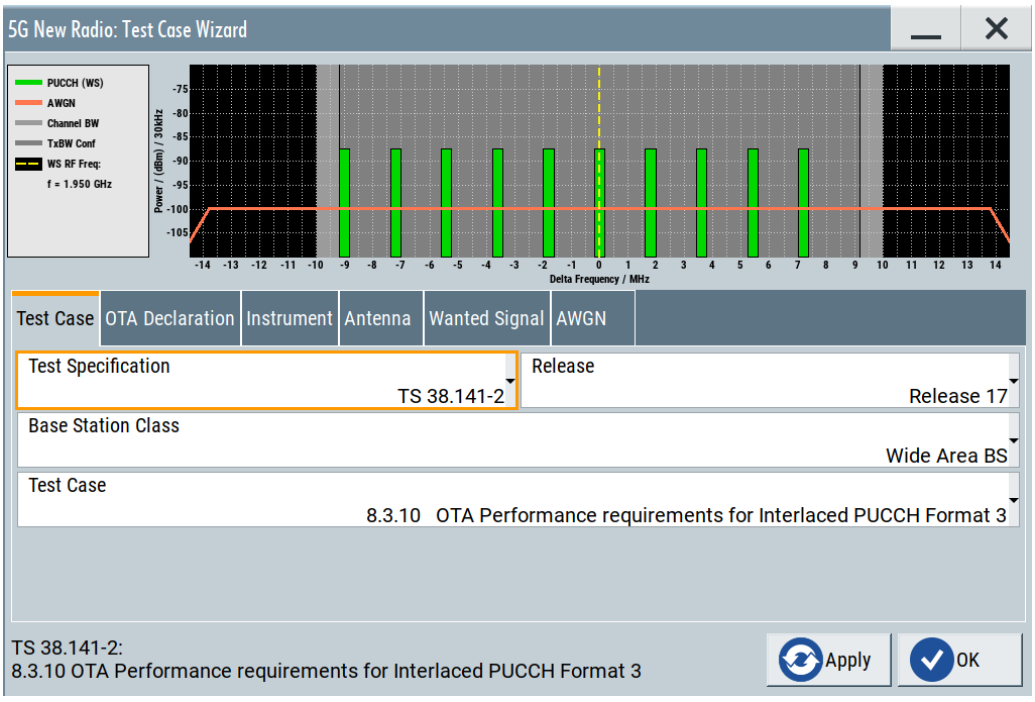
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	1
5G NR Rel. 17	K171	
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of interlaced PUCCH format 3 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK on the wanted signal. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.30 Test case 8.3.11: OTA performance requirements for PUCCH sub-slot based repetition format 0

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.11

Required options

Table 8-84: Required options for 8.3.11 Performance requirements for PUCCH sub-slot based repetition format 0

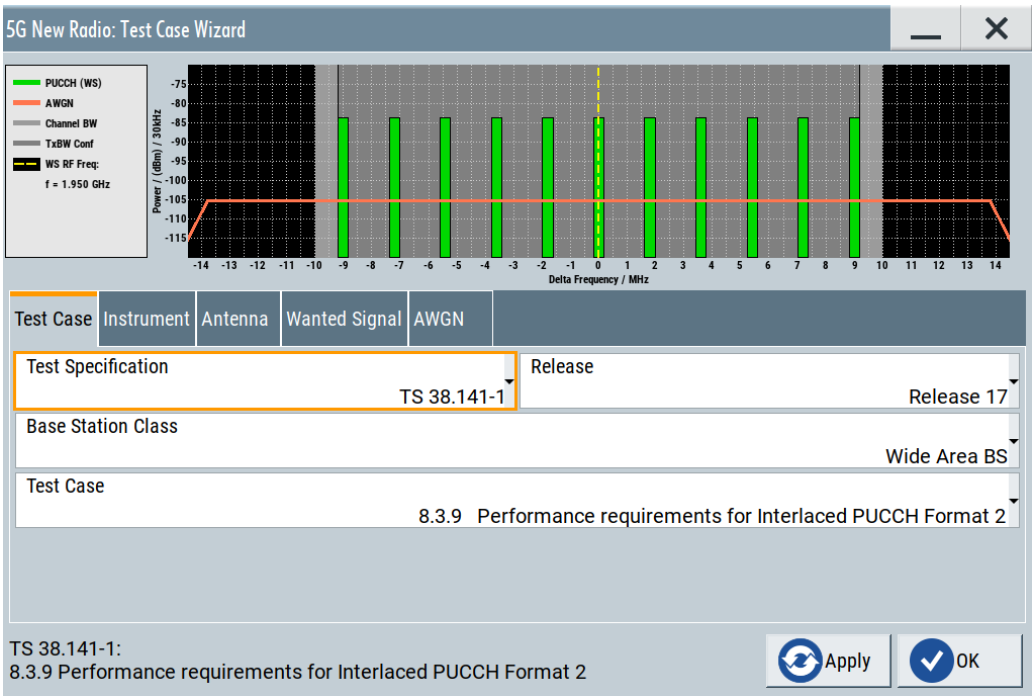
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH sub-slot based repetition format 0 for ACK missed detection is determined by two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.31 Test case 8.3.12.1: OTA NACK to ACK detection for PUCCH format 1 with DM-RS bundling

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.12.1

Required options

Table 8-85: Required options for 8.3.12.1 NACK to ACK detection for PUCCH format 1 with DM-RS bundling

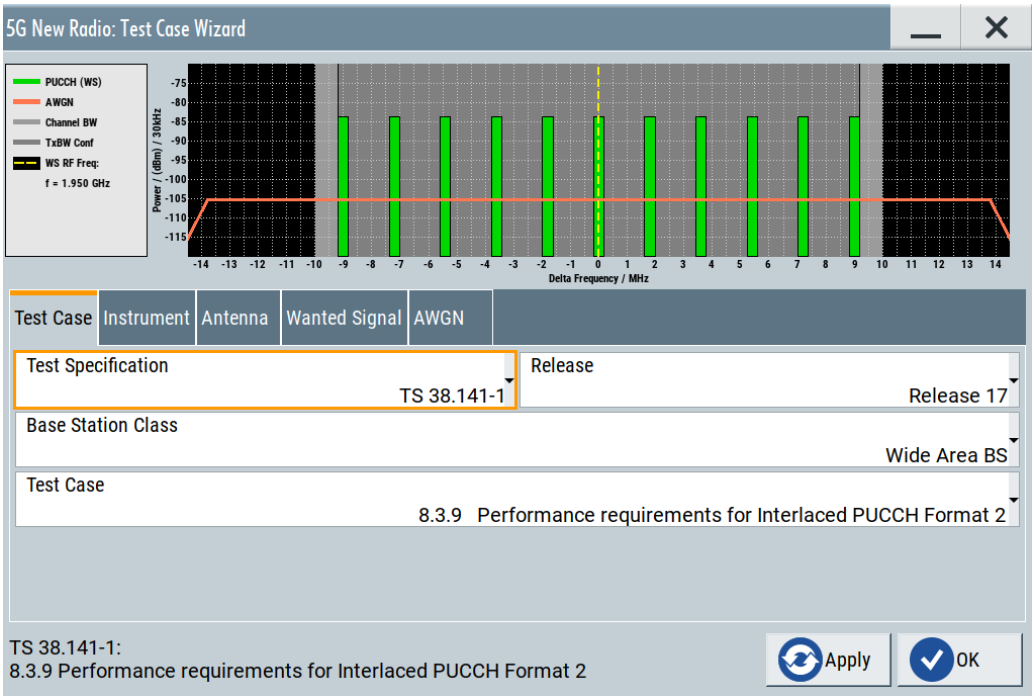
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH format 1 with DM-RS bundling for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1 % or less. The probability of false detection of the ACK shall be 1 % or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.32 Test case 8.3.12.2: OTA ACK missed detection for PUCCH format 1 with DM-RS bundling

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect ACK bits under multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.12.2

Required options

Table 8-86: Required options for 8.3.12.2 ACK missed detection for PUCCH format 1 with DM-RS bundling

RF path A	B100x	1
RF path B	B200x	1

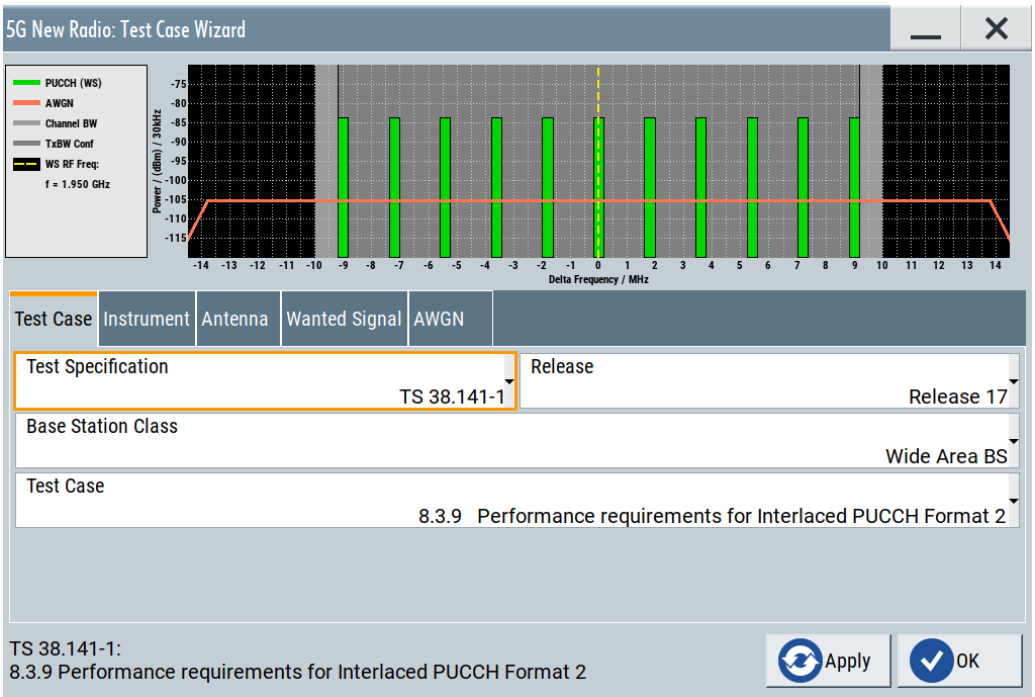
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance requirement of PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.33 Test case 8.3.13: OTA performance requirements for PUCCH format 3 with DM-RS bundling

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.3.13

Required options

Table 8-87: Required options for 8.3.13 Performance requirements for PUCCH format 3 with DM-RS bundling

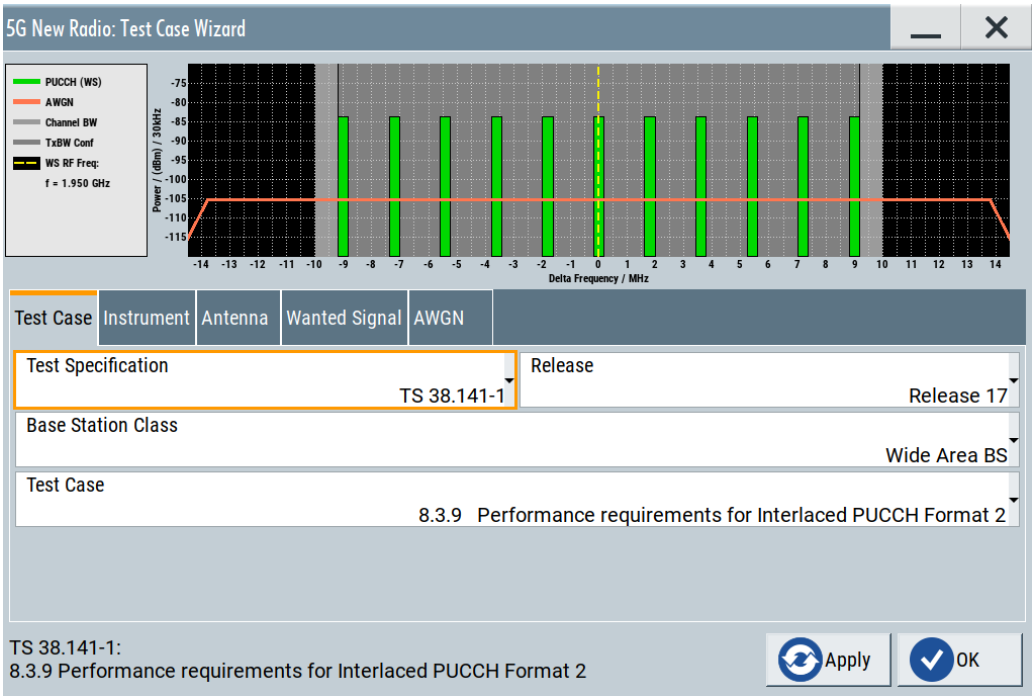
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	2
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	1
Note: Additional SGT required for 4/8 Rx		

Test setup

See Chapter 8.4, "Exemplary test setups", on page 346.

Short description

From 3GPP 38.141-2: The performance is measured by the required SNR at UCI block error probability not exceeding 1%.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

8.12.34 Test case 8.4.1: OTA PRACH false alarm probability and missed detection

Test purpose

From 3GPP 38.141-2: To verify the receiver's ability to detect PRACH preamble under static conditions and multipath fading propagation conditions for a given SNR.

For a detailed description on how to conduct this test case, see 3GPP 38.141-2, chapter 8.4.1

Required options

Table 8-88: Required options for 8.4.1 PRACH flase alarm propability and missed detection

		1 Tx, 2 Rx
RF path A	B100x	1
RF path B	B200x	1
BB generator	B9 / B10	1
Fading simulator	B14 / B15	2
AWGN	K62	1
Dyn. fading	K71	
MIMO fading	K74	
5G NR	K144	1
Cl. loop	K145	
5G NR Rel. 16	K148	
5G NR Rel. 17	K171	

Test setup

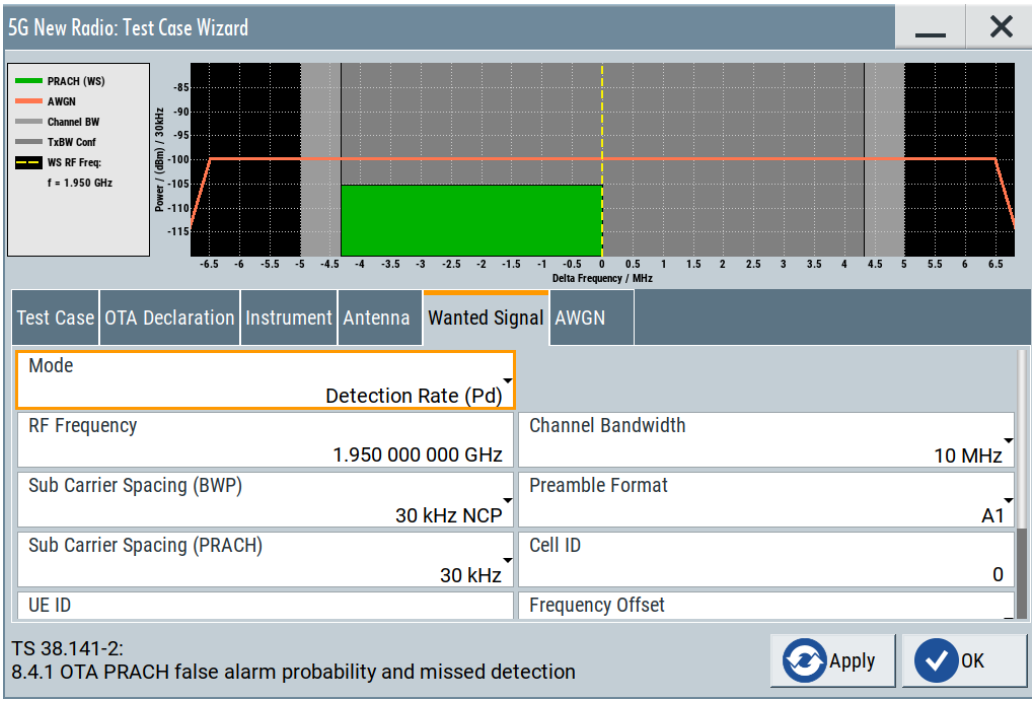
See Chapter 8.4.2, "Exemplary test setups for radiated (OTA) tests (TS 38.141-2)", on page 349.

Short description

From 3GPP 38.141-2: The performance requirement of PRACH for preamble detection is determined by the two parameters: total probability of false detection of the preamble (Pfa) and the probability of detection of preamble (Pd). The performance is measured by the required SNR at probability of detection, Pd of 99%. Pfa shall be 0.1% or less.

Pfa is defined as a conditional total probability of erroneous detection of the preamble (i.e. erroneous detection from any detector) when input is only noise.

Pd is defined as conditional probability of detection of the preamble when the signal is present.



For a description of available settings, refer to:

- Chapter 8.6.2, "Test case settings", on page 355
- Chapter 8.6.3, "OTA declaration", on page 357
- Chapter 8.6.4, "Instrument settings", on page 358
- Chapter 8.6.5, "Antenna settings", on page 361
- Chapter 8.6.6, "Wanted signal settings", on page 361
- Chapter 8.6.12, "AWGN settings", on page 377

9 Real-time feedback for closed loop BS tests

Some test scenarios, like for example the performance test cases specified in TS 38.141-1/-2 or IAB test cases specified in TS 38.176-1/-2, require a feedback line. With R&S SMW equipped with the following options, you can perform closed loop performance tests with feedback.

Required options

Option:

- Standard or wideband baseband generator (R&S SMW-B10/-B9)
- Baseband main module (R&S SMW-B13) or wideband baseband main module (R&S SMW-B13XT)
- Option 5G new radio R&S SMW-K144, per signal path
- Optional, option 5G NR Release 16 R&S SMW-K148, per signal path
- Option real-time feedback R&S SMW-K145, per signal path
- Further options, like R&S SMW-K62 or R&S SMW-B14/-B15/-K71/-K72/-K73/-K74

Real-time feedback principle in the context of 5G New Radio testing

The real-time feedback functionality in 5G New Radio case is similar to the one for the LTE/LTE-A and eMTC/NB-IoT testing. Consider, however, the following differences:

- Supported is serial transmission, with 16 data bits per feedback command
  See Chapter 9.2.1, "Serial modes", on page 553.
- Real-time feedback is enabled:
  - In LxMxN configurations, if coupled mode is used
  - In single-carrier configurations.
- Timing adjustment feedback is supported
- R&S SMW does not send new transport layer data for new transmissions as a UE would do. Hence, feedback of new data indicators or HARQ process indices is not required.
  The feedback mode is suitable for BLER tests, like the performance tests specified in TS 38.141-1. The goal of these tests is checking the CRC rather than the actual transport data.
- PUSCH transmission properties other than redundancy version are not signaled DCI 0_0 or 0_1 grants cannot be signaled. Specify the time and frequency scheduling, transport block size and spatial layer configuration by the corresponding parameters.
- Redundancy version (RV) signaling
  HARQ ACK/NACKmessages are not transmitted over the feedback line. The DUT merely sends feedback signal carrying the **redundancy version (RV)** to be applied for the subsequent PUSCH transmission.
- Asynchronous HARQ
  Signaling only the RV is necessary, because the 5G New Radio relays on an **asynchronous HARQ**.
- HPN mode

If your test situation requires it, you can set the HARQ process number to a specific value.

- Feedback timing
  The feedback timing reference point is derived from the uplink transmission.
  If your test situation requires it, you can set a Feedback Delay and a Processing Delay.
  See Chapter 9.3, "Timing aspects", on page 556.

9.1 Exemplary testing scenario

The test specifications in TS 38.141-1 define the test setups. For example, the test "Performance requirements for PUSCH " can be setup according to the Figure 9-1 and Figure 9-2.

One single instrument is sufficient.

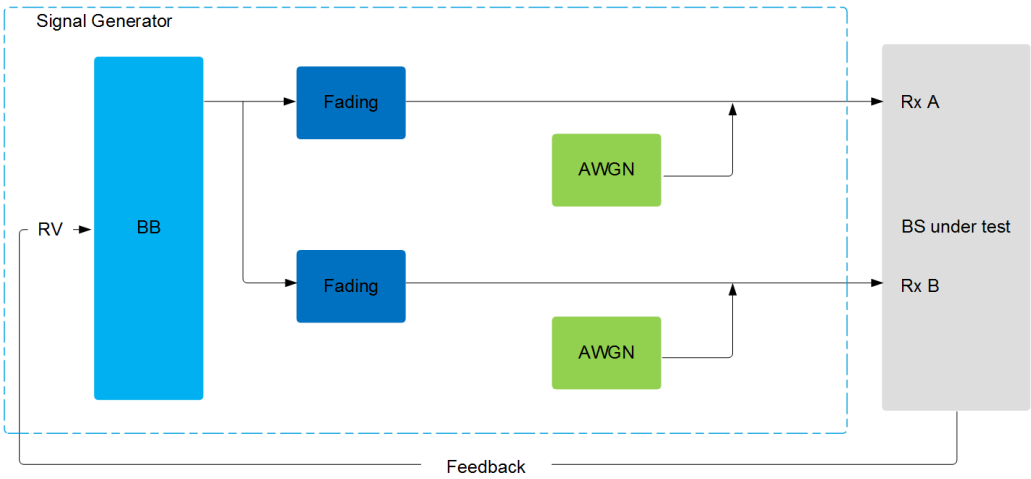


Figure 9-1: Exemplary test scenario (1x1x2 system configuration)

Signal generator = R&S SMW equipped with two baseband paths, see "Required options" on page 550
RV = Redundancy version
BB = Baseband
Fading = Fading simulator (i.e. channel simulator)
AWGN = Additive white Gaussian noise generator
BS = Base station
Feedback = HARQ feedback signal for PUSCH only

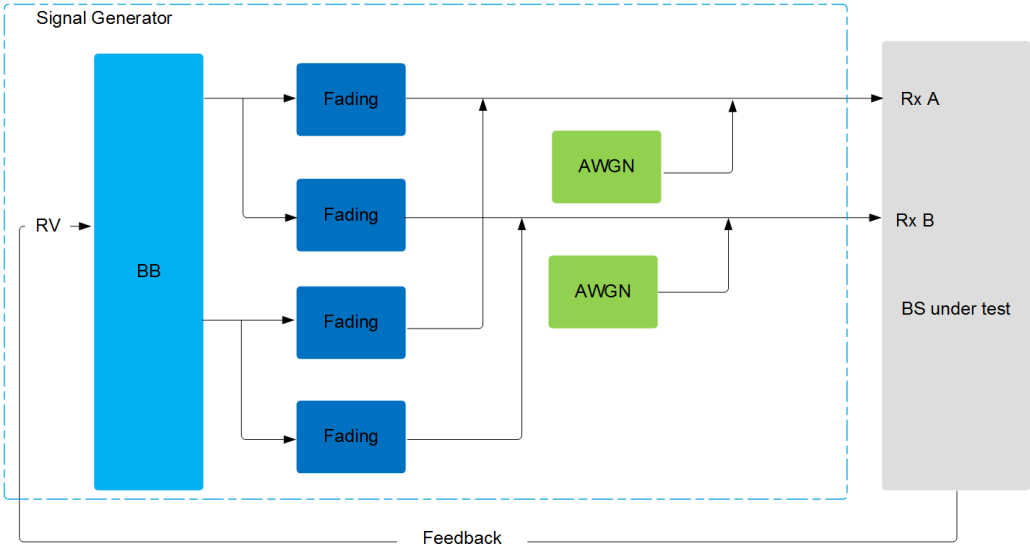


Figure 9-2: Exemplary test scenario (1x2x2 system configuration)

Signal generator = R&S SMW equipped with two baseband paths, see "Required options" on page 550
RV = Redundancy version
BB = Baseband
Fading = Fading simulator (i.e. channel simulator)
AWGN = Additive white Gaussian noise generator
BS = Base station
Feedback = HARQ feedback signal for PUSCH only

If your instrument is equipped with internal fading and AWGN generators, no more test equipment is required to perform the performance requirement tests. The simulation of the propagation conditions according to the specified test scenarios is achieved by selecting the required fading profiles and an additive white Gaussian noise.

For information on the available fading profiles and how to work with the fading simulator:

See user manual R&S®SMW-B14/-K71/-K72/-K73/-K74/-K75/-K820/-K821/-K822/-K823 Fading Simulation.

9.2 Feedback modes

Some test setups, like for example the performance verification tests, require a feedback line from the DUT (base station) to the signal source.

Input connectors

The R&S SMW expects the feedback signal at one of the input connectors:

- Option: R&S SMW-B10
  - "T/M 3"
  - "T/M 6"

- Option: R&S SMW-B9
  - "T/M 2"
  - "T/M 4"

How to route and enable feedback signal

The R&S SMW uses a flexible signal-to-connector mapping concept. In the default instrument state, the local "T/M x" connector is not configured as inputs of the feedback and the baseband feedback signal.

1. Select "Feedback > Connector" = "Local".
2. If R&S SMW-B10 is available, configure the connectors as follows:
   a) "Local Connectors > Connector > T/M 3 > Direction > Input".
   b) "Local Connectors > Connector > T/M 3 > Signal > Feedback".
3. If R&S SMW-B9 is available, configure the connectors as follows:
   a) "Local Connectors > Connector > T/M 2 > Direction > Input".
   b) "Local Connectors > Connector > T/M 2 > Signal > Feedback".
4. Connect the feedback line to the configured connector.

9.2.1 Serial modes

The serial line uses a serial protocol that is similar but not identical to the RS232.

It carries information in form of serial commands that are transmitted as a sequence of 1-bit long symbols. Symbols are interpreted as 1, if the signal voltage level exceeds a certain threshold, or as 0, if the voltage level is below this threshold.

The input impedance of the input connectors for the feedback line and the low/high threshold voltage are configurable parameters. Use the Local and global connectors settings dialog and adjust the parameters "Threshold Clock/Trigger Input" and "Impedance Clock/Trigger Input" as required.

Symbol rate

The serial feedback commands can be transmitted with a symbol rate of 115.2 kbps, 1.6 Mbps or 1.92 Mbps.

See "Serial Rate" on page 559.

The R&S SMW starts the sampling process at middle of the start bit. It then samples the subsequent received bits according to the selected sampling rate. Deviations between the selected sampling rate and the actual sampling rate are tolerated, if the used sampling point for each of the bits is within the stable bit duration.

For test cases with high subcarrier spacing (SCS) and short slot duration, a serial rate of 115.2 kbps is insufficient. We recommend that you use higher serial rate so that at least one feedback command per slot is received.

Structure

Serial commands consist of *16 data bits (D0 to D15)*. These commands can be transmitted in **serial** or **serial 3x8** modes. Serial commands start with one low-level start bit and ends with one high-level stop bit. Between two consecutive commands (or packets) or before the first command, the line has to be held on high level (idle). Parity bit are not used. The least significant bit (LSB) is transmitted first.

Figure 9-3: Structure of a serial command (Serial mode)

Idle = Always high
SB = Start bit, always low
EB = Stop bit, always high
D0 to D15 = Data bits, LBS first; see Chapter 9.2.2, "Structure of a serial and 3x8 serial feedback command", on page 554
D0 = LSB (least significant bit)
D15 = MSB (most significant bit)

In the serial 3x8 mode, a command does not consist of one singular serial packet, but is distributed over *three serial packets*, see Figure 9-4.

Figure 9-4: Structure of one feedback command in Serial 3x8 mode

Idle = Always high
SB = Start bit, always low
EB = Stop bit, always high
L, H = Low/high bits, used for synchronization purposes
D0 to D15 = Data bits, LSB first; see Chapter 9.2.2, "Structure of a serial and 3x8 serial feedback command", on page 554
D0 = LSB (least significant bit)
D15 = MSB (most significant bit)

The structure illustrated on Figure 9-4 is mandatory. The 16 data bits (D0 to D15) are distributed among the three 8-bits long packets. The remaining serial bits must comply with the specified low or high levels for synchronization purposes.

9.2.2 Structure of a serial and 3x8 serial feedback command

Table 9-1 shows the structure and the meaning of the 16 data bits (D0 to D15) in a feedback command; the LSB is D0, the MSB - D15.

Table 9-1: Structure of one feedback command

D15 to D14	D13 to D11	D10 to D0
BB selector	Message type selector	Message bits

Meaning of the bits

- **Main BB selector** (D15 to D14)
  Determines for which of the baseband blocks the feedback command is for.

Up to two baseband blocks in one R&S SMW can process feedback commands; each baseband processes only the feedback commands that are labeled with its BB selector.
You can send (i.e. multiplex) different feedback commands to different baseband blocks over the same shared feedback line. To provide the feedback signal to all related basebands, use a T connector to split the feedback line form the DUT and feed the signals to the corresponding T/M connectors simultaneously.
Alternatively, several baseband blocks that use the same BB selector can share the feedback commands, even if these baseband blocks are in different instruments connected to the same feedback line.
To set the BB selector per baseband, use the parameter Baseband Selector.
To set the secondary BB selector, use the message bits D5-D4.

- **Message type selector** (D13 to D11)
  Determines the message type and the command that is signaled.

  Have the following meaning:
  - 1: HARQ feedback with RV request
  - 2: TA feedback with timing adjustment command for the main BB selector
  - 4: HARQ feedback with RV request combined with TA feedback with timing adjustment command for the main BB selector.
  - 5: HARQ feedback with RV request for main and secondary BB selectors
  - 0, 3, 6, 7: Reserved
- **Message bits** (D10 to D0)

  If *Message type selector= 1*:
  - D10 to D2: Reserved
  - D1 to D0: Requested redundancy version

  If *Message type selector= 2*:
  - D10 to D5: Requested TA command for the baseband configured with the *main BB selector*
  - D4 to D0: Reserved

  If *Message type selector= 4*:
  - D10 to D5: Requested TA command for the baseband configured with the *main BB selector*
  - D4 to D2: Reserved
  - D1 to D0: Requested redundancy version for the baseband configured with the *main BB selector*

  If *Message type selector= 5*:
  - D10 to D8: Reserved
  - D7 to D6: Requested redundancy version for the baseband configured with the *secondary BB selector*
  - D5 to D4: Secondary BB selector
  - D3 to D2: Reserved
  - D1 to D0: Requested redundancy version for the baseband configured with the *main BB selector*

The message type 1 requested redundancy version signaling resembles the asynchronous HARQ feedback signaling of an air interface feedback to a real UE, where the BS signals the redundancy version via the DCI 0_0 and 0_1 to the UE. A simple ACK/NACK is not sufficient; signal the requested redundancy version via the feedback command.

9.3 Timing aspects

You can send zero, one or several feedback messages per slot over the serial or the serial 3x8 line.

Depending on the time a serial feedback command arrives at the instrument, it is associated with a specific PUSCH transmission. The received redundancy version is then applied for this PUSCH transmission, see Figure 9-5.

Example:

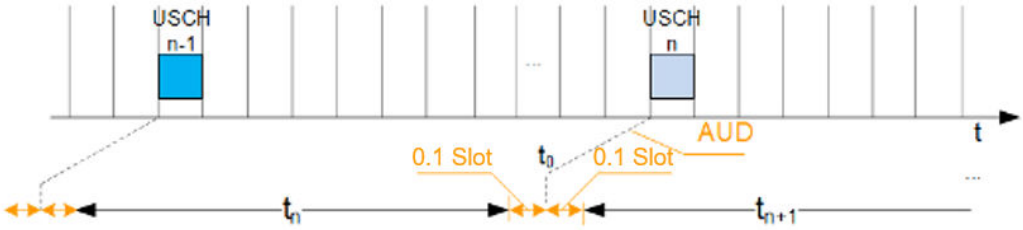


Figure 9-5: Feedback timing for PUSCH transmissions (example)

t	= Uplink timing (slots)
USCH n-1 and n	= PUSCH transmission
t_0	= Slot border
t_n, t_{n+1}	= Time periods during which an arrived serial command is applied to USCH n and n+1 respectively
AUD (additional user delay)	= "Feedback Delay" for HARQ feedback / "Processing Delay" for TA feedback. Negative values shift the feedback timing back in time
0.1 Slot	= Fixed guard period before and after slot border = Feedback commands should not arrive in the time period (t_0 - 0.1 Slot) to (t_0 + 0.1 Slot)

As shown on Figure 9-5, the UL feedback timing t_0 depends on the UL transmission. You can, however, use the parameters "Feedback Delay" and "Processing Delay" to shift the feedback timing, if it is required in your particular test situation. The starting point of the modified PUSCH is t_0 + abs(AUD).

Example:

See Figure 9-6 for another example of feedback timing for PUSCH transmission.

Figure 9-6: Feedback timing for PUSCH transmissions (second example)

t	= Uplink timing (slots)
USCH n-1, n, n+1	= PUSCH transmissions
AUD (additional user delay)	= "Feedback Delay" for HARQ feedback / "Processing Delay" for TA feedback. Negative values shift the feedback timing back in time
t_n	= Time periods during which an arrived serial command is applied to USCH n

Rules for processing of feedback commands

The R&S SMW expects and uses one feedback command per PUSCH transmission. The following applies, if there is a deviation:

- If no feedback command is received, an RV = 0 is assumed.
  The time and frequency scheduling of the transmissions cannot be changed by feedback commands; they remain as set with the corresponding parameters.
  See also "Real-time feedback principle in the context of 5G New Radio testing" on page 550.
- If more than one feedback commands are received, evaluated is the last one; i.e. applied is the RV signaled by the last feedback command.

9.4 Real-time feedback configuration settings

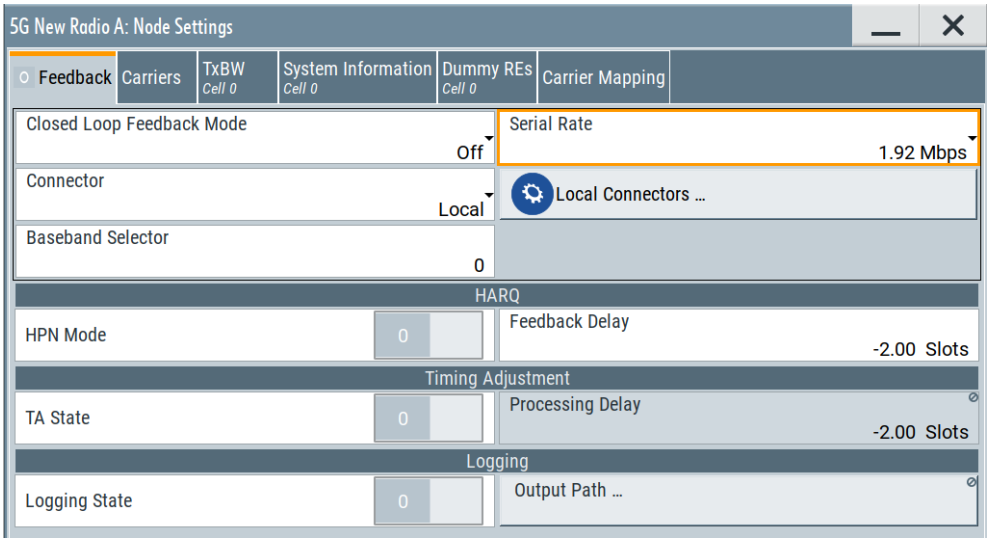
Option: see "Required options" on page 550.

Interdependencies: see "Real-time feedback principle in the context of 5G New Radio testing" on page 550.

Access:

1. Select "System Configuration > Fading/Baseband Configuration > Mode > Advanced".
2. Enable 1x2x2 configuration. Set "BB Source Config > Coupled Sources".
3. For performance test cases acccording to TS 38.141-1/-2:
   Select "General > Link Direction" > **"Uplink"**.
4. For IAB test cases acccording to TS 38.176-1/-2:
   Select "General > Link Direction" > **"Downlink"**.

5. Select "Node > Feedback".
6. To configure the input connectors to receive the feedback signal, if R&S SMW-B10 is available:
   a) Select "Connector > Local".
   b) Select "Local Connectors A > T/M 3 > Direction > Input".
   c) Select "Local Connectors A > T/M 3 > Signal > Feedback".
   d) Set "Local Connectors B > T/M 6 > Direction > Input" and "Signal > Feedback".
7. To enable the real-time feedback, set the "Realtime Feedback Mode" to a value different than "Off".



You can enable real-time feedback once per baseband block.

For background information, see Chapter 9, "Real-time feedback for closed loop BS tests", on page 550.

The remote commands required to define these settings are described in Chapter 12.34, "Real-time feedback", on page 937.

Settings:

Closed Loop Feedback Mode
Enables real-time feedback and determines the mode of the feedback line.

"Off" Real-time feedback is disabled.

"Serial/Serial 3x8"
The feedback is implemented by a serial protocol.
In "Serial 3x8" mode, a serial command consists of three serial packets.
See Chapter 9.2.1, "Serial modes", on page 553.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:MODE` on page 939

Serial Rate
Sets the bit rate of the serial transmission. You can select one of the predefined serial rates (115.2 kbps, 1.6 Mbps and 1.92 Mbps) or define a custom serial rate.

If you select a custom serial rate, you can define it in the "Resulting Serial Rate" field. The supported value range is 100 000 bps to 2 500 000 bps.

For test cases with high subcarrier spacing (SCS) and short slot duration, a serial rate of 115.2 kbps is insufficient. We recommend that you use higher serial rate so that at least one feedback command per slot is received.

Remote command:
Mode: `[:SOURce<hw>]:BB:NR5G:HFB:SRATe` on page 940
Custom serial rate: `[:SOURce<hw>]:BB:NR5G:HFB:CSRate` on page 938

Connector
Sets the feedback line connector.

Per default, the connectors are not configured to receive feedback signal. Configure connector direction and the signal-to-connector mapping first.

See "How to route and enable feedback signal" on page 553.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:CONNector` on page 939

Local Connectors
Provides a quick access to the related connector settings.

Some configuration requires two basebands, some just one. Sometimes you need to configure two separate input connectors for the feedback signal, in other - just one. The displayed settings always reflect the required configuration, for example:

- If standard system configuration is enabled, you access the connectors settings for both basebands via the dedicated dialogs.
- If 2x2x2 advanced system configuration with coupled sources is enabled, you need to configure the input connector only in the first baseband.

If you activate feedback and signal processing while the local connectors are not configured correctly, the R&S SMW shows a corresponding message.

For more information, refer to the description R&S SMW user manual, section "Local and global connectors settings".

Baseband Selector
In "Serial/Serial 3x8" mode, this parameter is required for multiplexing serial commands for different baseband units to one feedback line.

Configuring different baseband selectors for the different basebands enables you to send different feedback commands to the basebands. Even if they share a common feedback line (i.e. the same physical cable) the different feedback is possible. A baseband receives only the feedback commands that contain the same baseband selector as configured in its dialog (with the parameter "Baseband Selector"). A baseband ignores all feedback commands with different baseband selectors.

Example: Configuring the "Baseband Selector" for the 2 Tx antenna ports test cases

To perform the 2 Tx antenna ports test cases according to TS 38.141, the two basebands simulating the signals have to receive the same feedback signal, as they generate the two different DMRS antenna ports of the same TTI. In this case, configure the **same baseband selector in both baseband**. For example, set "Baseband A > ... > Baseband Selector = 0" and also " Baseband B > ... > Baseband Selector = 0".

Other way to achieve the same result is to enable coupled baseband sources ("System Config > Fading/Baseband Config > Mode = Advanced" and "BB Sources = Coupled"). In this mode, there is one dialog where you configure the settings and the "Baseband Selector" value. This value applies to both basebands and hence to both Tx channels that receive the same feedback signal.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:BASeband` on page 940

HPN Mode
Enables or disables the HARQ process number (HPN) mode.

If the "HPN Mode" is enabled, the feedback delay value is set to -1.00 and cannot be modified. Additionally, the HARQ Process Number parameter appears in the PUSCH dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:HPNMode` on page 939

Feedback Delay
Defines the point in time when the feedback can be sent to the instrument.

See Chapter 9.3, "Timing aspects", on page 556.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:DELay` on page 940

TA State
Option: R&S SMW-K148.

Enables timing advance (TA) adjustment for the selected feedback mode.

The TA adjustment enables you to set the Processing Delay to define a new timing advance value (N_{TA_New}) for advancing or delaying the UL transmission.

N_{TA_New} is defined by the equation:

$N_{TA\_New} = N_{TA\_Old} + (T_A-31)*16*64/2^{\mu}$

Where:

N_{TA_New} = New timing advance

N_{TA_Old} = Previous timing advance

T_A = Timing ajustment command

μ = index given by the configured SCS value (2^{μ}*15 kHz)

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:TAMode` on page 941

Processing Delay
Option: R&S SMW-K148.

Sets a delay to the slot to which the timing adjustment command (T_A) is applied.

For example, if "Processing Delay" is set to -2.00 and the T_A is received in slot number 6, after processing, the T_A is transmitted in slot number 8.

If TA State is disabled, the value set for Feedback Delay is used for "Processing Delay".

See Chapter 9.3, "Timing aspects", on page 556.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:PDELay` on page 941

Logging State
Enables the R&S SMW to create and store debug reports, i.e. log files with detailed information on the real-time feedback.

The instrument generates two types of reports:
- Transmission report
  - This file contains information about what is *sent* (e.g. redundancy versions) during the first 100 slots after triggering.
  - File is created after the 100 slots are sent.
- Reception report
  - This file contains information about the first 100 *received* serial commands.
  - File is created after 100 commands are successfully received.

The transmission and reception reports are divided in columns containing the following information:
- Absolute slot of message
- HARQ message payload
- HARQ message type
- HARQ primary baseband selector
- HARQ primary redundancy version
- HARQ secondary baseband selector
- HARQ secondary redundancy version
- HARQ associated HARQ process number
- TA message payload
- TA message type
- TA primary baseband selector
- TA primary timing adjustment command

The location of the log files is selected by the Output Path folder selection dialog.

Use these debug files for troubleshooting of complex real-time feedback tests.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:LOGState` on page 938

Output Path
Enables you to define the output folder on the device for the log files. It opens the folder selection dialog.

Remote command:
`[:SOURce<hw>]:BB:NR5G:HFB:LOGPath` on page 938

10 Generating logfiles for design cross-verification

If equipped with the option R&S SMW-K81, your R&S SMW can create logfiles for exchanging intermediate results of different logging points in the signal processing chain.

Analyzing the content of the logfiles can help you to verify the signal processing chain in both the DL and UL direction. The intermediate results provide a basis for enhanced debugging. By loading the coded bitstream from the instrument into an Rx software module for offline analysis in a simulation environment, the FEC implementation in DUT is verified. You can also compare the coded stream to the bitstreams from a Tx software module. The logfiles generation functionality can also be remote controlled, so that the design flow can be optimized and the process automated.

10.1 Required options

The generation of logfiles requires:

- Standard or wideband baseband generator (R&S SMW-B10/-B9)
- Baseband main module (R&S SMW-B13) or wideband baseband main module (R&S SMW-B13XT)
- Option 5G New Radio (R&S SMW-K144)
  (per signal path)
- Option log files generation (R&S SMW-K81)
  Two options R&S SMW-K81 are required if system configuration with baseband blocks with more that one output is used.
  For example, as it is in configuration with coupled or coupled per entity baseband sources.

10.2 Output files

Logfiles are generated after each step of signal processing chain defined in TS 38.212.

The R&S SMW saves the output logfiles in a user-defined network directory, selected with the parameter Output Path. A folder structure is automatically created according to the number of configured users, BWPs, channels, etc. The logfiles are named according to the naming convention described in "File format and filenames" on page 563.

File format and filenames

The log files are files in json format and are named according to the following naming structure `after_<SignalPorcessingStep>.json`. See Table 10-1 for an overview of the signal processing steps and the filenames per channel.

Table 10-1: Log files

File name (signal processing step)	PxSCH (per codeword)	CORESET (PDCCH/DCI)	PUCCH (Format 2, 3, 4)	PRACH	SSPBCH (MIB)
transport_block	x	-	-	-	-
after_block_segmentation	-	0*	-	-	-
after_code_block_crc_attachment	-	0*	-	-	-
after_interleaving	-	0*	-	-	-
after_crc_attachment	0*	-	-	-	-
after_code_block_segmentation	0*	-	-	-	-
after_channel_coding	0*	0*	-	-	-
after_rate_matching	0*	0*	-	-	-
after_code_block_concatenation	x	0*	-	-	-
after_encoding	x	x	x		x
after_scrambling	x	x	x		x

0* = if channel coding is enabled.

10.3 How to generate logfiles

The R&S SMW generates logfiles depending on the current configuration, like active channels, users, BWPs, codewords, channel coding.

Activating the logfile generation does not affect the content of the generated 5G NR signal and does not cause a recalculation of the signal. The generation of new logfiles is triggered by changing of a relevant 5G NR parameter or by enabling/disabling the generation of 5G NR signal.

Activation of logfile generation slows down the calculation speed of the instrument. Enable this function only if logfiles are explicitly requested.

General workflow

To enable the generation of logfiles, proceed as follows:

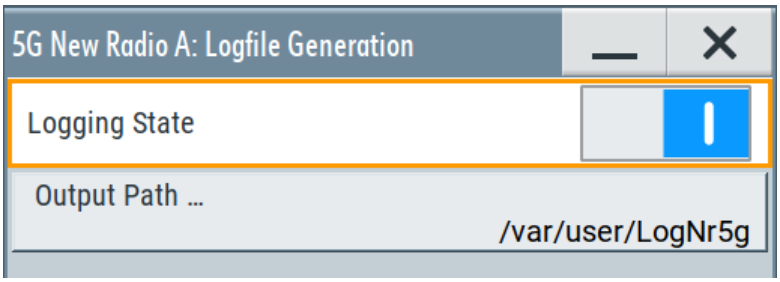
1. Select "5G New Radio > Logfile Generation > Output Path".
   Set the logfile storage path to, e.g. `/var/user/logfiles`.

   Note: Select an empty directory. Existing logfiles are overwritten.
2. Select "Logging State > On".
3. Adjust the 5G NR settings as required.
4. Set "5G New Radio > State > On".

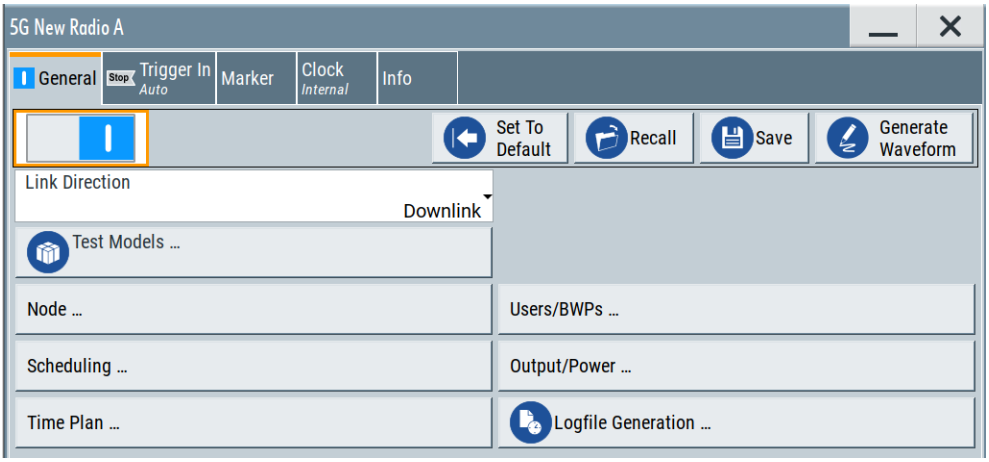
10.4 Logfile generation settings

Access:

1. Select "5G New Radio > General > Logfile Generation".
2. To enable log file generations, set "Logging State > On".



3. To start generation and logging, set "5G New Radio > State > On".



Logging State
Enables/disables logfile generation.

Note: Activation of logfile generation slows down the calculation speed of the instrument.
Enable this function only if logfiles are explicitly requested.

See also Chapter 10.3, "How to generate logfiles", on page 564.

Remote command:
`[:SOURce<hw>]:BB:NR5G:LOGGen:STATe` on page 942

Output Path
Selects the network directory the logged files are saved in.

Per default, files are saved in the user directory of the instrument.

Remote command:
`[:SOURce<hw>]:BB:NR5G:LOGGen:OUTPut` on page 942

11 Generating user plane data

If equipped with the option R&S SMW-K175, your R&S SMW can generate and export user plane (U-Plane) data based on the O-RAN specifications.

The O-RAN alliance defines a standardized data format for 3GPP signals. Data is exported into a set of `.json` files. The `.json` contain the raw frequency domain I/Q data, which you can convert into the desired format. This method allows you to use the data for various applications and on different types of measurement equipment based on the O-RAN standard.

For detailed information about the specifications, refer to the documents of the O-RAN alliance.

Access to U-Plane data generation

You can activate U-Plane data generation in the "General Settings" dialog. For details see Chapter 5.1, "General settings", on page 44.

Note that U-Plane data generation slows down the calculation speed of the instrument. Therefore, turn on U-Plane data generation only if required.

11.1 Required options

The generation of U-Plane data requires:

- Standard or wideband baseband generator (R&S SMW-B10/-B9)
- Baseband main module (R&S SMW-B13) or wideband baseband main module (R&S SMW-B13XT)
- Option 5G New Radio (R&S SMW-K144)
  (per signal path)
- Option log files generation (R&S SMW-K175)

11.2 File format and folder structure

When exporting the user plane, the R&S SMW stores the data in the `\user\u_plane` directory on its harddisk. A U-Plane dataset itself consists of a set of subdirectories.

```
\Output_0
 \Carrier_0
  \Num_0  \\15 kHz
  \Num_1  \\30 kHz
  \Num_2  \\60 kHz NCP
  \Num_3  \\60 kHz ECP
  \Num_4  \\120 kHz
  \Num_5  \\240 kHz
 \Carrier_1
```

```
  \Num_0
  \Num_1
  \Num_2
  \Num_3
  \Num_4
  \Num_5
 \Carrier_N
\Output_1
 ...
\Output_N
```

The `Num_x` folders contain the data files, one file for each subframe. Thus, every folder contains a set of `.json` files (`SF_<xx>.json)`. The number of files depends on the number of frames and is therefore 10 * <no_of_rf_frames>. The number of values in the file depends on the number of symbols. This number is variable, depending on the numerology. It also depends on the number of FFT samples:

number of I/Q values = number of symbols * FFT samples

- I/Q values within a symbol are separated by a comma
- The end of a symbol is indicated by a new line character (`\n`)
  Example for 15 kHz subcarrier spacing:
  `0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j,0+0j\n`

Note that the R&S SMW always generates a complete set of data, even for symbols that are not allocated and numerologies that you do not use. Those I/Q data have the value 0 ("0+0j"), while the I/Q data for symbols that are allocated have the actual real and imaginary values (e.g. "-0.707106781+0.707106781j").

12 Remote-control commands

The following commands are required to perform signal generation with the option R&S SMW-K144 in a remote environment. We assume that the R&S SMW has already been set up for remote operation in a network as described in the R&S SMW documentation. A knowledge about the remote control operation and the SCPI command syntax is 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 SMW user manual.

Common suffixes

The following common suffixes are used in the remote commands:

Suffix	Value range	Description
`ENTity<ch>`	1 to 4	Entity in a multiple entity configuration with separate baseband sources `ENTity3|4` require option R&S SMW-K76
`SOURce<hw>`	[1] to 4	Available baseband signals Only `SOURce1` possible, if the keyword `ENTity` is used
`OUTPut<ch>`	1 to 3	Available markers
`CELL<cc>`	0 to 15	Selects the carrier.
`SSPBch<ssb>`	0 to 3	Selects the SS/PBCH pattern.
`SUBF<sf>`	0 to 255	Selects the subframe.
`USER<us>`	0 to 200	Selects the user.
`ALLoc<al>`	0 to 64	Selects the allocation of a user.
`BWPart<bwp>`	0 to 4	Selects the bandwidth part.
`DCI<dci>`	0 to 32	Selects the DCI.
`CW<s2us0>`	0 to 1	Selects the codeword.
`SET<gr0>`	0 to 15	SRS resource sets
`RES<user0>`	0 to 63	SRS resources within a resource set
`RES<gr0>`	0 to 8	Sidelink resource pool in a bandwidth part
`RSET<st0>`	0 to 7	PRS resource sets
`RES<dir0>`	0 to 63	PRS resources within a resource set
`TD<gr>`	0 to 64	PDSCH time domain allocations

Using SCPI command aliases for advanced mode with multiple entities

You can address multiple entities configurations by using the SCPI commands starting with the keyword `SOURce` or the alias commands starting with the keyword `ENTity`.

Note that the meaning of the keyword `SOURce<hw>` changes in the second case.

For details, see section "SCPI Command Aliases for Advanced Mode with Multiple Entities" in the R&S SMW user manual.

The following commands specific to the R&S SMW-K144 option are described here:

12.1 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.

Example: Storing current configuration

```
SOURce1:BB:NR5G:SETTing:STORe "/var/user/my_nr"
*RST
SOURce1:BB:NR5G:SETTing:CATalog?
// my_nr, 5gnr
SOURce1:BB:NR5G:SETTing:LOAD "/var/user/5gnr"
SOURce1:BB:NR5G:STATe 1
SOURce1:BB:NR5G:NODE:NCARrier?
// 1
SOURce1:BB:NR5G:SETTing:DEL "my_nr"

SOURce1:BB:NR5G:WAVeform:CREate "/var/user/my_nr_wv"
```

Example: Loading predefined test signals

```
SOURce1:BB:NR5G:LINK DOWN
SOURce1:BB:NR5G:SETTing:TMODel:DL:CATalog?
// NR-FR1-TM1_1__FDD_100MHz_30kHz,
// NR-FR1-TM1_1__FDD_100MHz_60kHz,
// NR-FR1-TM1_1__FDD_10MHz_15kHz,
// ...
SOURce1:BB:NR5G:SETTing:TMODel:DL "NR-FR1-TM1_1__FDD_100MHz_30kHz"

SOURce1:BB:NR5G:STATe 1
SOURce1:BB:NR5G:PRESet
```

Example: Filtering and loading predefined test signals

```
SOURce1:BB:NR5G:LINK DOWN
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:TMODel TM1_1
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:DUPLexing FDD
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:FREQ FR1
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:BW F100
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:SCS 30
SOURce1:BB:NR5G:SETTing:TMODel:FILTer:CATalog?
// NR-FR1-TM1_1__FDD_100MHz_30kHz
SOURce1:BB:NR5G:SETTing:TMODel:DL "NR-FR1-TM1_1__FDD_100MHz_30kHz"

SOURce1:BB:NR5G:STATe 1
SOURce1:BB:NR5G:PRESet
```

Example: Using the quick settings

```
SOURce1:BB:NR5G:QCKSet:GENeral:CARDeply LT3
SOURce1:BB:NR5G:QCKSet:GENeral:DUPLexing TDD
SOURce1:BB:NR5G:QCKSet:GENeral:CBW BW100
SOURce1:BB:NR5G:QCKSet:GENeral:CHRaster R15
SOURce1:BB:NR5G:QCKSet:GENeral:CHSPacing 49980000
SOURce1:BB:NR5G:QCKSet:GENeral:SCSPacing N30
SOURce1:BB:NR5G:QCKSet:GENeral:ES:MOD QAM16
SOURce1:BB:NR5G:QCKSet:GENeral:ES:CS:STATe 1
SOURce1:BB:NR5G:QCKSet:GENeral:ES:CSLength 2
SOURce1:BB:NR5G:QCKSet:FRMFormat:IAB:STATe 0
SOURce1:BB:NR5G:QCKSet:FRMFormat:SLINt 10
SOURce1:BB:NR5G:QCKSet:FRMFormat:NDLSlots 8
SOURce1:BB:NR5G:QCKSet:FRMFormat:NSSLOts?
// 1
SOURce1:BB:NR5G:QCKSet:FRMFormat:NULSlots?
// 1

//Use special slot format
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe 1
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:SLFMt 1
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NDLSymbols?
// 0
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NGSYmbols?
// 0
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NULSymbols?
// 14

//Do not use special slot format
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe 0
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NDLSymbols 4
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NGSYmbols?
// 10
SOURce1:BB:NR5G:QCKSet:FRMFormat:SSC:NULSymbols?
// 0

SOURce1:BB:NR5G:QCKSet:GENeral:NCARier 1
SOURce1:BB:NR5G:QCKSet:GENeral:ES:TP:STATe?
// 1
SOURce1:BB:NR5G:QCKSet:GENeral:ES:RBOFfset?
// 0
SOURce1:BB:NR5G:QCKSet:GENeral:ES:RBNumber 273
SOURce1:BB:NR5G:QCKSet:GENeral:ES:RBConfig MAN
SOURce1:BB:NR5G:QCKSet:GENeral:ECPState?
// 0
SOURce1:BB:NR5G:QCKSet:APPLy
```

Example: Configuring the carrier

```
SOURce1:BB:NR5G:NODE:NCARrier 1
SOURce1:BB:NR5G:NODE:RFPHase:MODE AUTO
SOURce1:BB:NR5G:NODE:CELL0:CINDicator 1
SOURce1:BB:NR5G:NODE:CELL0:CELLid 1
SOURce1:BB:NR5G:NODE:CELL0:CIF 1
SOURce1:BB:NR5G:NODE:CELL0:SCHBy?
// 0
SOURce1:BB:NR5G:NODE:CELL0:CIFPresent?
// 0
SOURce1:BB:NR5G:NODE:CELL0:N1ID?
// 0
SOURce1:BB:NR5G:NODE:CELL0:N2ID?
// 1
SOURce1:BB:NR5G:NODE:CELL0:CARDeply FR1LT3
SOURce1:BB:NR5G:NODE:CELL0:CBW BW50
SOURce1:BB:NR5G:NODE:CELL0:TAPos 2
SOURce1:BB:NR5G:NODE:CELL0:PCFReq 1000000000
SOURce1:BB:NR5G:NODE:CELL0:TAPos 2
SOURce1:BB:NR5G:NODE:CELL0:RPOW?
// 0
SOURce1:BB:NR5G:NODE:CELL0:DFReq 0

// Defining timing and phase characteristics of the carrier
SOURce1:BB:NR5G:NODE:NCARrier 2
SOURce1:BB:NR5G:NODE:CELL0:TMPH:SYFNoffset 2
SOURce1:BB:NR5G:NODE:CELL0:TMPH:SFOFset 3
SOURce1:BB:NR5G:NODE:CELL0:TMPH:PHOFfset 30
SOURce1:BB:NR5G:NODE:CELL0:TMPH:CTOFfset 983540

//Defining system information
SOURce1:BB:NR5G:NODE:CELL0:SYINFo:HACBook DYN
SOURce1:BB:NR5G:NODE:CELL0:SYINFo:SUL:STATe ON
```

Example: Configuring the TxBWs

```
// enable 15 kHz SCS
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S15K:USE 1
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S15K:NRB?
// 270
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S15K:OFFSet 0
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S15K:KOMU?
// -1700

// enable 30 kHz SCS
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:USE 1
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:NRB?
// 133
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:OFFSet?
// 0
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:KOMU?
// -840
SOURce1:BB:NR5G:NODE:CELL0:TXBW:POINta?
// -49140000
// both k_0_u values are not allowed values

SOURce1:BB:NR5G:NODE:CELL0:TXBW:CONFlict?
// 1
// execute resolve conflicts to obtain valid values
SOURce1:BB:NR5G:NODE:CELL0:TXBW:RESolve
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:OFFSet?
// 1
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S30K:KOMU?
// 0
SOURce1:BB:NR5G:NODE:CELL0:TXBW:POINta?
// -24300000
```

Example: System Information

```
SOURce1:BB:NR5G:NODE:CELL1:TMPH:SYFNoffset 1
SOURce1:BB:NR5G:NODE:CELL1:SYINfo:HACBook DYN
SOURce1:BB:NR5G:NODE:CELL1:SYINfo:SUL:STATe 1
```

Example: LTE-CRS Coexistence

```
SOURce1:BB:NR5G:NODE:CELL0:CBW BW50
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S15K:USE 1
SOURce1:BB:NR5G:NODE:CELL0:TXBW:RESolve

SOURce1:BB:NR5G:NODE:CELL0:LTE:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:LTE:NPATT 2
//Configure pattern 2
SOURce1:BB:NR5G:NODE:CELL0:LTE:PATT2:POINta 100
SOURce1:BB:NR5G:NODE:CELL0:LTE:PATT2:CBW N25
SOURce1:BB:NR5G:NODE:CELL0:LTE:PATT2:VSHift 2
SOURce1:BB:NR5G:NODE:CELL0:LTE:PATT2:NAP AP2
```

Example: Configuring the SS/PBCH

```
SOURce1:BB:NR5G:NODE:CELL0:NSSPbch 1
SOURce1:BB:NR5G:NODE:CELL0:OFFSet TXBW
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:STATe 1

SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:SCSPacing N15
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:RBOFfset 125
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:SCOFfset 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:DFReq?
// -540000
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:CASE A
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:L L4
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POSition:PATTern #HF,4
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:BSPeriodicty BS10
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:HFRMidx 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:PSSPow 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:SSSPow 0

// PBCH configuration
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POWer 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:CCODing:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:CCODing:DATA PN9

SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:STATe 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SCSC N15_60
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:ASOF:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SCOFfset?
// 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SFOFfset 0
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:CSZero 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SSZero 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:CBARred NBAR
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:IFRResel ALWD
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SPARe:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:TAPos?
// 2
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:MIB:SCOFfset?
// 0

// AP configuration
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POSition:APMap0:COL0:ROW0:REAL 1
SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POSition:APMap0:COL0:ROW0:IMAGinary 0.7
// SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POSition:APMap0:COL0:ROW0:MAGNitude 0.7
// SOURce1:BB:NR5G:NODE:CELL0:SSPBch0:POSition:APMap0:COL0:ROW0:PHASe 270

// Setting full SFN counting
SOURce1:BB:NR5G:SCHeduling:SFN:STATe 1
```

Example: Configuring PRS resources

```
SOURce1:BB:NR5G:NODE:CELL0:PRS:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:PRS:SCSPacing N30
SOURce1:BB:NR5G:NODE:CELL0:PRS:NRSets 1
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:PER SL4
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:SLOffset 0
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:REPFactor REP1
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RBNumber 132
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:CMBSize C2
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:NRESources 1
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:REOffset 0
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:SLOffset 0
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:NSYMbol S4
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:SYOffset 0
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:SQID 0
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:POWer -10
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:APMap:COL0:ROW0:REAL 1
SOURce1:BB:NR5G:NODE:CELL0:PRS:RSET0:RES0:APMap:COL0:ROW0:IMAGinary 0
```

Example: Filling in the frame with dummy REs

```
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:STATe 1
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:POWer 0
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:MODulation QPSK
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:SCSPacing N15

// load a data list from the default directory; the file must exist
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:DATA DLIS
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:DSELect "/var/user/dummyRE"

//Configure OCNG for cartesian coordinates
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:PREC:STATe ON
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:NAPS 2
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:REAL 1
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:IMAG 1
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL1:ROW0:REAL 0
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:IMAG 0

//Configure OCNG for cylindrical coordinates
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:PREC:STATe ON
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:NAPS 2
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:MAGNitude 1
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:PHASe 0
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL1:ROW0:MAGNitude 0
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:APMap:COL0:ROW0:PHASe 0
```

Example: Mapping the carriers to the outputs

```
SCONfiguration:MODE STAN
SCONfiguration:APPLy

SOURce1:BB:NR5G:NODE:NCARrier 2
SOURce1:BB:NR5G:NODE:CARMapping:CARRier0:ROW0 ON
SOURce1:BB:NR5G:NODE:CARMapping:CARRier0:ROW1 OFF
SOURce1:BB:NR5G:NODE:CARMapping:CARRier1:ROW0 OFF
SOURce1:BB:NR5G:NODE:CARMapping:CARRier1:ROW1 ON

// automatical mapping if advanced system configuration is used
SCONfiguration:MODE ADV
SCONfiguration:FADing SISO8X1X1
SCONfiguration:BASeband:SOURce COUP
SCONfiguration:APPLy

SOURce1:BB:NR5G:NODE:NCARrier?
// 8
ENTity1:SOURce1:BB:NR5G:NODE:CARMapping:ROW0:CELL?
// 0
...
ENTity1:SOURce1:BB:NR5G:NODE:CARMapping:ROW7:CELL?
// 7
```

Example: Configuring the users and the BWPs

```
// enable 2 users
SOURce1:BB:NR5G:UBWP:NUSer 2
SOURce1:BB:NR5G:UBWP:RESTart COAL
SOURce1:BB:NR5G:UBWP:USER0:UEID 10
SOURce1:BB:NR5G:UBWP:USER0:RNTI:CS 1
SOURce1:BB:NR5G:UBWP:USER0:RNTI:MCSC 1
SOURce1:BB:NR5G:UBWP:USER0:RNTI:SPCSI 1
SOURce1:BB:NR5G:UBWP:USER0:RNTI:RA 1
SOURce1:BB:NR5G:UBWP:USER0:RNTI:SFI 1
SOURce1:BB:NR5G:UBWP:USER0:NUMSfi 1
SOURce1:BB:NR5G:UBWP:USER0:RNTI:TC 1
SOURce1:BB:NR5G:UBWP:USER0:DSCH:CCODing:STATe 0
SOURce1:BB:NR5G:UBWP:USER0:DSCH:DATA PN9
SOURce1:BB:NR5G:UBWP:USER0:DSCH:INITpattern 10
// SOURce1:BB:NR5G:UBWP:USER0:DSCH:DATA PATT
// SOURce1:BB:NR5G:UBWP:USER0:DSCH:PATTern #H1E15,14
SOURce1:BB:NR5G:UBWP:USER1:UEID 20
SOURce1:BB:NR5G:UBWP:USER1:DSCH:DATA DLIS
SOURce1:BB:NR5G:UBWP:USER1:DSCH:DLISt "/var/user/user"
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SRS:GTYPe A
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SRS:BD23 4

// configure the BWPs per user
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:NBWParts 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:INDicator 1
```

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SCSPacing N30
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RBNumber 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RBOFfset 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PRBoffset?
// 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:DFReq?
// -2340000
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:NBWParts 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:INDicator 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SCSPacing N30
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:RBNumber 11
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:RBOFfset 11
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:DFReq?
// -18000000

SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:NBWParts 2
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP0:INDicator 1
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP0:RBNumber 110
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP0:RBOFfset 20
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP0:DFReq?
// 3060000
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP1:INDicator 2
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP1:RBNumber 120
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP1:RBOFfset 10
SOURce1:BB:NR5G:UBWP:USER1:CELL0:DL:BWP1:DFReq?
// 1260000
```

Example: Fixed reference channels

```
SOURce1:BB:NR5G:LINK UP
SOURce1:BB:NR5G:UBWP:USER0:USCH:CCODing:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:TYPE FR1A15
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:SCS?
// N30
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:ALRB?
// 51
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:MODulation?
// QPSK
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:PASize?
// 4352
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:RBOFfset 10

SOURce1:BB:NR5G:NODE:CELL0:CARDeply GT6
SOURce1:BB:NR5G:UBWP:USER0:USCH:CCODing:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:TYPE FR2A58
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:FRC:PTRS:STATe?
// 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:MAPType?
// B
```

Example: Configuring the configurable allocations in the users and BWPs groups

```
SOURce1:BB:NR5G:LINK DOWN
SOURce1:BB:NR5G:SCHeduling:MODE MANual


SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:NALLoc 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:CONTent PDSCh
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:SLOT 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:SYMNumber 14
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:SYMoffset 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:RBNumber 20
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:RBOFfset 100
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:POWer 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:REPetitions SUBF

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:NALLoc 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CONTent COR
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:RBNumber 30
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:RBOFfset 100
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:REPetitions FRAM

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:COPYto:SLOT 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:COPYto:SUBF 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:COPYto:APPLY
```

Example: Configuring the PDSCH incl. PTRS and Precoding settings

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:CTYPe T1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:APINdex 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:MLENgth 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:SID0 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:SID1 20
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:CTYPe T2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:APINdex 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:MLENgth 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:SID0 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:SID1 200

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:SCRambling:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DSID 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:MCWDci 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:MCSTable QAM256
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:RESalloc?
// T1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:VPINter?
// VPN
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:RESalloc T0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:RBGSize C1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:MCBGroups DIS
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:CBGF:STATe 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:XOVerhead N16

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:OI11 1

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:BSAMe 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:REOF RE01
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:EPRE RAT1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:MCS1 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:MCS2 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:MCS3 3
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:RB0 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTA:PTRS:RB1 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:DMTB:PTRS:STATe 0

//Configure precoding with codebook
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:PREC:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:PREC:MOD CB
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:APCSirs N4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:CBTYpe?
//T1SP
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:PCN1?
//N2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:PCN2?
//N1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:CBMD N1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:SPCB0:I11 0
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:SPCB0:I12?
//0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:SPCB0:I13?
//0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:SPCB0:I2 0

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CONTent PDSC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SLOT 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:MAPType A
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SYMNumber 7
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SYMoffset 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:RBNumber 273
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:REPetitions SLOT


SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TYPE?
// F11
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:NCW?
// 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PATGrp N
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:MOD QAM16
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PHYSbits?
// 61488
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:SEQGen CELL
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:NSID 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:APSelect AP1000

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:LENGth 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:SLTSymbols?
// "2,3"
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:DMRS:POWer 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:NLAYer?
// 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:CDMData 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:INTervp?
// 0

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:APSelect0?
// AP1000
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:AP0:ROW0:REAL 0.7
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:AP0:ROW0:IMAGinary 0.7

SOURce1:BB:NR5G:UBWP:USER0:USCH:CCODing:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PDSCh:CCODing:IMCS 5
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PDSCh:CCODing:TCRate?
// 0.369140625
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PDSCh:CCODing:TBSize?
// 22536
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PDSCh:CCODing:RVINdex 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PDSCh:CCODing:TBSFactor S1
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:MODE MAN
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:TMDen TD1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:REOF RE01
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:FRQDen FD2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PTRS:EPRE RAT1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PREC:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PREC:BTYPe DYN
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:PREC:BBSet1 N4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:PREC:BBSet2 N4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PREC:BTYPe STAT
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:PREC:BSZIe N4

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PREC:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:PREC N2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:BMAid 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSI:RTSize 0
```

Example: Configuring PDSCH time domain scheduling with PDSCH time domain allocation list

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TDANum 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD0:KNULl 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD0:MAPPing A
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD0:STARt 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD0:LENGth 3
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD0:SLIV?
// 28
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD1:KNULl 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD1:MAPPing B
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD1:STARt 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD1:LENGth 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:TD1:SLIV?
// 14
```

Example: Scheduling PxSCH type 0 allocation

```
// PDSCH
SOURce1:BB:NR5G:LINK DOWN
SOURce1:BB:NR5G:SCHeduling:MODE MAN

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:RESalloc DS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:RESalloc T0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:RESalloc:PATTern #H3FFFF,18

// PUSCH
SOURce1:BB:NR5G:LINK UP

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:RESalloc DS
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:RBGSize C1
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:RESalloc T0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:RESalloc:PATTern #H3FFFF,18
```

Example: Configuring the CSI-RS settings

```
// periodic ZP CSI-RS
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:NRESources 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:PER 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:OFFSet 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:RBNumber 273
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:SRBNumber 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:ROW 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:BITMap #HAFA,12
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:I0 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:ZP:SET0:RES0:I1 2

// periodic NZP CSI-RS
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:NRESources 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:PER 4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:OFFSet 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:RBNumber 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:SRBNumber 50
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:ROW 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:BITMap #HF,4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:I0 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:I1 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:SCID 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:PWR 3

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:APMap:AP3000:ROW0:REAL 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CSIRs:NZP:SET0:RES0:APMap:AP3000:ROW0:IMAGinary 0.7
```

Example: Antenna port settings

```
SCONfiguration:MODE ADV
SCONfiguration:FADing MIMO2X4X4
SCONfiguration:BASeband:SOURce CPEN
SCONfiguration:APPLy

ENTity1:SOURce1:BB:NR5G:LINK DOWN
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL0:ROW0:REAL 1
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL0:ROW0:IMAGinary?
// 0
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL1:ROW1:REAL 1
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL2:ROW2:REAL 1
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL3:ROW3:REAL 1

ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL0:ROW0:MAGNitude 1
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL0:ROW0:PHASe 360
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL1:ROW1:MAGNitude 0
ENTity1:SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:APMap:COL1:ROW1:PHASe 270
```

Example: Configuring one SRS resource set

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:NRSets 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RSTYpe PER
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:TXConfig NCB
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:USAGe?
// NCB

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:NRESources 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:PER SL10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:OFFSet 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:SPOS 3
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:SYMNumber SYM2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:FPOS 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:FQSHift 20
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:BSRS 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:CSRS 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:BHOP 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:REFactor?
// REP1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:TRTComb TC4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:COFFset 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:SEQ:CYCShift 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:SEQ:ID 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:POWer 3
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:NAPort AP1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:PTRS P0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:APMap:AP1000:ROW0:MAGNitude 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:APMap:AP1000:ROW0:PHASe 0
// SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:APMap:AP1000:ROW0:REAL?
```

```
// SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:RES0:APMap:AP1000:ROW0:IMAGinary?

SOURce1:BB:NR5G:LINK UP
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:STATe 0
// open the timeplan and observe the SRS allocations
```

Example: Configuring the DL BWP rate match settings

```
SOURce1:BB:NR5G:LINK DOWN

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:GRPNumber 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:NRESources 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:GRID G1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:SLTPatt #H1001,14
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:PER 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:PERPatt #H2,2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:RBDList "/var/user/dl"
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS0:RBPatt?

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS1:SLOT 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS1:PER 4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS1:PERPatt #H5,4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RATM:RS1:SLTPatt #H8888888,28

SOURce1:BB:NR5G:SCHed:CELL0:SUB0:USER0:BWPart0:ALLoc1:PDSCH:PATGrp G1
```

Example: Search space configuration

For example on how the CORESET is configured, see Example"Configuring the CORESET settings" on page 587.

```
SOURce1:BB:NR5G:SCHeduling:MODE MAN
SOURce1:BB:NR5G:SCHeduling:RSSPace 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe0:AGGLevel?
// AL1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe0:MAXCandidate 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe1:AGGLevel?
// AL2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe1:MAXCandidate 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe2:AGGLevel?
// Al4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe2:MAXCandidate 4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe3:AGGLevel?
// Al8
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe3:MAXCandidate 6
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe4:AGGLevel?
// Al16
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SPACe4:MAXCandidate 8
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:AGGLevel AL1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CANDidate 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DCI0:INDex?
// 22
```

Example: Configuring the CORESET settings

For example of how the search space is configured, see Example"Search space configuration" on page 586.

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CONTent COR

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:PREGran REG
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:ID 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SCRam:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DMRS:SCRam:ID 0

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:IL:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:IL:BUNSize 6
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:IL:SHIDx 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:IL:SIZE IS6

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCCes:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCCes:DATA DLIS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCCes:DLISt "/var/user/dl"
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCCes:DATA PATTern
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCCes:PATTern #H9,4

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DMRS:SCRam:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DMRS:SCRam:ID 10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:AULBwp?

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:NDCI 5

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe?
// C
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:RNTI?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FMT F00
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SSP USS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:AGGLevel AL1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CANDidate 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DCI0:INDex?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FRDRes 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FRHFlag 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TB1:MCS 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TB1:NDI 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TB1:RV 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:HAPRoc 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TPUSch 2
// 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USINd 0
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:HBTS?
// #H00000434600,44
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SRSResind 4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:PRECinfo 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CSIRequest 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:BOINd 0

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:MOFFs 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:USAGe?
// C
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:RNTI?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DCI1:AGGLevel AL2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DCI1:INDex 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:FMT F10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:SSP CSS3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:FRDRes 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TIDRes 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:VTPRb?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TB1:MCS 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TB1:NDI 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TB1:RV 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:HAPRoc 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:DAI1 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TPUCch 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:PUCResind 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:PDSHarq 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:HBTS?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:CPDSch 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:USAGe?
// C
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:FMT F01
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:ANTPorts 15
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:SRSRequest 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:TPSTate 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:DMSQinit 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:MRANk 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:PTDMrs 1
...

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:USAGe SI
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:RNTI?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:FMT F10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:SSP CSS0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:AGGLevel AL1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:CANDidate 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart1:ALLoc0:CS:DCI3:INDex?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:FRDRes 0
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:TIDRes 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:VTPRb 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:TB1:MCS 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:TB1:RV 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:SIINd 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:RESVed?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:HBTS?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:CPDSch 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe TSRS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SR1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TP1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe TPUC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CL1?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TP1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe INT
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:PE1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe SFI
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SI1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TBSCalin 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CAINd 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SI16 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SR1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CL22 0
```

Example: Custom DCI

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FMT CUSTom
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:DATA PATTern
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:BITLength 12
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:PATTern #HCA3,12
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:DATA DLISt
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:DLISt "var/user/nr_dl"
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:DATA PN9
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:INITpattern 16
```

Example: DCI format 2_0, 2_1 and 2_2

Listed are only the related commands:

```
SOURce1:BB:NR5G:UBWP:USER0:UEID 0

// DCI format 2_0
SOURce1:BB:NR5G:UBWP:USER0:RNTI:SFI 1
SOURce1:BB:NR5G:UBWP:USER0:NUMSfi 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe SFI
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FMT F20
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:SI1 100

// DCI format 2_1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:IN 10
```

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDCCh:NUMPreempt 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:USAGe INT
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:FMT F21
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI1:PE1 200

// DCI format 2_2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:PUSCh 20
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:PUCCh 1
// SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:SRS 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PUSCh:TPAS 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PUSCh:BD22 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PUCCh:TPAS 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PUCCh:BD22 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:USAGe TPUS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:USAGe TPUC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:FMT F22
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:FMT F22
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:CL1 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:TP1 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI2:TP2 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:TP1 3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI3:CL1 1
```

Example: DCI format 2_4

R&S SMW-K148

Listed are only the related commands:

```
SOURce1:BB:NR5G:UBWP:USER0:UEID 0

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:CIRNti 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:CILength 4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:NCINd 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe CI
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:FMT F24
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CI1 #HE,4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:CI2 #H3,4
```

Example: DCI format 2_6

R&S SMW-K148

Listed are only the related commands:

```
SOURce1:BB:NR5G:UBWP:USER0:UEID 0

SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:RNTI:PSRNti 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SRS:NB26 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SRS:NSCG 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:USAGe PS
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:WA1 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:DI1 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:RESVed #HF,4
```

Example: Configuring the PUSCH settings

```
SOURce1:BB:NR5G:LINK UP

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:BSAMe 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:CTYPe T1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:APINdex 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:MLENgth 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PUID 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:SID0 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:SID1 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:CTYPe T2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:APINdex 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:MLENgth 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:PUID 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:SID0 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:SID1 10
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:TPSTate 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:MRANk 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:TXConfig?
// CB
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:MCSTable QAM256
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:MTTPrecoding QAM256
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:CBSubset FPNC
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:SCRambling:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DSID 100
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:MCBGroups G0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOP INTER
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOFfsets:NOFFsets 4
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOFfsets:OFFSet0 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOFfsets:OFFSet1 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOFfsets:OFFSet2 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FHOFfsets:OFFSet3 2

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:XOVerhead N0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:FPTR FPM2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:OI01 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:HPRNumber 4

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:MODE UCI
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:MODE UCLS
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:ALPHa A0_8
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:ALPHa A1_0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:HARQ:OFF1 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:HARQ:OFF2 5
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CGUCi:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CGUCi:OFFSet 2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CSI:OF10 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CSI:OF11 5
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CSI:OF20 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:CSI:OF21 10
```

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SLOT 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:MAPType A
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SYMNumber 14
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:RBNumber 273
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:POWer 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:REPetitions SLOT

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:TYPE?
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:MOD QAM64
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CW0:PHYSbits?
// 196560
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMR:NIDSel CID
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMR:SEQHopping GRP
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMRS:LENGth 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMRS:SLTSymbols?
// "2,3,10,11"
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMRS:POWer -3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:TXSCheme:NLAYer?
// 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:TXSCheme:CDMData 2


SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:TXSCheme:TPMidx 1

// enable at least one SRS resource set with at least one SRS resource
// SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:NRSets 1
// SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:SRS:RS:SET0:NRESources 1
// ... configre the SRS
// SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:TXSCheme:SRI 1

SOURce1:BB:NR5G:UBWP:USER0:USCH:CCODing:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:CCODing:IMCS 11
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW0:PUSCh:CCODing:TCRate?
// 0.455078125
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW0:PUSCh:CCODing:TBSize?
// 90176
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:CCODing:RVINdex 1

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:ACK:BITS 4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:ACK:PATTern #HC,4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CSI1:BITS 5
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CSI1:PATTern #H15,5
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CSI2:PATTern #H0,1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CSI2:BITS 3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CSI2:PATTern #H2,3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CGUC:BITS 3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:UCI:CGUC:PATTern #H2,3

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:FHOP:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:FHOI 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:DMRS:APSelect0 AP0
```

```
//Configure PUSCH interlacing
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:UITL 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:NINT 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:INT0:INTL 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUSCh:INT1:INTL 2

//Configure PUSCH repetition
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:REPetitions TA
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PERiod 10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:DURation 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:AGFT F2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:AGOFfset 0
```

Example: Configuring the PUSCH PTRS with enabled transform precoding

```
SOURce1:BB:NR5G:LINK UP

SOURce1:BB:NR5G:UBWP:USER0:USCH:CCODing:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:TPSTate 1

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:TMDensity TD2
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:SCID CID
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:RB0 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:RB1 270
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:RB2 275
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:RB3 276
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTA:PTRS:TP:RB4?
// 276

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CONTent PUSC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:MODE MAN
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:TMDensity TD2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:NGRPs G4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:SCID PUID
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:TP:SPPG S4
```

Example: Configuring the PUCCH settings

```
SOURce1:BB:NR5G:LINK UP

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:ADMRs:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:BPSK:STATe 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:HACK:STATe?
// 0

SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:UR16 0


SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:NALLoc 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CONTent PUCC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SLOT 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:FMT F4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SYMNumber 4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:SYMoffset 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:RBNumber 10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:RBOFfset 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:POWer 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:REPetitions SUBF

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:GRPHopping ENA
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:HOPid 100
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:ISFHopping 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:SHOPping 20
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:TOFFset 0.000025
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CPEXt 25
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:FS:OCCLength L4
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:FS:OCCindex 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:PL:SRCount?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:PL:UCI:BITS 3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:PL:UCI:PATTern #H5,3
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:PL:ACK:BITS?
// 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:PL:ACK:PATTern?
// #H0,0

//Setting a PUCCH allocation as burst refence for the burst power mode
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:BMAid 1

//Use PUCCH interlace
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:FMT F2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:NINT 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:INT0:INTL 2
```

Example: Configuring the PRACH settings

```
SOURce1:BB:NR5G:LINK UP
SOURce1:BB:NR5G:NODE:CELL0:CARDeply GT6
SOURce1:BB:NR5G:NODE:CELL0:TXBW:S120K:USE 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:SCSPacing N120

SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:NALLoc 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:CONTent PRAC
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:SCSPacing N120
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:FORMat FA1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:RSET URES
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:RSEQuence 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:ZCZone 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:PRINdex 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:TOFFset 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:RBNumber?
// 12

//Setting a PRACH allocation as burst refence for the burst power mode
//SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PRACh:BMAid 1
```

Example: Time domain windowing

```
SOURce1:BB:NR5G:TDWind:STATe?
// 0
SOURce1:BB:NR5G:OUTPut:TDWind:TRTime:S15K:TRTime 5
...
SOURce1:BB:NR5G:OUTPut:TDWind:TRTime:S240K:TRTime 5
SOURce1:BB:NR5G:OUTPut:TDWind:TRTime:S240K:TRTSamples?
// 11
```

Example: Output settings

```
SOURce1:BB:NR5G:OUTPut:SEQLen 10
SOURce1:BB:NR5G:OUTPut:SSOC:STATe 0
SOURce1:BB:NR5G:OUTPut:OUTPut:FMODe CBW
SOURce1:BB:NR5G:OUTPut:SAMRmode FFt
SOURce1:BB:NR5G:OUTPut:BBConf:ROW0:SRATe?
// 122880000
SOURce1:BB:NR5G:OUTPut:BBConf:ROW0:CONFlict?
// 0
SOURce1:BB:NR5G:OUTPut:BBConf:ROW0:PBRate?
// 122880000
SOURce1:BB:NR5G:OUTPut:BBConf:ROW0:VARiation 0

SOURce1:BB:NR5G:OUTPut:CLEVel 80
SOURce1:BB:NR5G:OUTPut:CMODe VECT

SOURce1:BB:NR5G:OUTPut:CFReduction:STATe 1
SOURce1:BB:NR5G:OUTPut:CFReduction:ALGorithm?
// CLF
SOURce1:BB:NR5G:OUTPut:CFReduction:TCRFactor 10
SOURce1:BB:NR5G:OUTPut:CFReduction:ITERations 5
SOURce1:BB:NR5G:OUTPut:CFReduction:OCFactor?
// 0
SOURce1:BB:NR5G:OUTPut:CFReduction:RCFactor?
// 0

SOURce1:BB:NR5G:OUTPut:POWer:BBConf:ROW0:AVRL?
// 0
SOURce1:BB:NR5G:OUTPut:POWer:BWRef:ACRL?
// 0
SOURce1:BB:NR5G:OUTPut:POWer:S240K:ACRL?
// 0

SOURce1:BB:NR5G:OUTPut:BBConf:CONFlict?
// 0
```

Example: Configure and enable triggering

```
SOURce:BB:NR5G:TRIGger:SEQuence SINGle
SOURce:BB:NR5G:TRIGger:SLENgth 200

// the first 200 samples of the current waveform will be output after
// the next trigger event
// SOURce:BB:NR5G:TRIGger:SEQuence ARETrigger
// SOURce:BB:NR5G:TRIGger:SOURce EGT1
// external trigger signal must be provided at the USER connector
// SOURce:BB:NR5G:TRIGger:EXTernal:SYNChronize:OUTPut ON
// SOURce:BB:NR5G:TRIGger:EXTernal:DELay 200
// SOURce:BB:NR5G:TRIGger:EXTernal:INHibit 100

SOURce:BB:NR5G:TRIGger:SEQuence AAUTo
SOURce:BB:NR5G:TRIGger:SOURce INTernal
SOURce:BB:NR5G:STAT ON
SOURce:BB:NR5G:TRIGger:EXEC

// SOURce:BB:NR5G:TRIGger:SOURce INTB
// the internal trigger signal from the other path must be used
// SOURce:BB:NR5G:TRIGger:OBASeband:DELay 25
// SOURce:BB:NR5G:TRIGger:OBASeband:INHibit 10
```

Example: Specifying delay and inhibit values in time units

```
SOURce1:BB:NR5G:CLOCk 1000000
SOURce1:BB:NR5G:TRIGger:SEQuence AAUT
SOURce1:BB:NR5G:TRIGger:SOURce EGT1
SOURce1:BB:NR5G:TRIGger:DELay:UNIT SAMP
SOURce1:BB:NR5G:TRIGger:EXTernal:DELay 100
SOURce1:BB:NR5G:TRIGger:EXTernal:RDELay?
// Response: 100

SOURce1:BB:NR5G:TRIGger:DELay:UNIT TIME
SOURce1:BB:NR5G:TRIGger:EXTernal:TDELay 0.00001
SOURce1:BB:NR5G:TRIGger:EXTernal:RDELay?
// Response: 0.00001

SOURce1:BB:NR5G:TRIGger:DELay:UNIT SAMP
SOURce1:BB:NR5G:TRIGger:EXTernal:DELay 10
```

Example: Configure and enable standard marker signals

```
SOURce:BB:NR5G:TRIGger:OUTPut1:MODE RAT
SOURce:BB:NR5G:TRIGger:OUTPut1:ONTime 10
SOURce:BB:NR5G:TRIGger:OUTPut1:OFFTime 20
SOURce:BB:NR5G:TRIGger:OUTPut1:INVert ON

SOURce:BB:NR5G:TRIGger:OUTPut2:MODE?
// RESTart
SOURce:BB:NR5G:TRIGger:OUTPut2:FOFFset 10
SOURce:BB:NR5G:TRIGger:OUTPut2:ROFFset 20

SOURce:BB:NR5G:TRIGger:OUTPut2:DELay 16

SOURce:BB:NR5G:TRIGger:OUTPut3:MODE PER
SOURce:BB:NR5G:TRIGger:OUTPut3:PERiod 30
```

Example: Configure and enable an UL/DL marker

```
SOURce1:BB:NR5G:TRIGger:OUTPut1:MODE ULDL
SOURce1:BB:NR5G:TRIGger:OUTPut1:DUPLexing TDD
SOURce1:BB:NR5G:TRIGger:OUTPut1:SCSPacing SCS60
SOURce1:BB:NR5G:TRIGger:OUTPut1:ECPState 1
SOURce1:BB:NR5G:TRIGger:OUTPut1:SLINt 10
SOURce1:BB:NR5G:TRIGger:OUTPut1:NDLSlots 5
SOURce1:BB:NR5G:TRIGger:OUTPut1:NSSlots?
// 1
SOURce1:BB:NR5G:TRIGger:OUTPut1:NULSlots 4
SOURce1:BB:NR5G:TRIGger:OUTPut1:IAB:STATe 0

//Use special slot format
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:SFI:STATe 1
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:SLFMt 0
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NDLSymbols?
// 14
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NGSYmbols?
//0
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NULSymbols?
// 0

//Do not use special slot format
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:SFI:STATe 0
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NDLSymbols 8
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NGSYmbols?
// 6
SOURce1:BB:NR5G:TRIGger:OUTPut1:SSC:NULSymbols?
// 0
```

Example: Clock settings

```
SOURce:BB:NR5G:CLOCk:SOURce ELCL
SOURce:BB:NR5G:CLOCk:MODE SAMP
CLOCk:INPUt:FREQuency?
```

Example: Configuring the HARQ-ACK in DCI1_0 and 0_1 settings

```
SOURce1:BB:NR5G:NODE:NCARrier 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:NDCI 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:FMT F10
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:FMT F01
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DAI1 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:HAPRoc 1
```

Example: Reconfiguring a 2x1x1 coupled system for MIMO usage

```
SCONfiguration:MODE ADV
SCONfiguration:FADing FAAFBB
SCONfiguration:BASeband:SOURce COUP
SCONfiguration:APPLy
ENTity1:SOURce1:BB:NR5G:NODE:NCARrier 1
```

Example: Configuring a sidelink signal

```
SOURce:BB:NR5G:LINK SIDE
//Carrier configuration
SOURce:BB:NR5G:NODE:NCARrier 1
SOURce:BB:NR5G:NODE:RFPHase:MODE AUTO
SOURce:BB:NR5G:NODE:CELL0:CELLid 112
SOURce:BB:NR5G:NODE:CELL0:CARDeply FR1LT3
SOURce:BB:NR5G:NODE:CELL0:CBW BW100
SOURce:BB:NR5G:NODE:CELL0:DFReq 0
//Tx bandwidth configuration
SOURce:BB:NR5G:NODE:CELL0:TXBW:S30K:USE 1
SOURce:BB:NR5G:NODE:CELL0:TXBW:S30K:OFFSet 0
//S-SS/PSBCH configuration
SOURce:BB:NR5G:NODE:CELL0:NSSPbch 1
SOURce:BB:NR5G:NODE:CELL0:OFFSet?
//POIN
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SCSPacing N30
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:RBOFfset 126
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:INTerval 1
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:TOFFs 0
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:BINPeriod B1
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:INCoverage 1
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:SBITs #H0,2
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SL:TDDConf #H000,12
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:PSSPow 0
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:SSSPow 0
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:POWer 0
SOURce:BB:NR5G:NODE:CELL0:SSPBch0:STATe 1
//User and bandwidth part configuration
SOURce:BB:NR5G:UBWP:NUSer 1
SOURce:BB:NR5G:UBWP:RESTart OFF
SOURce:BB:NR5G:UBWP:USER0:SSCH:CCODing:STATe 1
SOURce:BB:NR5G:UBWP:USER0:SSCH:SCRambling:STATe 1
SOURce:BB:NR5G:UBWP:USER0:SSCH:DATA PN9
SOURce:BB:NR5G:UBWP:USER0:SSCH:INITpattern 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:NBWParts 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:INDicator 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:SCSPacing N30
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RBNumber 273
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RBOFfset 0
//Resource pool configuration
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RESPool:NRESpool 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:NPRB 80
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:STRB 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:SCHSize R20
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:NSUBchannels 4
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:MREServe 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:REPList 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:MSCTable QAM64
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:AMCS 0
```

```
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:MNPRes 2
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:PAT2 1
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:PAT3 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:PAT4 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:SCALing FP5
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:BOF1 4
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:BOF2 4
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:BOF3 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:BOF4 0
SOURce:BB:NR5G:UBWP:USER0:CELL0:SL:BWP0:RES0:RESBits 2
//PSSCH and PSCCH scheduling
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:NALLoc 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CONTent PSCS
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SLOT 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SYMNumber 10
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SYMoffset 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:RBNumber 20
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:RBOFfset 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:POWer 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:STATe 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:REPetitions SLOT
//PSSCH and PSCCH configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSSCh:NDMRs 2
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSSCh:NSUBchan 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSSCh:MOD QPSK
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSSCh:TXSCheme:NLAYers 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSSCh:DMRS:APSel P1000
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSCCh:SCRid 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSCCh:BDWidth RB10
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PSCCh:SYMLength 2
//PSSCH and PSCCH antenna port configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:APMap:COL0:REAL 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:APMap:COL0:ROW0:IMAGinary 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:COL1:ROW0:REAL 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:COL1:ROW0:IMAGinary 0
//SCI1A configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:PRTY 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:FRDRes 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:TIDRes 2
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:BOINd 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:DPATterns 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:MCS 10
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:AMCSind 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:S2FMt 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:RESVed #H3,2
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:PAT1?
//SCI2A configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:S2FMt 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:HARProc 5
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:NDI 1
```

```
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:REDundancy 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:SOURid 124
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:DESTid 1285
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:HARFb 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:CTINd 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:CSIReq 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI2:PATTern?
//SCI2B configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:S2FMt 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:HARProc 5
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:NDI 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:REDundancy 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:SOURid 124
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:DESTid 1285
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:HARFb 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:ZONeid 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI:CORReq 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SCI2:PATTern?
//Channel cosing configuration
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW2U0:PSSCh:CCODing:FRCR 1
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW2U0:PSSCh:CCODing:TCRate 0.1171875
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:SL:PHYSbits?
//2676
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW2U0:PSSCh:CCODing:TBSize?
//2664
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW2U0:PSSCh:CCODing:RVINdex 0
SOURce:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CW2U0:PSSCh:CCODing:TBSFactor S1
```

12.2 General commands

[:SOURce<hw>]:BB:NR5G:ANALyzer:CONTent <FileName>

Exports the signal configuration to an `.allocation` file that you can import into the NR 5G application on a signal and spectrum analyzer.

Parameters:

<FileName> string

String containg the name and path to the configuration file.

Manual operation: See "Export Settings to Analyzer" on page 49

[:SOURce<hw>]:BB:NR5G:LINK <LinkDir>

Selects the transmission direction.

Parameters:

<LinkDir> DOWN | SIDE | UP

DOWN
Selects downlink direction.

SIDE
Selects sidelink direction.
Requires Option: R&S SMW-K170

UP
Selects downlink direction.

*RST: DOWN

Example: See Example"Loading predefined test signals" on page 571.

Manual operation: See "Link Direction" on page 49

[:SOURce]:BB:NR5G:PLVersion?

Queries the installed version of the 5G New Radio application.

Return values:

<PluginVersion> string

Example: `SOURce1:BB:NR5G:PLVersion?`

Usage: Query only

Manual operation: See "5G NR Application Version" on page 35

[:SOURce<hw>]:BB:NR5G: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:NR5G:STATe`.

Example: See Example"Storing current configuration" on page 571.

Usage: Event

Manual operation: See "Set to Default" on page 46

[:SOURce<hw>]:BB:NR5G:SETTing:CATalog?

Queries the files with settings in the default directory. Listed are files with the file extension `*.nr5g`.

Return values:

<FileNames> <filename1>,<filename2>,...

Returns a string of filenames separated by commas.

Example: See Example"Storing current configuration" on page 571.

Usage: Query only

Manual operation: See "Save/Recall" on page 46

[:SOURce<hw>]:BB:NR5G:SETTing:DEL <Filename>

Deletes the selected file from the default or the specified directory. Deleted are files with extension `*.nr5g`.

Parameters:

<Filename> "<filename>"

Filename or complete file path; file extension can be omitted

Example: See Example"Storing current configuration" on page 571.

Manual operation: See "Save/Recall" on page 46

[:SOURce<hw>]:BB:NR5G:SETTing:LOAD <Filename>

Loads the selected file from the default or the specified directory. Loaded are files with extension `*.nr5g`.

Parameters:

<Filename> "<filename>"

Filename or complete file path; file extension can be omitted

Example: See Example"Storing current configuration" on page 571.

Manual operation: See "Save/Recall" on page 46

[:SOURce<hw>]:BB:NR5G:SETTing:STORe <Filename>

Saves the current settings into the selected file; the file extension (`*.nr5g`) is assigned automatically.

Parameters:

<Filename> "<filename>"

Filename or complete file path

Example: See Example"Storing current configuration" on page 571.

Manual operation: See "Save/Recall" on page 46

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL <TmodUp>
[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL <TmodDn>

Loads a test model file with predefined settings.

Parameters:

<TmodDn> "<filename>"

Filename as queried with one of the following commands:
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL:CATalog?`
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL:CATalog?`
`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`

Example: See Example"Loading predefined test signals" on page 571.

Manual operation: See "Select" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL:CATalog?
[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL:CATalog?

Queries the filenames of predefined files with test signals in the default directory.

Return values:

<FileNames> <filename1>,<filename2>,...

Returns a string of filenames separated by commas.

Example: See Example"Loading predefined test signals" on page 571.

Usage: Query only

Manual operation: See "User Files" on page 50

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:BW <FilterBandwidth>

Applies a bandwidth filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterBandwidth> ALL | F5 | F10 | F15 | F20 | F25 | F30 | F40 | F50 | F60 | F70 | F80 | F90 | F100 | F200 | F400 | F35 | F45 | F800 | F1600 | F2000

*RST: ALL

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Bandwidth" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog

Queries the filenames of predefined test signal files in the default directory after applying a filter.

Return values:

<FileNames> <filename1>,<filename2>,...

Returns a string of filenames separated by commas.

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Filter Test Models" on page 51

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:DUPLexing <FilterDuplexing>

Applies a duplexing filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterDuplexing> ALL | FDD | TDD

*RST: ALL

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Duplexing" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:FREQ <FilterFreqRange>

Applies a frequency range filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterFreqRange> ALL | FR1 | FR2

*RST: ALL

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Frequency Range" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:SCS <FilterScs>

Applies a subcarrier spacing filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterScs> ALL | F15 | F30 | F60 | F120 | F480 | F960

*RST: ALL

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Subcarrier Spacing" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TCASe <FilterTestCase>

Applies a ORAN test case filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterTestCase> ALL | TC323110 | TC323112 | TC323114 | TC32311 | TC32312 | TC32314 | TC32316 | TC32318 | TC32511 | TC32512 | TC32513 | TC32514 | TC32515 | TC32516 | TC32517 | TC32518 | TC32611 | TC32612 | TC32613 | TC32614 | TC32615 | TC32313 | TC32315 | TC32317 | TC32319 | TC32381 | TC323111 | TC323113 | TC323115 | TC323117 | TC323121 | TC32332 | TC32532 | TC32333 | TC32334 | TC32335 | TC32336 | TC32337 | TC32338 | TC32339 | TC323310 | TC323311 | TC32533 | TC32534 | TC32535 | TC32536 | TC32537 | TC32538 | TC32539 | TC325310 | TC325311

*RST: n.a. (no preset. default: ALL)

Manual operation: See "Test Case" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TMODel <FilterTestModel>

Applies a test model filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterTestModel> ALL | TM1_1 | TM1_2 | TM2 | TM2a | TM3_1 | TM3_1A | TM3_2 | TM3_3 | TM2B | TM3_1B

*RST: ALL

Example: See Example"Filtering and loading predefined test signals" on page 572.

Manual operation: See "Test Models" on page 52

[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:TMSTandard <FilterStandard>

Applies a standard filter to narrow down the files returned by the query `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:FILTer:CATalog`.

Parameters:

<FilterStandard>

NR
3GPP test models.

ORAN
ORAN test cases.

*RST: n.a. (no preset. default: NR)

Manual operation: See "Standard" on page 51

[:SOURce<hw>]:BB:NR5G:SIMPle <State>

Turns the simple mode of the user interface on and off.

Parameters:

<State>

1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Simple Mode" on page 53

[:SOURce<hw>]:BB:NR5G:STATe <State>

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

Parameters:

<State>

1 | ON | 0 | OFF

*RST: 0

Example: See Example"Storing current configuration" on page 571.

Manual operation: See "State" on page 45

[:SOURce<hw>]:BB:NR5G:UPLane:STATe <UPlaneState>

Turns generation of user plane data according to O-RAN standard on and off.

Parameters:

<UPlaneState>

1 | ON | 0 | OFF

*RST: 0

Manual operation: See "U-Plane Generation" on page 53

[:SOURce]:BB:NR5G:VERSion?

Queries the version of the 3GPP standard underlying the definitions.

Return values:
<Version> string

Example: `SOURce1:BB:NR5G:VERSion?`

Usage: Query only

Manual operation: See "3GPP Specification Table" on page 35

[:SOURce<hw>]:BB:NR5G:WAVeform:CREate <Filename>

Stores the current settings as an ARB signal in a waveform file (`*.wv`).

Parameters:
<Filename> string

Filename or complete file path; file extension is assigned automatically

Example: See Example"Storing current configuration" on page 571.

Manual operation: See "Generate Waveform File" on page 46

12.3 FRC wizard commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WDEPloyment <Deployment>

Selects the frequency deployment for the FRC wizard.

Parameters:
<Deployment> FR1LT3 | FR1GT3 | FR2_1 | FR2 | BT36 | GT6 | LT3 | BT37125 | GT7125 | FR2_2

*RST: FR1LT3

Example: See `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WTYP` on page 611

Manual operation: See "Deployment" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WMAType <MappingType>

Selects the PUSCH mapping type for the selected FRC.

Parameters:

<MappingType> A | B

*RST: A

Manual operation: See "Mapping Type" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WMODulation?

Queries the modulation for the selected FRC in the FRC wizard.

Return values:

<Modulation> BPSK | BPSK2 | QPSK | QAM16 | QAM64 | QAM256 | QAM1024 | NSQAM2048 | NSQAM4096 | PSK8 | NSAPSK16_23 | NSAPSK16_34 | NSAPSK16_45 | NSAPSK16_56 | NSAPSK16_89 | NSAPSK16_910 | NSAPSK32_34 | NSAPSK32_45 | NSAPSK32_56 | NSAPSK32_89 | NSAPSK32_910

*RST: QPSK

Example: See `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WTYP` on page 611

Usage: Query only

Manual operation: See "Modulation" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WPASize?

Queries the payload size of the selected FRC.

Return values:

<PayloadSize> integer

Range: 528 to 217128
*RST: 984

Usage: Query only

Manual operation: See "Payload Size" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WROFfset <RBOffset>

Defines an RB offset for the selected FRC.

Parameters:

<RBOffset> integer

Range: 0 to Nr5gMax_RbOffs
*RST: 0

Manual operation: See "RB Offset" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WSCSpacing?

Queries the subcarrier spacing for the selected FRC in the FRC wizard.

Return values:

<SCSpacing> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

*RST: N30

Example: See `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WTYP` on page 611

Usage: Query only

Manual operation: See "SC Spacing" on page 48

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:WTYP <FrcWizardId>

Selects an FRC for base station testing with the FRC wizard.

Parameters:

<FrcWizardId> FR1A11 | FR1A12 | FR1A13 | FR1A14 | FR1A15 | FR1A16 | FR1A17 | FR1A18 | FR1A19 | FR2A11 | FR2A12 | FR2A13 | FR2A14 | FR2A15 | FR1A21 | FR1A22 | FR1A23 | FR1A24 | FR1A25 | FR1A26 | NA | FR1A38 | FR1A39 | FR1A310 | FR1A311 | FR1A312 | FR1A313 | FR1A314 | FR1A322 | FR1A323 | FR1A324 | FR1A325 | FR1A326 | FR1A327 | FR1A328 | FR1A48 | FR1A49 | FR1A410 | FR1A411 | FR1A412 | FR1A413 | FR1A414 | FR1A422 | FR1A423 | FR1A424 | FR1A425 | FR1A426 | FR1A427 | FR1A428 | FR1A58 | FR1A59 | FR1A510 | FR1A511 | FR1A512 | FR1A513 | FR1A514 | FR1A331 | FR1A332 | FR2A31 | FR2A32 | FR2A33 | FR2A34 | FR2A35 | FR2A36 | FR2A37 | FR2A38 | FR2A39 | FR2A310 | FR2A311 | FR2A312 | FR2A41 | FR2A42 | FR2A43 | FR2A44 | FR2A45 | FR2A46 | FR2A47 | FR2A48 | FR2A49 | FR2A410 | FR2A51 | FR2A52 | FR2A53 | FR2A54 | FR2A55 | FR2A313 | FR2A314 | FR2A315 | FR2A316 | FR2A317 | FR2A318 | FR2A319 | FR2A320 | FR2A321 | FR2A322 | FR2A323 | FR2A324 | FR2A411 | FR2A412 | FR2A413 | FR2A414 | FR2A415 | FR2A416 | FR2A417 | FR2A418 | FR2A419 | FR2A420 | FR2A56 | FR2A57 | FR2A58 | FR2A59 | FR2A510 | FR1A31 | FR1A32 | FR1A33 | FR1A34 | FR1A35 | FR1A36 | FR1A37 | FR1A315 | FR1A316 | FR1A317 | FR1A318 | FR1A319 | FR1A320 | FR1A321 | FR1A329 | FR1A330 | FR1A41 | FR1A42 | FR1A43 | FR1A44 | FR1A45 | FR1A46 | FR1A47 | FR1A415 | FR1A416 | FR1A417 | FR1A418 | FR1A419 | FR1A420 | FR1A421 | FR1A51 | FR1A52 | FR1A53 | FR1A54 | FR1A55 | FR1A56 | FR1A57 | FR1A110 | FR1A111 | FR1A333 | FR1A333A | FR1A334 | FR1A334A | FR2A71 | FR2A72 | FR2A73 | FR2A74 | FR2A75 | FR2A76 | FR2A77 | FR2A78 | FR2A79 | FR2A710 | FR1A429 | FR1A429A | FR1A430 | FR1A430A | FR1A431A | FR1A431 | FR1A432A | FR1A432 | FR1A3A1 | FR1A3A2 | FR1A3A3 | FR1A3A4 | FR1A3B1 | FR1A3B2 | FR1A3B3 | FR1A3B4 | TS381411_FR1A71 | TS381411_FR1A72 | TS381411_FR1A73 | TS381411_FR1A74 | TS381412_FR1A81 | TS381412_FR1A82 | TS381412_FR1A83 | TS381412_FR1A84 | FR2A325 | FR2A326 | FR2A3A1 | FR2A3A2 | FR2A3A3 | FR2A3A4 | FR2A3A5 | FR2A3A6 | FR2A3A7 | FR2A3A8 | TS38176_FR1A211 | TS38176_FR1A212 | TS38176_FR1A213 | TS38176_FR1A214 | TS38176_FR1A215 | TS38176_FR1A216 | TS38176_FR1A217 | TS38176_FR1A218 | TS38176_FR1A219 | TS38176_FR1A2110 | TS38176_FR1A2111 | TS38176_FR1A2112 | TS38176_FR1A2113 | TS38176_FR1A2114 | TS38176_FR1A2115 | TS38176_FR1A2116 | TS38176_FR1A231 | TS38176_FR1A232 | TS38176_FR1A233 | TS38176_FR1A234 | TS38176_FR1A235 |

TS38176_FR1A236 | TS38176_FR1A237 |
TS38176_FR1A238 | TS38176_FR1A239 |
TS38176_FR1A2310 | TS38176_FR1A2311 |
TS38176_FR1A2312 | TS38176_FR1A2313 |
TS38176_FR1A2314 | TS38176_FR1A241 |
TS38176_FR1A242 | TS38176_FR1A243 |
TS38176_FR1A244 | TS38176_FR1A245 |
TS38176_FR1A246 | TS38176_FR1A247 | TS38176_FR2A211 |
TS38176_FR2A212 | TS38176_FR2A213 |
TS38176_FR2A214 | TS38176_FR2A215 |
TS38176_FR2A216 | TS38176_FR2A217 |
TS38176_FR2A218 | TS38176_FR2A219 |
TS38176_FR2A2110 | TS38176_FR2A2111 |
TS38176_FR2A2112 | TS38176_FR2A2113 |
TS38176_FR2A2114 | TS38176_FR2A2115 |
TS38176_FR2A2116 | TS38176_FR2A2117 |
TS38176_FR2A2118 | TS38176_FR2A2119 |
TS38176_FR2A2120 | TS38176_FR2A2121 |
TS38176_FR2A2122 | TS38176_FR2A2123 |
TS38176_FR2A2124 | TS38176_FR2A221 |
TS38176_FR2A222 | TS38176_FR2A223 |
TS38176_FR2A224 | TS38176_FR2A225 |
TS38176_FR2A226 | TS38176_FR2A227 |
TS38176_FR2A228 | TS38176_FR2A229 |
TS38176_FR2A2210 | TS38176_FR2A231 |
TS38176_FR2A232 | TS38176_FR2A233 |
TS38176_FR2A234 | TS38176_FR2A235 |
TS38176_FR2A236 | TS38176_FR2A237 |
TS38176_FR2A238 | TS38176_FR2A239 |
TS38176_FR2A2310 | TS38176_FR2A2311 |
TS38176_FR2A2312 | TS38176_FR2A2313 |
TS38176_FR2A2314 | TS38176_FR2A2315 |
TS38176_FR2A2316 | TS38176_FR2A2317 |
TS38176_FR2A2318 | TS38176_FR2A2319 |
TS38176_FR2A2320 | TS38176_FR2A241 |
TS38176_FR2A242 | TS38176_FR2A243 |
TS38176_FR2A244 | TS38176_FR2A245 |
TS38176_FR2A246 | TS38176_FR2A247 |
TS38176_FR2A248 | TS38176_FR2A249 |
TS38176_FR2A2410 | FR1A112 | FR1A113 | FR1A114 |
FR1A115 | FR1A116 | FR1A117 | FR1A118 | FR1A119 |
FR1A27 | FR1A28 | FR1A29 | FR1A210 | FR1A211 | FR1A212 |
FR1A213 | FR1A214 | FR1A215 | FR1A216 |
TS381411_FR1A82 | TS381411_FR1A83 | TS381411_FR1A84 |
TS381411_FR1A81 | TS381411_FR1A85 | TS381412_FR1A91 |
TS381412_FR1A92 | TS381412_FR1A93 |
TS381412_FR1A94 | TS381412_FR1A95 | TS38181_FR1A11 |
TS38181_FR1A12 | TS38181_FR1A13 | TS38181_FR1A14 |
TS38181_FR1A15 | TS38181_FR1A16 | TS38181_FR1A17 |
TS38181_FR1A18 | TS38181_FR1A19 | TS38181_FR1A21 |

TS38181_FR1A22 | TS38181_FR1A23 | TS38181_FR1A24 | TS38181_FR1A25 | TS38181_FR1A26 | TS38181_FR1A31 | TS38181_FR1A32 | TS38181_FR1A33 | TS38181_FR1A34 | TS38181_FR1A35 | TS38181_FR1A36 | TS38181_FR1A3A1 | TS38181_FR1A3A3 | FR2A101 | FR2A102 | FR2A103 | FR2A105 | FR2A104 | FR2A106 | FR2A107 | FR2A108 | FR2A109 | FR2A1010 | FR2A1011 | FR2A1012 | FR1A335 | FR1A337 | FR1A336 | FR1A338 | FR1A3B5 | FR1A3B6 | FR1A3B7 | FR1A3B8 | FR2A327 | FR2A3B1 | FR2A3B2

*RST: FR1A12

Example: //Configure FRC wizard

```
BB:NR5G:UBWP:USER:CELL:UL:BWP:FRC:WTYP FR1A11
BB:NR5G:UBWP:USER:CELL:UL:BWP:FRC:WDEPloyment FR1LT3
BB:NR5G:UBWP:USER:CELL:UL:BWP:FRC:WMODulation?
BB:NR5G:UBWP:USER:CELL:UL:BWP:FRC:WSCSpacing?
```

Manual operation: See "FRC" on page 48

12.4 Quick settings command

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CARDeply <Deployment>

Selects one of the frequency ranges, specified for 5G NR transmission.

Parameters:

<Deployment> FR1LT3 | FR1GT3 | FR2_1 | FR2_2

*RST: FR1LT3

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Deployment" on page 38

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CBW <QckSetChannelBW>

Selects the bandwidth of the node carrier.

Parameters:

<QckSetChannelBW> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 | BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 | BW200 | BW400 | BW800 | BW1600 | BW2000

*RST: BW100

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Channel Bandwidth" on page 38

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CCTModel <State>

Creates a copy of a component carrier based on a test model configuration.

Prerequisites for this command

- Select a single carrier (`[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:NCARier`).
- Select a test model (`[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:DL` / `[:SOURce<hw>]:BB:NR5G:SETTing:TMODel:UL`).

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Copy Carrier With Selected Test Model" on page 37

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CHRaster <ChannelRaster>

Sets the "Channel Raster" based on the set "Deployment".

If "Deployment" is set to "FR1 ≤ 3GHz" or "FR1 > 3GHz" the "Channel Raster" can be set to 15 kHz or 100 kHz.

If "Deployment" is set to "FR2-1" the "Channel Raster" is set to 60 kHz.

If "Deployment" is set to "FR2-2" the "Channel Raster" is set to 100 kHz.

"Channel Raster" is not displayed when the "Number of Carriers" is shown inactive.

Parameters:

<ChannelRaster> R15 | R60 | R100

*RST: R100

Example: See Example"Using the quick settings" on page 573

Manual operation: See "Channel Raster" on page 38

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:CHSPacing <ChannelSpacing>

Queries or sets the value for the "Channel Spacing". It is by default automatically calculated by the set "Channel Raster" and the set "Channel Bandwidth".

The value can be manually adjusted, but is recalculated if the "Channel Raster" or the "Channel Bandwidth" is adjusted.

"Channel Spacing" is not displayed when the "Number of Carriers" is shown inactive. In this case, it is used like "Carrier Spacing" equals 0.

Parameters:

<ChannelSpacing> integer

Range: 0 to 800E6

*RST: 0

Example: See Example"Using the quick settings" on page 573

Manual operation: See "Channel Spacing" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:SCSPacing <SubcarrierSpacing>

Sets the subcarrier spacing.

Parameters:

<SubcarrierSpacing> SCS15 | SCS30 | SCS60 | SCS120 | SCS240 | SCS480 | SCS960

*RST: SCS30

Example: See Example"Using the quick settings" on page 573.

Options: SCS480 and SCS960 require R&S SMW-K171

Manual operation: See "Subcarrier Spacing" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ECPState <QSScsEcpState>

Show if the extended cyclic prefix is enabled or disabled.

Parameters:
<QSScsEcpState> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Use Extended Cyclic Prefix" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:DUPLexing <QckSetDuplexing>

Selects the duplexing mode.

Parameters:
<QckSetDuplexing> TDD | FDD
*RST: FDD

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Duplexing" on page 37

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:NCARier <QckSetNumCarrie>

Selects the number of carriers. Needed for carrier aggregation.

Parameters:
<QckSetNumCarrie> integer
Range: 1 to 16
*RST: 1

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of Carriers" on page 37

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:MOD <QckSetModType>

Sets the modulation scheme.

Parameters:
<QckSetModType> QPSK | QAM16 | QAM64 | QAM256 | BPSK2 | QAM1024
*RST: QPSK

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Modulation" on page 40

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:CS:STATe <QckSetCSState>

Activate to schedule a CORESET.

Parameters:
<QckSetCSState> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Use CORESET" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:CSLength <QckSetCORSETLen>

Sets the number of symbols in the CORESET.

Parameters:
<QckSetCORSETLen> integer

Range: 1 to 3
*RST: 1

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of CORESET Symbols" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBConfig <QckSetRbConfig>

Sets the configuration mode for the resource block configuration.

Parameters:
<QckSetRbConfig> MAN | EFL | EFR | ERL | ERR | OUTF | INNF | I1RL | I1RR | OUTP | O1RL | O1RR | R1IF | R1IL | R1IR | R2IF | R2IL | R2IR

*RST: MAN

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Resource Block Configuration" on page 40

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBNumber <QckSetRBNum>

Sets the number of resource blocks.

Parameters:
<QckSetRBNum> integer

Range: 1 to 273
*RST: 273

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of Resource Blocks" on page 40

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:RBOFfset <QckSetRBOffset>

Sets the resource block offset.

Parameters:
<QckSetRBOffset> integer

Range: 0 to 272
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Resource Block Offset" on page 40

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:ES:TP:STATe <State>

Turns transform precoding on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Use Transform Precoding" on page 39

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SLINt <Slots>

Sets the duration of the frame in slots.

Parameters:
<Slots> integer
Range: 2 to 20
*RST: 10

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Slot Period" on page 41

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:IAB:STATe <State>

Turns usage of the IAB frame format on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Use IAB Format" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:GENeral:SFFM:STATe <State>

Turns synchronization to the marker on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 1

Manual operation: See "Synchronize Frame Format to Marker" on page 37

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NDLSlots <QckSetDLSlots>

Sets the number of DL slots in the frame.

Parameters:
<QckSetDLSlots> integer
Range: 0 to 10
*RST: 10

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of DL Slots" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NSSLots?

Queries the number of special slots in the frame.

Return values:
<QckSetNoSplSlot> integer
Range: 0 to 1
*RST: n.a. (no preset. default: 0)

Example: See Example"Using the quick settings" on page 573.

Usage: Query only

Manual operation: See "Number of Special Slots" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:NULSlots <Slots>

Queries the number of UL slots in the frame.

Parameters:
<Slots> integer
Range: 0 to 10
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of UL Slots" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SLFMt <QckSetSlotFmt>

Sets the special slot format index.

Parameters:
<QckSetSlotFmt> integer
Range: 0 to 45
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Slot Format Index" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NDLSymbols <Symbols>

Defines the number of downlink symbols in a special slot.

Prerequisites to define the number of downlink symbols:

- Enter downlink mode (`[:SOURce<hw>]:BB:NR5G:LINK`).
- Turn off usage of special slot format (`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe`).

Otherwise, the command is a query only.

Parameters:

<Symbols> integer

Range: 0 to 14
*RST: 14

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of DL Symbols" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NGSYmbols?

Queries the number of guard symbols.

Return values:

<QckSetSGuardSym>integer

Range: 0 to 14
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Usage: Query only

Manual operation: See "Number of Guarded Symbols" on page 43

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NULSymbols <Symbols>

Defines the number of uplink symbols in a special slot.

Prerequisites to define the number of downlink symbols:

- Enter uplink mode (`[:SOURce<hw>]:BB:NR5G:LINK`).
- Turn off usage of special slot format (`[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe`).

Otherwise, the command is a query only.

Parameters:

<Symbols> integer

Range: 0 to 14
*RST: 0

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Number of UL Symbols" on page 43

[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SFI:STATe <State>

Turns usage of the special slot format on and off.

If on, select a special frame as defined by 3GPP with `[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:SLFMt`.

If off, select the number of symbols with

- Downlink: `[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NDLSymbols`
- Uplink: `[:SOURce<hw>]:BB:NR5G:QCKSet:FRMFormat:SSC:NULSymbols`

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Using the quick settings" on page 573.

Manual operation: See "Use Special Format Index" on page 42

[:SOURce<hw>]:BB:NR5G:QCKSet:APPLy

Adopts the configuration.

Example: See Example"Using the quick settings" on page 573.

Usage: Event

Manual operation: See "Apply" on page 40

[:SOURce<hw>]:BB:NR5G:QCKSet:DISCard

Ignores the configuration.

Example: See Example"Using the quick settings" on page 573.

Usage: Event

Manual operation: See "Discard" on page 40

12.5 Carrier commands

[:SOURce<hw>]:BB:NR5G:NODE:NCARrier <NumCarrier>

Sets the number of simulated carriers.

When used in a previously configured system, reconfigures the number of simulated carriers.

Parameters:

<NumCarrier> integer

Range: 1 to 16
*RST: 1

Example: See Example"Configuring the carrier" on page 574.
See Example"Reconfiguring a 2x1x1 coupled system for MIMO usage" on page 599.

Manual operation: See "Number of Carriers" on page 57

[:SOURce<hw>]:BB:NR5G:NODE:RFPHase:MODE <RFPhaseComp>

Enables the frequency-related phase compensation after each symbol, as specified in TS 38.211.

It uses the parameter Frequency in GHz to set the carrier frequency to be compensated.

Parameters:

<RFPhaseComp> 0 | OFF | MANual | 1 | AUTO

0|OFF
Disables the frequency-related phase compensation.

MANual
Enables the Frequency in GHz field for manual input of the carrier frequency value to be compensated.

1|AUTO
Sets automatically the carrier Frequency in GHz value to be compensated.

*RST: AUTO

Example: See Example"Configuring the carrier" on page 574

Manual operation: See "RF Phase Compensation" on page 60

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CELLid <CellId>

Sets the cell identity of the selected cell.

Parameters:

<CellId> integer

For sidelink, the cell ID range isr 0 to 671.

Range: 0 to 1007
*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Cell ID" on page 61

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CIF <Cif>

Queries the value of the carrier indicator field (CIF).

Parameters:

<Cif> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "CIF" on page 62

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CIFPresent <CifPresent>

Defines whether the carrier indicator field (CIF) is included in the PDCCH DCI formats transmitted from the corresponding cell.

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.

According to the 5G NR specification, cross-carrier scheduling is enabled by higher-level signaling. To simulate a cross-carrier scheduling in this implementation, enable the "Node > Carriers > CIF Present" per each cell.

Parameters:

<CifPresent> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "CIF Present" on page 61

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CINDicator <CellIndicator>

Sets the cell indicator.

Parameters:

<CellIndicator> integer

Range: 0 to 15

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Cell Indicator" on page 60

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:N1ID?

Queries the physical layer indicator group ($N_{ID}^{(1)}$).

(Sidelink: $N_{ID,1}^{SL}$)

Return values:

<ID> integer

Range: 0 to 335
*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Usage: Query only

Manual operation: See "N1 ID/N2 ID" on page 61

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:N2ID?

Queries the physical layer indicator group ($N_{ID}^{(2)}$).

(Sidelink: $N_{ID,2}^{SL}$)

Return values:

<ID> integer

Range: 0 to 2
*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Usage: Query only

Manual operation: See "N1 ID/N2 ID" on page 61

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CARDeply <Deployment>

Selects one of the frequency ranges, specified for 5G NR transmission.

Parameters:

<Deployment> FR1LT3 | FR1GT3 | FR2_1 | FR2_2

*RST: FR1LT3

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Deployment" on page 62

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:CBW <ChanBandWidth>

Selects the bandwidth of the node carrier.

Some bandwidths are available with R&S SMW-K171.

Parameters:

<ChanBandWidth> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 | BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 | BW200 | BW400 | BW800 | BW1600 | BW2000

*RST: BW100

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Channel Bandwidth" on page 62

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DFReq <DeltaFToDc>

Shifts the signal relative to the center output frequency.

Use different frequency offsets to separate the channels of the configured and enabled cells.

Parameters:

<DeltaFToDc> float

Range: -40E6 to 40E6
Increment: 1.0
*RST: 0.0

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Delta f to Output/MHz" on page 63

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:MAPPed <CellMapped>

If enabled, the signal of the selected cell is mapped to the output.

Parameters:

<CellMapped> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Cell Mapped" on page 63

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SHSPec <State>

Turns shared spectrum access on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Shared Spectrum Access" on page 63

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PCFReq <CarrierFreq>

Sets the carrier frequency of the selected carrier at which the frequency phase compensation is applied.

Parameters:

<CarrierFreq> float

Range: 0 to 999E9
Increment: 1E2
*RST: 1E9

Example: See `[:SOURce<hw>]:BB:NR5G:NODE:RFPHase:MODE` on page 623.

Manual operation: See "Frequency in GHz" on page 62

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:RFPHase:REFerence <RefFrequency>

Select the reference frequency for RF phase compensation.

Parameters:

<RefFrequency> RFA | RFB | NONE

NONE
Define the frequency manually with `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PCFReq` on page 627.

RFA | RFB
Selects the frequency on path A or B as the reference frequency.

*RST: RFA

Manual operation: See "RF Ref." on page 62

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SCHBy <SchedBy>

Displays in which cell coordinates the carrier aggregation, if there is intra-band CA.

Queries the component carrier/cell that signals the UL and DL grants for the selected cell. The signaling cell is determined by its cell index.

According to the 5G NR specification, cross-carrier scheduling has to be enabled per user and per component carrier.

To enable signaling for one particular cell on the primary cell, i.e. cross-carrier scheduling, set the "Scheduled By" to 0.

Parameters:

<SchedBy> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15

*RST: 0

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "Scheduled By" on page 61

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TAPos <DmrsTypeAPos>

Sets the position of the first DMRS symbol within the slot, if mapping type A is used.

Parameters:

<DmrsTypeAPos> integer

Range: 2 to 3
*RST: 2

Example: See Example"Configuring the carrier" on page 574.

Manual operation: See "DMRS Type A Position" on page 63

12.6 Copy carrier commands

[:SOURce<hw>]:BB:NR5G:NODE:CC:ADD

Creates new carriers based on the configuration of an existing carrier.

Example: //Duplicate carriers

```
BB:NR5G:NODE:CC:NEWCarriers 2
BB:NR5G:NODE:CC:CPYSel LOADfile
BB:NR5G:NODE:CC:LOAD "c:\configuration.nr5g"
BB:NR5G:NODE:CC:CPYFrom 1
BB:NR5G:NODE:CC:CINFo?
BB:NR5G:NODE:CC:CPYTo?
BB:NR5G:NODE:CC:ADD
```

Usage: Event

Manual operation: See "Apply" on page 60

[:SOURce<hw>]:BB:NR5G:NODE:CC:CINFo?

Queries basic information about the carrier you want to duplicate.

Prerequisites for this command

- Select a file as the source of the new carrier (`[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYSel`).

Return values:

<Information> string

String containing the information about the carrier.

Usage: Query only

Manual operation: See "Carrier Info" on page 59

[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYFrom <Carrier>

Selects the carrier you want to duplicate.

Prerequisites for this command

- Selecting a carrier is only possible if there are more than one carrier in the table or in the configuration file.

Parameters:

<Carrier> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Load Carrier" on page 59

[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYSel <Source>

Selects the source of a carrier that you want to create based on an existing carrier.

Parameters:

<Source>

CARRier
Carrier from the current carrier table.

LOADfile
Carrier from a previously saved signal configuration (`.nr5g` file).

*RST: CARRier

Manual operation: See "Copy / Load From" on page 59

[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYTo?

Queries the index number the new carriers are created with.

Return values:

<Carrier> string

String containing the number of the new carriers.

Usage: Query only

Manual operation: See "Copy To New Carrier" on page 60

[:SOURce<hw>]:BB:NR5G:NODE:CC:LOAD <FileName>

Selects a file containing an existing carrier you want to duplicate.

Prerequisites for this command

- Select a file as the source of the new carrier (`[:SOURce<hw>]:BB:NR5G:NODE:CC:CPYSel`).

Parameters:
<FileName> string
String containing the file name.

Manual operation: See "Recall File" on page 59

[:SOURce<hw>]:BB:NR5G:NODE:CC:NEWCarriers <Carriers>

Defines the number of carriers you want to create based on an existing carrier.

Parameters:
<Carriers> integer
Range: 0 to 15
*RST: 1

Manual operation: See "Number of New Carriers" on page 59

12.7 System information commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:HACBook
<HarqAckCodebook>

Defines the HARQ ACK reporting according to the PDSCH HARQ ACK codebook.

Parameters:
<HarqAckCodebook> SEMistatic | DYNamic

SEMistatic
Sets the HARQ ACK reporting according to the PDSCH HARQ ACK codebook to "Semi-static".
A UE reports HARQ ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to- HARQ feedback timing indicator field in a corresponding DCI format 1_0 or DCI format 1_1.
The UE reports NACK values for HARQ-ACK information bits in an HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ feedback timing indicator field in a corresponding DCI format 1_0 or DCI format 1_1.

DYNamic
Sets the HARQ ACK reporting according to the PDSCH HARQ ACK codebook to "dynamic".
For a serving cell, an active DL BWP, and an active UL BWP, as described in clause 12, the UE determines a set of occasions for candidate PDSCH receptions for which the UE can transmit corresponding HARQ ACK information in a PUCCH in slot . If serving cell is deactivated, the UE uses as the active DL BWP for determining the set of occasions for candidate PDSCH receptions a DL BWP provided by firstActiveDownlinkBWP-ID.

*RST: SEMistatic

Example: See Example"System Information" on page 575

Manual operation: See "PDSCH HARQ ACK Codebook" on page 64

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:HACR <CodebookR16>

Defines the state of the higher layer parameter `pdsch-HARQ-ACK-Codebook-r16`.

Parameters:
<CodebookR16> NCON | EDYN

NCON
Does not apply the release 16 codebook (not configured).

NCON
Applies the release 16 codebook (enhanced dynamic).

*RST: NCON

Manual operation: See "PDSCH HARQ ACK Codebook R16" on page 65

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:SUL:STATe <CarrierSULState>

Defines if the carrier supports supplementary uplink (SUL) or not.

Parameters:
<CarrierSULState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"System Information" on page 575

Manual operation: See "SUL" on page 65

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:INDSize <BitLength>

Defines the bit length of the DCI field "Carrier Indicator" available in DCI formats 1_2.

Parameters:

<BitLength> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Indicator Size DCI1_2" on page 65

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:IS02 <BitLength>

Defines the bit length of the DCI field "Carrier Indicator" available in DCI formats 0_2.

Parameters:

<BitLength> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Indicator Size DCI0_2" on page 65

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:CTOFfset <Offset>

Defines a cell specific custom timing advance offset in terms of time (T_c).

Prerequisites for this command

- Select more than one carrier (`[:SOURce<hw>]:BB:NR5G:NODE:NCARrier`).

Parameters:

<Offset> integer

Range: -2004572 to 1964636
*RST: 0

Example: See: Example"Configuring the carrier" on page 574.

Manual operation: See "Custom Timing Advance Offset (Tc)" on page 68

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:PHOFfset <Offset>

Defines a cell specific phase offset.

Parameters:

<Offset> float

Range: 0 to 360
Increment: 0.01
*RST: 0

Example: See: Example"Configuring the carrier" on page 574.

Manual operation: See "Phase Offset" on page 68

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SFOFfset <Offset>

Defines a cell specific cyclic subframe shift in terms of subframes.

Parameters:

<Offset> integer

Range: 0 to 10
*RST: 0

Example: See: Example"Configuring the carrier" on page 574.

Manual operation: See "Sub Frame Offset" on page 67

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SSBToffset <Offset>

Defines a time offset for the SS/PBCH block.

Parameters:

<Offset> S0 | S5 | S10 | S15

Time offset in milliseconds (0, 5, 10 and 15 ms).

*RST: S0

Manual operation: See "Ssb Time Offset R17" on page 67

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TMPH:SYFNoffset <SysFrmNumOff>

Sets an offset value for the system frame number. The first generated frame starts with the given system frame number offset.

Parameters:

<SysFrmNumOff> integer

Range: 0 to 1023
*RST: 0

Example: See Example"System Information" on page 575

Manual operation: See "System Frame Number Offset" on page 66

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>[:TMPH]:TAOFfset <TimingAdjOffset>

Sets an offset ($N_{TA\ offset}$) to the timing advance value for UL/DL switching synchronization as specified in TS 38.211.

The $N_{TA\ offset}$ values can be set as specified in TS 38.133.

Parameters:

<TimingAdjOffset> N0 | N13792 | N25600 | N39936

*RST: N0

Example: See: Example"Configuring the carrier" on page 574.

Options: R&S SMW-K148

Manual operation: See "Timing Advance Offset" on page 67

12.8 TxBW commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:POINta <Frequency>

Sets the frequency offset between the reference Point A and the center carrier frequency.

Parameters:

<Frequency> float

Range: -50e6 to 0
Increment: 0.015
*RST: 49140000

Example: See Example"Configuring the TxBWs" on page 575.

Manual operation: See "Point A to Baseband Center" on page 69

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:CONFlict?

Queries whether there is a conflict.

Return values:
<Conflict> 1 | ON | 0 | OFF
*RST: n.a. (no preset. default: 0)

Example: See Example"Configuring the TxBWs" on page 575.

Usage: Query only

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:RESolve

Recalculates the frequency-dependent settings and thus redefines the frequency position of the TxBW.

Example: See Example"Configuring the TxBWs" on page 575.

Usage: Event

Manual operation: See "Resolve Conflicts" on page 70

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S960K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S480K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S240K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S120K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S15K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S60K:USE <ScsUse>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:USE <ScsUse>

Enables an SCS in the particular cell.

Parameters:
<ScsUse> 1 | ON | 0 | OFF

Example: See Example"Configuring the TxBWs" on page 575.

Options: Subcarrier spacings 480 kHz and 960 kHz require R&S SMW-K171

Manual operation: See "Use" on page 71

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S120K:NRB?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S15K:NRB?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S60K:NRB?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:NRB?

Queries the number of available resource blocks (N_RB).

Return values:
<NRB> integer
Range: 0 to 273
*RST: 0

Example: See Example"Configuring the TxBWs" on page 575.

Usage: Query only

Manual operation: See "N_RB" on page 71

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S120K:OFFSet <ScsOffset>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S15K:OFFSet <ScsOffset>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S60K:OFFSet <ScsOffset>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:OFFSet <ScsOffset>

Sets the offset between the usable RB and the common RBs.

Parameters:
<ScsOffset> float

Range: 0 to 9
Increment: 1
*RST: 0

Example: See Example"Configuring the TxBWs" on page 575.

Manual operation: See "TxBW Offset" on page 71

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S120K:KOMU?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S15K:KOMU?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S60K:KOMU?
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:TXBW:S30K:KOMU?

Queries the value of the parameter k_0^{μ}.

Return values:
<KoMu> integer

Range: -6; 0; 6 further values indicate conflict
*RST: 0

Example: See Example"Configuring the TxBWs" on page 575.

Usage: Query only

Manual operation: See "k0μ" on page 71

12.9 LTE-CRS coexistence commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:NPAT <CRSPatterns>

Defines the number of LTE cell specific reference signals in the resource grid.

Parameters:
<CRSPatterns> integer
Range: 1 to 4
*RST: 1

Manual operation: See "Number of LTE CRS Patterns" on page 73

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe <LteCrsState>

Enable the LTE-CRS.

Parameters:
<LteCrsState> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"LTE-CRS Coexistence" on page 575.

Manual operation: See "State" on page 73

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:CBW <ResourceBlocks>

Selects the channel bandwidth of an LTE carrier.

Prerequisites for this command

- Turn on LTE-CRS coexistence (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe`).

Parameters:
<ResourceBlocks> N6 | N15 | N25 | N50 | N75 | N100
*RST: N6

Example: See Example"LTE-CRS Coexistence" on page 575.

Manual operation: See "LTE Bandwidth (RB)" on page 73

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:NAP <AntennaPorts>

Selects the number of antenna ports for an LTE signal.

Prerequisites for this command

- Turn on LTE-CRS coexistence (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe`).

Parameters:
<AntennaPorts> AP1 | AP2 | AP4
*RST: AP1

Example: See Example"LTE-CRS Coexistence" on page 575.

Manual operation: See "LTE Antenna Ports" on page 74

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:POINta <ResourceBlocks>

Defines an LTE carrier offset relative to reference point A (in terms of resource blocks).

Prerequisites for this command

- Turn on LTE-CRS coexistence (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe`).

Parameters:

<ResourceBlocks> integer

Range: 0 to 30300
*RST: 0

Example: See Example"LTE-CRS Coexistence" on page 575.

Manual operation: See "Offset to Point A (15 kHz SC Spacing)" on page 73

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:PATT<st0>:VSHift <Value>

Selects the vShift parameter for an LTE signal.

Prerequisites for this command

- Turn on LTE-CRS coexistence (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:LTE:STATe`).

Parameters:

<Value> integer

Range: 0 to 5
*RST: 0

Example: See Example"LTE-CRS Coexistence" on page 575.

Manual operation: See "vShift" on page 73

12.10 SS/PBCH commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:OFFSet <OffsetRelativeT>

Defines the reference point, relative to which the SS/PBCH is allocated in frequency domain.

For the sidelink application: the reference point of the S-SS/PSBCH is always the reference point A.

Parameters:

<OffsetRelativeT> TXBW | POINta

TXBW
The frequency position of the SS/PBCH is set relative to the usable RBs that apply for the current numerology, i.e. to the start of the TxBWs.

POINta
The frequency position of the SS/PBCH is set relative to the position of point A.

*RST: TXBW

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Offset Relative to" on page 75
See "Offset Relative to" on page 83

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:NSSPbch <NuOfPbchPattern>

Sets the number of SS/PBCH patterns to be configured.

For the sidelink application: number of S-SS/PSBCH patterns.

Parameters:

<NuOfPbchPattern> integer

Range: 0 to 4
*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Number of SS/PBCH Patterns" on page 75
See "Number of S-SS/PSBCH Patterns" on page 83

[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:AP4000[:ROW<ch0>] <AP4000>

Sets if the SS/PBCHs are output at the selected output.

Parameters:

<AP4000> 0 | 1 | OFF | ON

*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Antenna Port" on page 75
See "Antenna Port" on page 83

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:STATe <sspbchState>

Enables the transmission of SS/PBCH.

For the sidelink application: transmission state of the S-SS/PSBCH pattern.

Parameters:

<sspbchState> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "State" on page 81
See "State" on page 84

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCSPacing <SCSPacing>

Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Parameters:

<SCSPacing> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

For the sidelink application, the maximum subcarrier spacing is 120 kHz.

*RST: N30

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "SC Spacing/CP" on page 76
See "SC Spacing/CP" on page 83

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:RBOFfset <RBOffset>

Sets the start resource block of the selected allocation as offset to the start of usable RBs that apply for the current numerology.

Parameters:

<RBOffset> integer

Range: 0 to 126
*RST: 10

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "RB Offset/RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS)" on page 76
See "RB Offset (15 kHz SCS)/RB Offset (60 kHz SCS)" on page 83

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCOFfset <SCOffset>

Sets the start subcarrier of the selected allocation within the resource block.

Parameters:

<SCOffset> integer

The value range depends on the selected RB offset (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:RBOFfset`).

Range: 0 to 11
*RST: 6

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "SC Offset/SC Offset (15 kHz SCS)/SC Offset (60 kHz SCS)" on page 77

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:DFReq?

Queries the frequency offset between the center of the SS/PBCH block to the center of the carrier.

For the sidelink application: offset between S-SS/PSBCH block and center frequency of the carrier.

Return values:

<PbchDeltaF> float

Range: -40E6 to 40E6
Increment: 1.0
*RST: 0.0

Example: See Example"Configuring the SS/PBCH" on page 576.

Usage: Query only

Manual operation: See " Delta f to Carrier (Centers)" on page 77
See "Δf to Carrier (Centers)/MHz" on page 84

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CASE <PbschCase>

Selects one of the SS/PBCH cases, as specified in TS 38.213.

Parameters:

<PbschCase> **A|B|C|D|E**

F|G
Requires R&S SMW-K171.

*RST: B

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Case" on page 77

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:L <PositionBitLen>

Sets the number of SS/PBCH blocks, transmitted per half-frame.

Parameters:

<PositionBitLen> L4 | L8 | L64 | L10 | L20

*RST: L4

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "L" on page 78

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Parameters:

<Pattern> 64 bits

An internally generated sequence according to a bit pattern.
Each bit applies to one SS/PBCH block.
1: SS/PBCH block is present
0: SS/PBCH transmission is suppressed.

*RST: #HC

<BitCount> integer

Range: 4 to 64
*RST: 4

Example: See Example"Configuring the SS/PBCH" on page 576

Manual operation: See "Positions" on page 78

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:BSPeriodicty <BurstSetPer>

Sets the burst set periodicity.

Parameters:

<BurstSetPer> BS5 | BS10 | BS20 | BS40 | BS80 | BS160 | BS320 | BS640

*RST: BS10

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Burst Set Periodicity" on page 78

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:HFRMidx <HalfFrameIdx>

Defines in which half-frame of the time plan the first SS/PBCH burst occasion is located.

The "Half Frame Index" value depends on the configured "Burst Set Periodicity".

The default value is 0, it locates the first SS/PBCH occasion in the first half-frame. If you set the value to 1, the first SS/PBCH occasion is in the second half-frame and so forth.

Parameters:

<HalfFrameIdx> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Half Frame Index" on page 79

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POWer <PbchPower>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:PSSPow <PssPower>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SSSPow <SssPower>

Sets the power of the SSS/PSS/PBCH allocations relative to the power of the other resource elements.

For the sidelink application: power of S-PSS, S-SSS and PSBCH.

Parameters:

<SssPower> float

Range: -80.0 to 10.0
Increment: 0.01
*RST: 0.0

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "PSS/SSS Power" on page 80

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:IMAGinary <ImaginaryValue>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:REAL <RealValue>

Define the mapping of the antenna ports to the physical antennas for the SS/PBCH pattern if Cartesian mapping coordinates are used.

Suffix:

<dir0> Depends on the number of positions defined in the SS/PBCH pattern
Defines the position of the SS/PBCH pattern to which the AP-mapping configuration is applied

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<RealValue> 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: 1

Example: See Example"Configuring the SS/PBCH" on page 576

Manual operation: See "Mapping table" on page 81

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:MAGNitude <Magnitude>

Defines the mapping of the antenna ports to the physical antennas for the SS/PBCH pattern if cylindrical mapping coordinates are used.

Suffix:

<dir0> Depends on the number of positions defined in the SS/PBCH pattern
Defines the position of the SS/PBCH pattern to which the AP-mapping configuration is applied

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<Magnitude> float

Range: 0 to 1
Increment: 0.001
*RST: 0

Example: Example"Configuring the SS/PBCH" on page 576

Manual operation: See "Mapping table" on page 81

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:PHASe <Phase>

Defines the mapping of the antenna ports to the physical antennas for the SS/PBCH pattern if cylindrical mapping coordinates are used.

Suffix:

<dir0> Depends on the number of positions defined in the SS/PBCH pattern
Defines the position of the SS/PBCH pattern to which the AP-mapping configuration is applied

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<Phase> float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example: Example"Configuring the SS/PBCH" on page 576

Manual operation: See "Mapping table" on page 81

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:STATe <State>

Enables PBCH channel coding.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Channel Coding" on page 96

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:DATA <PbchDataSource>

Selects the PBCH data source.

Parameters:

<PbchDataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Data Source" on page 96

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:DLISt <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"Configuring the SS/PBCH" on page 576.

Manual operation: See "Data Source" on page 96

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:CCODing:PATTern
<Pattern>, <BitCount>

Sets a bit pattern as a data source.

Parameters:

<Pattern> 64 bits
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Data Source" on page 96

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:STATe
<SSPbchMIBState>

Defines how the MIB is defined.

Parameters:

<SSPbchMIBState> 1 | ON | 0 | OFF

1|ON
A faster way to define the MIB.
You can define if channel coding is used or not and select an arbitrary data source; further settings are not required.

0|OFF
Allows you to configure the MIB content according to TS 38.331.

*RST: 1

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Dummy Content for MIB" on page 95

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SCSC
<SSPbchSCSCommon>

Selects the common SCS (subcarrier spacing).

Parameters:

<SSPbchSCSCommon> N15_60 | N30_120
*RST: N15_60

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "SCS Common" on page 97

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:ASOF:STATe
<SSPbchASCOfStat>

If enabled, the SSPBCH subcarrier offset is set automatically, depending on the selected common subcarrier spacing.

Parameters:
<SSPbchASCOfStat> 1 | ON | 0 | OFF

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Auto Subcarrier Offset" on page 97

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SCOFfset
<SSPbchCustomSsb>

Queries the SS/PBCH subcarrier offset.

Parameters:
<SSPbchCustomSsb>float

Range: 0 to 31

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "SSPBCH Subcarrier Offset" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SFOFfset?

By default, the counting of the SFN (system frame number) starts with 0. Use this parameter to set a different start SFN value.

Return values:
<SSPbchSFStartOf> integer

Range: 0 to 1023
*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Usage: Query only

Manual operation: See "System Frame Number Start Offset" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:CSZero
<SSPbchCSZero>

Sets the common control resource set (CORESET) of the initial downlink BWP.

Parameters:
<SSPbchCSZero> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "CORESET Zero" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SSZero
<SSPbchSSZero>

Sets the common search space of the initial downlink BWP.

Parameters:
<SSPbchSSZero> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Search Space Zero" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:CBARred
<SSPbchCellBarre>

Cell barring is system information that indicates if UEs can camp on the particular cell `NBAR` or not `BARR`.

Parameters:
<SSPbchCellBarre> BARR | NBAR

*RST: BARR

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Cell Barred" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:IFRResel
<SSPbchInFreqSel>

Sets the value of the system information parameter intraFreqReselection.

Parameters:
<SSPbchInFreqSel> ALWD | NALW

*RST: ALWD

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Intra Freq Reselection" on page 98

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:MIB:SPARe:STATe
<PbchSpareState>

Sets the system information bit spare, as defined in TS 38.331.

Parameters:
<PbchSpareState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Manual operation: See "Spare" on page 99

12.11 S-SS/PSBCH configuration commands

Commands to configure the S-SS/PSBCH described elsewhere.

- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:NSSPbch`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:OFFSet`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCSPacing`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:RBOFfset`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:DFReq?`

Commands to configure S-SS/PSBCH power described elsewhere.

- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:PSSPow`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SSSPow`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POWer`

Commands to configure S-SS/PSBCH antenna port mapping described elsewhere.

- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:IMAGinary`
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:MAGNitude` on page 645
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:PHASe` on page 645
- `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:POSition:APMap<dir0>:COL<apc>:ROW<apr>:REAL` on page 644

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:BINPeriod <SSBlocks>

Defines the number of transmitted S-SS/PSBCH blocks.

Parameter values depend on:

- Selected subcarrier spacing (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SCSPacing`).

Parameters:

<SSBlocks> B1 | B2 | B4 | B8 | B16 | B32 | B64

*RST: B1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "S-SS/PSBCH Blocks in Period" on page 84

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:INCoverage <State>

Turns the higher layer parameter `inCoverage` for the PSBCH on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "InCoverage" on page 99

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:INTerval <Slots>

Defines the number of slots between two consecutive S-SS/PSBCH blocks.

Parameters:

<Slots> integer

Range: 1 to 639
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Time Interval/Slots" on page 84

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:SBITs <Pattern>, <BitCount>

Defines the spare bits for the PSBCH.

Parameters:

<Pattern> 2 bits

*RST: #H0

<BitCount> integer

Range: 2 to 2
*RST: 2

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SpareBits" on page 100

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:TDDConf <Pattern>, <BitCount>

Defines the bit pattern for the PSBCH TDD configuration.

Parameters:

<Pattern> 12 bits
*RST: #H0

<BitCount> integer
Range: 12 to 12
*RST: 12

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "tddConfig" on page 100

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SSPBch<ssb>:SL:TOFFs <Slots>

Defines the offset between slot 0 and first S-SS/PSBCH block.

Parameters:

<Slots> integer
Range: 0 to 1279
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Time Offset/Slots" on page 84

12.12 PRS commands

Option: R&S SMW-K148

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:NRSets <NumResSet>

Sets the number of resource sets of the DL PRS frequency layer.

Parameters:

<NumResSet> integer

Range: 1 to 8
*RST: 1

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Number of PRS Resource Sets" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:CMBSize <PrsRSCombSize>

Sets the resource element (RE) spacing in each symbol of a resource within a resource set.

Parameters:

<PrsRSCombSize> C2 | C4 | C6 | C12

*RST: C2

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Comb Size (K_comb)" on page 87

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:NRESources <PrsNumRes>

Sets the number of resources included in the resource set.

Parameters:

<PrsNumRes> integer

Range: 1 to 64
*RST: 1

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Number of PRS Resources" on page 87

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:PER <PrsRSPeriod>

Sets the periodicity of the DL PRS allocation in slots for the given resource set.

Parameters:

<PrsRSPeriod> SL10240 | SL5120 | SL2560 | SL1280 | SL640 | SL320 | SL160 | SL64 | SL64 | SL40 | SL32 | SL20 | SL16 | SL10 | SL8 | SL5 | SL4

*RST: SL4

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Periodicity (T_per)" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RBNumber <PrsRSNumRB>

Sets the number of resource blocks (RBs) for all resources in the resource set in multiples of 4 RBs.

Parameters:

<PrsRSNumRB> integer

Range: 24 to 272
*RST: 272

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "No. RBs" on page 87

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RBSTart <PrsRSRBStart>

Sets the starting RB index of the resource set with respect to the reference point A.

The point A is defined as the absolute frequency of the reference resource block.

Parameters:

<PrsRSRBStart> integer

Range: 0 to 2176
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Start RB (to point A)" on page 87

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:REPFactor <PrsRSRepFactor>

Sets the number of repetitions of each resource for a single instance of the resource set.

Parameters:

<PrsRSRepFactor> REP32 | REP16 | REP8 | REP4 | REP1 | REP2

*RST: REP1

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Repetition Factor (T_rep)" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:IMAGinary <PrsAPImag>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:REAL <PrsAPReal>

Sets the mapping of the antenna ports (AP) for the PRS resource, if Cartesian coordinates are used.

Parameters:

<PrsAPReal> 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: 1

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Mapping table" on page 89

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:MAGNitude <PrsAPMagn>
[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:APMap:COL<apc>:ROW<apr>:PHASe <PrsAPPhase>

Sets the mapping of the antenna ports (AP) for the PRS resource, if cylindrical coordinates are used.

Parameters:

<PrsAPPhase> float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Mapping table" on page 89

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:NSYMbol <PrsResNSymb>

Sets the number of symbols of the resource within a slot.

Parameters:

<PrsResNSymb> S12 | S6 | S4 | S2

*RST: S2

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "No. Symbols (L_PRS)" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:POWer <PrsResPower>

Sets the average EPRE (energy per resource element) of the resource used for PRS transmission.

Parameters:

<PrsResPower> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Power / dB" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:REOFfset <PrsResREOff>

Sets the resource element (RE) offset in the frequency domain for the first symbol in a resource.

Parameters:

<PrsResREOff> integer

Range: 0 to 11
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "RE Offset (k_off.)" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SLOFfset <PrsResSlotOff>

Set the starting slot of the resource with respect to the corresponding resource set Slot Offset (T_offset).

Parameters:
<PrsResSlotOff> integer
Range: 0 to 10239
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Resource Slot Offset (k_off.,res)" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SQID <PrsResSeqID>

Sets the resource ID to initialize the c_{init} value for the generation of the DL PRS sequence.

Parameters:
<PrsResSeqID> integer
Range: 0 to 4095
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Sequence ID" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:RES<dir0>:SYOFfset <PrsResSymbOff>

Sets the starting symbol of the resource within a slot.

Parameters:
<PrsResSymbOff> integer
Range: 0 to 12
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Symbol Offset (l_start)" on page 88

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:SLOFfset <PrsRSSlotOffset>

Sets a slot offset for the resource set with respect to the SFN0 slot 0.

Parameters:
<PrsRSSlotOffset> integer
Range: 0 to 10239
*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Slot Offset (T_offset)" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:RSET<st0>:TGAP <PrsRSTimeGap>

Sets an offset in slots between two resources with the same resource ID within a resource set.

The time gap should not exceed the Periodicity (T_per).

Parameters:

<PrsRSTimeGap> TG1 | TG2 | TG4 | TG8 | TG16 | TG32

*RST: TG1

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "Time Gap (T_gap)" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:SCSPacing <PrsNumerology>

Sets the combination of the subcarrier spacing (SCS) and the cyclic prefix (CP) for the DL PRS frequency layer.

Set the value according to the configured Deployment.

Parameters:

<PrsNumerology> N15 | N30 | N60 | N120 | X60 | N480 | N960

<N|X> <SCS>

N = Normal CP, X = Extended CP, SCS = SCS in kHz

*RST: N30

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "SC Spacing / CP" on page 86

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:PRS:STATe <PrsState>

Enables the DL PRS positioning frequency layer for the given carrier cell.

Parameters:

<PrsState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring PRS resources" on page 577.

Manual operation: See "State" on page 86

12.13 Dummy resource elements commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:STATe <DummyResState>

Enables filling in unallocated resource elements (RE) with dummy data.

Parameters:

<DummyResState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "State" on page 90

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:POWer <Power>

Sets the power of the resource elements filled in with dummy data.

Parameters:

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Power" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:SCSPacing <SCSPacing>

Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP), where the available values depend on the "Deployment".

See Table 2-2.

Parameters:

<SCSPacing> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

*RST: N30

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "SC Spacing/CP" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:MODulation <Modulation>

Sets the modulation scheme for the dummy REs.

Parameters:

<Modulation> BPSK | BPSK2 | QPSK | QAM16 | QAM64 | QAM256 | QAM1024

*RST: QPSK

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Modulation" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:TPSTate <TrPrecState>

In uplink, enables using the optional DFT-S scheme.

Parameters:

<TrPrecState> 1 | ON | 0 | OFF

*RST: 0

Example:

```
SOURce1:BB:NR5G:LINK UP
SOURce1:BB:NR5G:NODE:CELL0:DUMRes:TPSTate 1
```

Manual operation: See "Transform Precoding" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:DATA <DataSource>

Sets the data source for the dummy REs.

Parameters:

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Data Source" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:DLISt <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: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Data Source" on page 91

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Parameters:

<Pattern> 64 bits
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Data Source" on page 91

12.14 OCGN commands

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:IMAGinary <ImaginaryValue>

Define the mapping of the antenna ports to the physical antennas for unused (dummy) resource elements in cartesian mapping format (imaginary value).

Suffix:

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<ImaginaryValue> float

Range: -1 to 1
Increment: 0.001
*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Mapping Table" on page 93

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:MAGNidute <Magnitude>

Define the mapping of the antenna ports to the physical antennas for unused (dummy) resource elements in cylindrical mapping format (magnitude value).

Suffix:

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<Magnitude> float

Range: 0 to 1
Increment: 0.001
*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Mapping Table" on page 93

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:PHASe <Phase>

Define the mapping of the antenna ports to the physical antennas for unused (dummy) resource elements in cylindrical mapping format (phase value).

Suffix:

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<Phase> float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Mapping Table" on page 93

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:APMap:COL<apc>:ROW<apr>:REAL <RealValue>

Define the mapping of the antenna ports to the physical antennas for unused (dummy) resource elements in cartesian mapping format (real value).

Suffix:

<apc> Depends on the selected number of layers
Defines the antenna port (i.e. the column in the antenna port mapping table)

<apr> Depends on the number of basebands outputs currently mapped to a cell
Available basebands (i.e. rows in the antenna port mapping table)

Parameters:

<RealValue> 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

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Mapping Table" on page 93

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:NAPS <NumAPs>

Selects the number of antenna ports that unused resource elements (dummy REs) are mapped to.

Parameters:

<NumAPs> integer

Range: 1 to 12
*RST: 1

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Number of Antenna Ports" on page 93

[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:DUMRes:PREC:STATe <State>

Turns precoding for unused resource elements (dummy REs) on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Filling in the frame with dummy REs" on page 577.

Manual operation: See "Precoding" on page 92

12.15 Carrier mapping commands

[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>] <MapCellSel>

Maps the NR 5G carriers to certain baseband outputs.

Suffix:

<st0> Selects the carrier.
The number of carriers depends on your configuration (`[:SOURce<hw>]:BB:NR5G:NODE:NCARrier`).

<apr> Selects the baseband output.
The number of baseband outputs depends on your configuration.

Parameters:

<MapCellSel> 1 | ON | 0 | OFF

ON | 1
Carrier <st0> is mapped to baseband output <ch0>.

OFF | 0
Carrier <st0> is not mapped to baseband output <ch0>.

*RST: 1

Manual operation: See "Carrier" on page 94

12.16 DL and UL user properties commands

[:SOURce<hw>]:BB:NR5G:UBWP:NUSer <NumUsers>

Sets the number of simulated users.

Parameters:

<NumUsers> integer

Range: 1 to 50
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Options: R&S SMW-K148 supports up to 50 users.

Manual operation: See "Number of Users" on page 101

[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:INTerval <Slots>

Defines the number of slots after which the slot index within a frame restarts.

Prerequisites for this command

- Turn on custom slot index restart (`[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:STATe`).

Parameters:

<Slots> integer

Range: 0 to 640
*RST: 10

Example: See `[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:STATe` on page 666

Manual operation: See "Slot Interval" on page 102

[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:STATe <State>

Turns a restart of the slot index within a frame on and off.

If on, define the restart interval with `[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:INTerval`.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: //Use custom restart of the slot index

```
[:SOURce]:BB:NR5G:UBWP:RESTart:SIDX:STATe ON
[:SOURce<hw>]:BB:NR5G:UBWP:RESTart:SIDX:INTerval 80
```

Manual operation: See "Restart Slot Index" on page 102

[:SOURce<hw>]:BB:NR5G:UBWP:SINTerval <SlotInterval>

Defines the number of slots after which the data source restarts (restart every <x> slots).

Prerequisites for this command

- Single numerology setup
- `[:SOURce<hw>]:BB:NR5G:UBWP:RESTart` = SLOT

Parameters:

<SlotInterval> integer

Range: 1 to 20

*RST: 10

Manual operation: See "Slot Interval" on page 101

[:SOURce<hw>]:BB:NR5G:UBWP:SOFFset <SlotOffset>

Defines an offset in terms of slots for the restart of the data source.

Prerequisites for this command

- Single numerology setup
- `[:SOURce<hw>]:BB:NR5G:UBWP:RESTart` = SLOT
- `[:SOURce<hw>]:BB:NR5G:UBWP:SINTerval` > 1

Parameters:

<SlotOffset> integer

Maximum offset = slot interval - 1

Range: 0 to 19

*RST: 0

Manual operation: See "Slot Offset" on page 101

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSPC:STATe <Source>

Turns usage of a unique data source for the PDSCH in a multi-carrier scenario on and off.

Parameters:

<Source> 1 | ON | 0 | OFF

*RST: 1

Manual operation: See "Data Source Unique per Carrier" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:ORAN:TC <OranTc>

Selects the ORAN test case for ORAN data generation.

Prerequisites for this command

- Turn on ORAN compliant data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:ORAN:USDS`).

Parameters:

<OranTc> TC3231_1 | TC3231_2 | TC3231_3 | TC3231_4 | TC3231_5 | TC3231_6 | TC3231_7 | TC3231_8 | TC3231_9 | TC3231_10 | TC3231_11 | TC3231_12 | TC3231_13 | TC3231_14 | TC3231_15 | TC3231_16 | TC3231_17 | TC3251_1 | TC3251_2 | TC3251_3DL | TC3251_3UL | TC3251_5 | TC3251_7 | TC3251_8DL | TC3251_8UL | TC3251_4DL | TC3251_4UL | TC3261_1DL | TC3261_1UL | TC3261_3DL | TC3261_3UL | TC3261_5DL | TC3261_5UL | TC3261_6DL | TC3261_6UL

*RST: TC3231_1

Manual operation: See "ORAN Test Case" on page 103

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:ORAN:USDS <State>

Turns usage of the PxSCH data source according to the ORAN standard on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use ORAN Data Source" on page 103

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA <DataSource>

Selects the data source for the PUSCH UCI.

Prerequisites for this command

- Allow selection of data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DSUNique`).

Parameters:

<DataSource>

ONE | ZERO
Data source is a sequence that contains only "0" or "1".

DLISt
Data source is a sequence based on a binary data list.

PATTern
Data source is sequence based on a bit pattern.

PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23
Data source is a pseudo-random sequence.

*RST: PN9

Manual operation: See "PUCCH Payload Data Source" on page 106

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DLISt <File>

Selects an existing data list file from the default directory or from the specific directory.

Prerequisites for this command

- Select a file as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA`).

Parameters:

<File>

string

Filename incl. file extension or complete file path.

Manual operation: See "Initialization / Pattern / Data List" on page 106

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DSUNique <State>

Turns selection of different data sources for the PUCCH payload on and off.

If off, you can select a data source with `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA`.

Parameters:

<State>

1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Unique Data Source for PUCCH Payload" on page 106

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:INITpattern <Pattern>

Sets an initialization value for the second m-sequence in the PN sequence.

Prerequisites for this command

- Select a PN sequence as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA`).

Parameters:

<Pattern> integer

Range: 1 to 0x7fffff
*RST: 1

Manual operation: See "Initialization / Pattern / Data List" on page 106

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Prerequisites for this command

- Select a bit pattern as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUPLoad:DATA`).

Parameters:

<Pattern> 64 bits

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Manual operation: See "Initialization / Pattern / Data List" on page 106

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA <DataSource>

Selects the data source for the PUSCH UCI.

Prerequisites for this command

- Allow selection of data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DSUNique`).

Parameters:

<DataSource>

ONE | ZERO
Data source is a sequence that contains only "0" or "1".

DLISt
Data source is a sequence based on a binary data list.

PATTern
Data source is sequence based on a bit pattern.

PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23
Data source is a pseudo-random sequence.

*RST: PN9

Manual operation: See "PUSCH UCI Data Source" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DLISt <File>

Selects an existing data list file from the default directory or from the specific directory.

Prerequisites for this command

- Select a file as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA`).

Parameters:

<File> string

Manual operation: See "Initialization / Pattern / Data List" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DSUNique <State>

Turns selection of different data sources for the PUSCH UCI on and off.

If off, you can select a data source with `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA`.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Unique Data Source for PUSCH UCI" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:INITpattern <Pattern>

Sets an initialization value for the second m-sequence in the PN sequence.

Prerequisites for this command

- Select a PN sequence as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA`).

Parameters:

<Pattern> float

Range: 1 to 0x7fffff
Increment: 1
*RST: 1

Manual operation: See "Initialization / Pattern / Data List" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Prerequisites for this command

- Select a bit pattern as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:PUUCi:DATA`).

Parameters:

<Pattern> 64 bits

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Manual operation: See "Initialization / Pattern / Data List" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:RESTart <RestartDataSel>

Sets the parameter for restarting the configured data sources in customized DCIs.

Parameters:

<RestartDataSel> OFF | COAL | FRAMe | SLOT

OFF
Disables the restart of data and control. Data sources are initialized only once at the start of the generated signal.

COAL
Enables the restart of data and control after each codeword and allocation. For example, the same payload is used for repeated allocations.

FRAMe
Enables the restart of data and control after each frame. For example, the same payload is used for allocations which are repeated each frame.

SLOT
Enables the restart of data and control after each slot. For example, the same payload is used for allocations which are repeated each slot.

*RST: OFF

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "Restart Data and Control" on page 101

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:CS <CsRnti>

Sets the CS-RNTI of the user. It is a unique UE identification used for semi-persistent scheduling in the downlink.

Parameters:

<CsRnti> integer

Range: 1 to 65522
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "CS-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:G <Value>

Sets the G-RNTI of the user.

Parameters:

<Value> integer

Range: 1 to 65522
*RST: 1

Manual operation: See "G-RNTI" on page 112

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:GCS <Value>

Sets the G-CS-RNTI of the user.

Parameters:

<Value> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "G-CS-RNTI" on page 112

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MCCH <Value>

Sets the MCCH-RNTI of the user.

Parameters:

<Value> integer

For release 17, the MCCH-RNTI has a fix value of 65533.

Range: 1 to 65533
*RST: 1

Manual operation: See "MCCH-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MCSC <McsCRnti>

Sets the MCS-C-RNTI of the user. It is a unique UE identification used for modulation coding scheme in the downlink.

Parameters:

<McsCRnti> integer

Range: 1 to 65522
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "MCS-C-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:MSGB <MsgBRnti>

Sets the MsgB-RNTI of the user. It is a unique UE identification used as an identifier of the RRC connection and for scheduling with a temporary cell.

Parameters:

<MsgBRnti> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "MsgB-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:PEI <Value>

Sets the PEI-RNTI of the user.

Parameters:

<Value> integer

For release 17, the MCCH-RNTI has a fix value of 65532.

Range: 1 to 65532
*RST: 1

Manual operation: See "PEI-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:RA <RaRnti>

Sets the RA-RNTI of the user. It is used for an identification of the random access response in the downlink and is used during the random access procedure.

Parameters:

<RaRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "RA-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SFI <UserSfiRnti>

Parameters:

<UserSfiRnti> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "SFI-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SPCSi <SpCsiRnti>

Sets the SP-CSI-RNTI of the user. It is a unique UE identification used for semi-persistent CSI reporting on PUSCH.

Parameters:

<SpCsiRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "SP-CSI-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:TC <TcRnti>

Sets the TC-RNTI of the user. It is a unique UE identification used as an identifier of the RRC connection and for scheduling with a temporary cell.

Parameters:

<TcRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "TC-RNTI" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SL <Value>

Sets the SL-RNTI of the user.

Parameters:

<Value> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "SL-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:SLCS <Value>

Sets the SL-CS-RNTI of the user.

Parameters:

<Value> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "SL-CS-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:RNTI:V <Value>

Sets the V-RNTI of the user.

Parameters:

<Value> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "V-RNTI" on page 111

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:UEID <UserId>

Sets the RNTI of the user.

Parameters:

<UserId> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "UE ID (C-RNTI)" on page 103

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:NUMSfi <NumSfiInDci20>

Sets how many slot format indicator (SFI) fields are transmitted in the DCI format 2_0.

Parameters:

<NumSfiInDci20> integer

Range: 1 to 16
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "SFIs in DCI 2_0" on page 110

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:CCODing:STATe <UschChaCod>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CCODing:STATe <DschChaCod>

Enables DSCH/USCH channel coding.

Parameters:

<DschChaCod> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "DSCH/USCH Channel Coding" on page 104

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:SCRambling:STATe <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:SCRambling:STATe <State>

Turns PUSCH scrambling on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 1

Manual operation: See "DSCH/USCH Scrambling" on page 104

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:DATA <UschDataSource>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DATA <DschDataSource>

Sets the DSCH/USCH data source.

Parameters:

<DschDataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "(P)DSCH/(P)USCH Data Source" on page 104

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:DLISt <UschDataList>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DLISt <DschDataList>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DschDataList> string

Filename incl. file extension or complete file path

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "(P)DSCH/(P)USCH Data Source" on page 104

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:INITpattern <Pattern>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:INITpattern <Pattern>

Sets an initialization value for the second m-sequence in the PN sequence.

Parameters:

<Pattern> float

Range: 1 to 0x7fffff
Increment: 1
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "Initialization" on page 105

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:PATTern <Pattern>, <BitCount>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Parameters:

<Pattern> 64 bits
*RST: #H0

<BitCount> integer
Range: 1 to 64
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "(P)DSCH/(P)USCH Data Source" on page 104

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:SCGW <Value>

Sets the parameter "Number of SCell Groups Within Active Time".

Parameters:

<Value> integer
Range: 0 to 5
*RST: 0

Manual operation: See "SCell Groups Within Active Time" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:ANFMode <Mode>

Selects the state of the parameter `ackNackFeedbackMode`.

Parameters:

<Mode> NCON | JOIN | SEP
*RST: NCON

Manual operation: See "Ack-Nack-Feedback-Mode" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PH1F <State>

Turns the "One-Shot HARQ-ACK Request" DCI field in DCI format 1_1 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "PDSCH Harq-Ack-One-Shot-Feedback-R16" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DAIT <State>

Configures the higher layer parameter `nfi-TotalDAIIncluded` as defined in 3GPP 38.331.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "NFI-TotalDAI-Included" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DAUL <State>

Configures the higher layer parameter `ul-TotalDAI-Included` as defined in 3GPP 38.331.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "UL-TotalDai-Included" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:DA02 <DAIDci02>

Parameters:
<DAIDci02> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Downlink Assignment Index 0_2" on page 108

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:HARTind <State>

Turns the "HARQ-ACK Retransmission Indicator" field available in DCI format 1_1 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "HARQ-ACK Retransmission Indicator DCI1_1" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NRBS <Value>

Defines the number of the "Available RB Set Indicators" fields in DCI format 2_0.

Parameters:

<Value> integer

Range: 0 to 16
*RST: 0

Manual operation: See "Available RB Set Indicators DCI2_0" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:PSSCdyn <State>

Turns the "PUCCH Cell Indicator" field available in DCI format 1_1 on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "PUCCH-sSCellDyn DCI1_1" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:RBIS <IndicatorSize>

Defines the size of the "Available RB Set Indicator" field in DCI format 2_0.

Parameters:

<IndicatorSize> integer

Range: 1 to 5
*RST: 1

Manual operation: See "Available RB Set Indicator Size DCI2_0" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CDIN <Value>

Defines the number of the "COT Duration Indicators" fields in DCI format 2_0.

Parameters:

<Value> integer

Range: 0 to 16
*RST: 0

Manual operation: See "COT Duration Indicators DCI2_0" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CODS <CotDurationSize>

Defines the size of the "COT Duration Indicator" field in DCI format 2_0.

Parameters:

<CotDurationSize> integer

Range: 1 to 6
*RST: 1

Manual operation: See "COT Duration Indicator Size DCI2_0" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NSSF <Value>

Defines the number of the "Search Space Switching Flags" fields in DCI format 2_0.

Parameters:

<Value> integer

Range: 0 to 4
*RST: 0

Manual operation: See "Search Space Switching Flags DCI2_0" on page 109

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:NSAS <Value>

Defines the size of the "Sidelink Assignment Index" in DCI format 3_0.

Parameters:

<Value> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Bits for Sidelink Assignment Index" on page 109

12.17 SL user properties commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe <SschChaCoding>

Turns channel coding for the PSSCH on and off.

Parameters:

<SschChaCoding> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SSCH Channel Coding" on page 113

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DATA <DataSource>

Selects the data source for the PSSCH.

Parameters:

<DataSource>

DLISt
Data source is binary data from a data list.
Select the data list with `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DLISt`.

PATTern
Data source is a equence according to a bit pattern.
Define the bit pattern with `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:PATTern`.

PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23
Data source is a pseudo-random sequence.
Set the initial value with `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:INITpattern`.

ZERO | ONE
Data source is a sequence containing all 0's or all 1's.

*RST: PN9

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SSCH Data Source" on page 113

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DLISt <DataList>

Selects a data list as a PSSCH data source.

Prerequisites for this command

- Select a data list as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DATA`).

Parameters:

<DataList>

string

String containing the path and file name of the data list.

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SSCH Data Source" on page 113

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:INITpattern <Pattern>

Defines the initial value when the PSSCH data source is a pseudo-random sequence.

Prerequisites for this command

- Select one of the pseudo-random sequences as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DATA`).

Parameters:

<Pattern> integer

Range: 1 to #H7fffff
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Initialization" on page 113
See "Pattern" on page 113
See "Data List" on page 114

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:PATTern <Pattern>, <BitCount>

Defines a bit pattern as the PSSCH data source.

Prerequisites for this command

- Select bit pattern as data source (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:DATA`).

Parameters:

<Pattern> 64 bits

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:SCRambling:STATe <State>

Turns PSSCH scrambling on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SSCH Scrambling" on page 113

12.18 DL/UL BWP commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:NBWParts <BandwidthParts>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:NBWParts <BandwidthParts>

Sets the number of downlink bandwidth parts (BWP).

Parameters:

<BandwidthParts> integer

Range: 0 to 4
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "Number of DL/UL BWPs" on page 116

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:INDicator <ID>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:INDicator <ID>

Sets the indicator for the selected BWP.

Parameters:

<ID> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "BWP Indicator" on page 116

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CILength <CancelIndLength>

Sets the length for each cancellation indication in the DCI format 2_4.

The "Cancellation Indication Length" and Number of Cancellation Indications set the size of the DCI format 2_4 pattern.

Parameters:

<CancelIndLength> 1 | 2 | 4 | 7 | 8 | 14 | 16 | 32 | 56 | 112

*RST: 1

Example: See Example"DCI format 2_4" on page 590.

Options: R&S SMW-K148.

Manual operation: See "Cancellation Indication Length" on page 148

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:CIRNti <CiRnti>

Sets the CI-RNTI of the user. This parameter is a unique UE identifier for the cancellation indication in the DCI format 2_4.

Parameters:

<CiRnti> integer

Range: 1 to 65519

*RST: 1

Example: See Example"DCI format 2_4" on page 590.

Options: R&S SMW-K148.

Manual operation: See "CI-RNTI" on page 148

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NCINd <NumCancelInd>

Sets the number of cancellation indications in the DCI format 2_4.

The maximum number of cancellation indications depends on the Cancellation Indication Length value.

Parameters:

<NumCancelInd> integer

Range: 1 to 8

*RST: 1

Example: See Example"DCI format 2_4" on page 590.

Options: R&S SMW-K148.

Manual operation: See "Number of Cancellation Indications" on page 148

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:AIRNti <AiRnti>

Sets the AI-RNTI of the user. It is a unique UE identifier for the starting position block in the DCI format 2_5.

Parameters:

<AiRnti> integer

Range: 1 to 65519
*RST: 1

Manual operation: See "AI-RNTI" on page 148

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NAINd <NumAvailInd>

Sets the number of availability indications in the DCI format 2_5.

Parameters:

<NumAvailInd> integer

Range: 1 to 16
*RST: 1

Manual operation: See "Number of Availability Indications" on page 148

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PSRNti <PsRnti>

Sets the PS-RNTI of the user. It is a unique UE identifier for the starting position block in the DCI format 2_6.

Parameters:

<PsRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"DCI format 2_6" on page 590.

Options: R&S SMW-K148.

Manual operation: See "PS-RNTI" on page 149

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SCSPacing <SCSPacing>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SCSPacing <SCSpacing>

Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP).

Parameters:

<SCSpacing> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

*RST: N30

Example: See Example"Configuring the users and the BWPs" on page 578.

Options: N480 and N960 require R&S SMW-K171

Manual operation: See "SC Spacing/CP" on page 116

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS: NB26 <NumBlckInDci26>

Sets the number of dormancy indications in the DCI format 2_6.

Parameters:

<NumBlckInDci26> integer

Range: 1 to 10
*RST: 1

Example: See Example"DCI format 2_6" on page 590.

Options: R&S SMW-K148.

Manual operation: See "Number of Dormancy Indications" on page 149

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS: NSCG <NumCellGroups>

Sets the number of bits for the "SCell Dormancy Indication" pattern in the DCI format 2_6.

Parameters:

<NumCellGroups> integer

Range: 0 to 5
*RST: 0

Example: See Example"DCI format 2_6" on page 590.

Options: R&S SMW-K148.

Manual operation: See "Number of SCell Groups Outside Active Time" on page 149

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS: BD23 <NumBlocksInDci2>

Sets the number of blocks (i.e. couples of closed loop indicators and TPC command fields) in the DCI format 2_3.

Parameters:

<NumBlocksInDci2> integer

Range: 1 to 11
*RST: 1

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "Number of Blocks" on page 147

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:GTYPe <GroupType>

Sets the SRS-TPC-PDCCH-Group type.

Parameters:

<GroupType> A | B

*RST: A

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "SRS-TPC-PDCCH-Group Type" on page 147

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:RBNumber <UlBwpRBNumber>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RBNumber <DlBwpRBNum>

Sets the number of resource blocks (RB) the bandwidth part (BWP) occupies.

Parameters:

<DlBwpRBNum> integer

The number of available RBs depends on the SCS and channel bandwidth.
CORESET allocations span always a multiple of 6 resource blocks. Thus, for CORESET allocations the minimum value is 6 and the allowed values are multiple of 6.

Range: 1 to 273
*RST: 11

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "No. RBs" on page 117

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:RBOFfset <ResourceBlocks>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RBOFfset <ResourceBlocks>

Sets the offset between the first resource block in the BWP relative to the first usable resource blocks (URB).

Parameters:

<ResourceBlocks> integer

Range: 0 to 255
*RST: 0

Example: See Example"Configuring the users and the BWPs" on page 578.

Manual operation: See "RB Offset in TxBW" on page 117

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PRBoffset?
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PRBoffset?

Queries the frequency starting position of the BWP relative to the point A.

Return values:

<PointAOffset> integer

Range: 0 to 500
*RST: 0

Example: See Example"Configuring the users and the BWPs" on page 578.

Usage: Query only

Manual operation: See "RB Offset to Point A" on page 117

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:DFReq?
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DFReq?

Queries the frequency offset between the BWP center and the center frequency of the carrier.

Return values:

<Frequency> float

Range: -40E6 to 40E6
Increment: 1.0
*RST: 0.0

Example: See Example"Configuring the users and the BWPs" on page 578.

Usage: Query only

Manual operation: See " Δf to Carrier (Centers) /MHz" on page 117

12.19 SL BWP commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:DFReq?

Queries the frequency offset between the BWP center and the center frequency of the carrier.

Return values:

<Frequency> integer

Range: -4E7 to 4E7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Usage: Query only

Manual operation: See " Δf to Carrier (Centers) /MHz" on page 120

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>: INDicator <ID>

Defines the ID of a sidelink bandwidth part.

Parameters:

<ID> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "BWP Indicator" on page 119

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>: PAOFfset?

Queries the starting position of the sidelink bandwidth part in the frequency domain relative to point A.

Return values:

<ResourceBlocks> integer

Range: 0 to 300
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Usage: Query only

Manual operation: See "RB Offset to Point A" on page 120

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RBNumber <ResourceBlocks>

Defines the number of resource blocks for a sidelink bandwidth part.

Parameters:

<ResourceBlocks> integer

Range: 1 to 273
*RST: 273

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "No. RBs" on page 119

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RBOFfset <ResourceBlocks>

Defines a resource block offset for a sidelink bandwidth part.

Parameters:

<ResourceBlocks> integer

Range: 0 to 272
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "RB Offset in TxBW" on page 120

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:SCSPacing <Numerology>

Defines the subcarrier spacing of a sidelink bandwidth part.

Parameters:

<Numerology> N15 | N30 | N60 | X60 | N120

*RST: N30

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "SC Spacing/CP" on page 119

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:NBWParts <BandwidthParts>

Defines the number of sidelink bandwidth parts.

Parameters:

<BandwidthParts> integer

Range: 0 to 4
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of SL BWPs" on page 119

12.20 BWP configuration commands

12.20.1 PDSCH commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:HARTind <State>

Turns the "HARQ-ACK Retransmission Indicator" field available in DCI format 1_2 on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "HARQ-ACK Retransmission Indicator DCI1_2" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PRINdicator <State>

Turns the "Priority Indicator" field in DCI format 4_2 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Priority Indicator DCI4_2" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PSSCdyn <State>

Turns the "PUCCH Cell Indicator" field available in DCI format 1_2 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "PUCCH-sSCellDyn DCI1_2" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:CBGF:STATe <CBGFlushIndicat>

Indicates if the code block group buffer is empty. Default is disabled.

Parameters:
<CBGFlushIndicat> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Code Block Group Flush Indicator" on page 126

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh[:DMRS]:APSelect<s2us0> <PdschAPSel>

Each layer of a PDSCH allocation is mapped to a certain antenna port. By the command the antenna ports are selected which are used for the transmission of the PDSCH allocation.

Parameters:
<PdschAPSel> AP1000 | AP1001 | AP1002 | AP1003 | AP1004 | AP1005 | AP1006 | AP1007 | AP1008 | AP1009 | AP1010 | AP1011
*RST: AP1000

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "DMRS Antenna Ports ..." on page 233

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:BSAMe <SameDmreSetting>

Per default, the same configuration applies for DMRS mapping type A and B. Disable "Same Settings for Type A and Type B" to modify the mapping type B settings.

Mapping type A and B define the DMRS position in the PDSCH, the starting symbol and length. The UE informs the BS about the mapping type supportability via the UE capability information message.

Parameters:

<SameDmreSetting> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Same Settings for Type A and Type B" on page 133

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:CTYPe <TypeBConfigType>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:CTYPe <TypeAConfigType>

Sets the configuration type (type 1 or type 2) and defines the mapping of the DMRS to the physical resource elements.

Parameters:

<TypeAConfigType> T1 | T2

*RST: T1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Config Type" on page 133

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:APINdex <TypeBAddPosIdx>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:APINdex <TypeAAddPosIdx>

Sets the parameter additional position index, required to select the positions of the DMRS symbols.

Parameters:

<TypeAAddPosIdx> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Additional Position Index" on page 134

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:MLENgth <TypeBMaxLength>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:MLENgth <DmrsMaxLength>

Sets if single- or double-symbol DMRS is used.

Parameters:

<DmrsMaxLength> integer

Range: 1 to 2
*RST: 2

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Max Length" on page 134

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:SID0 <ScramID0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:SID1 <ScramID1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:SID0 <ScramID0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:SID1 <ScramID1>

Sets the scrambling ID.

Parameters:

<ScramID1> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Scrambling ID 0/Scrambling ID 1" on page 134

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:UR16 <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:UR16 <State>

Turns the higher layer parameter "dmrs-downlink-r16" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use R16 DMRS" on page 134

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:HP5Bits <BitLength>

Selects the size of the "HARQ Process Number" DCI field in DCI format 1_1.

Parameters:

<BitLength>

OFF | 0
4 bits

ON | 1
5 bits

*RST: 0

Manual operation: See "Harq-ProcessNumberSizeDCI1_1" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCBGroups <DlMaxCBGperTB>

Limits the number of code block groups per transport block.

In 5G NR a huge TB (transport block) is split into multiple code blocks (CB). Multiples CBs are grouped into one code block group (CBG). The number of code blocks grouped into the CBG can be limited by the "Max Code Block Groups Per Transport Block" setting.

Parameters:

<DlMaxCBGperTB> G2 | G4 | DISabled | G6 | G8

G2
Limits the number of code block groups per transport block to 2.

G4
Limits the number of code block groups per transport block to 4.

G6
Limits the number of code block groups per transport block to 6.

G8
Limits the number of code block groups per transport block to 8.

DISabled
Default value (also G0), which disabled the limitation of code block groups per transport block.

*RST: DISabled

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Max Code Block Groups Per Transport Block" on page 126

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BBSet1 <DlBwpBundleSet1>

Configures the dynamic PRB bundle type. Only available if "Precoding" is enabled and "Dynamic" is selected as "PRB Bundling Type".

Parameters:

<DlBwpBundleSet1> N4 | WIDeband | N2WB | N4WB

N4
Default value. Dynamic PRB bundle size set 1 is set to N4.

WIDeband
Dynamic PRB bundle size set 1 is set to wideband.

N2WB
Dynamic PRB bundle size set 1 is set to N2-wideband.

N4WB
Dynamic PRB bundle size set 1 is set to N4-wideband.

*RST: N4

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Bundle Size Set 1" on page 128

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BSSet2 <DlBwpBundleSet2>

Configures the dynamic PRB bundle type. Only available if "Precoding" is enabled and "Dynamic" is selected as "PRB Bundling Type".

Parameters:

<DlBwpBundleSet2> N4 | WIDeband

N4
Default value. Dynamic PRB bundle size set 2 is set to N4.

WIDeband
Dynamic PRB bundle size set 2 is set to wideband.

*RST: N4

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Bundle Size Set 2 " on page 129

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BSIZe <DlBwpStaticBSiz>

Configures the static PRB bundle type. Only available if "Precoding" is enabled and "Static" is selected as "PRB Bundling Type".

Parameters:

<DlBwpStaticBSiz> N4 | WIDeband | N2WB | N4WB

N4
Default value. Static PRB bundle is set to N4.

WIDeband
Static PRB bundle is set to wideband.

N2WB
Static PRB bundle is set to N2 wideband.

N4WB
Static PRB bundle is set to N4 wideband.

*RST: N4

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Static Bundle Size " on page 128

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MAOFfset:NMOFfset <Value>

Turns the "Minimum Applicable Offset Indicator" field in DCI format 1_1 on and off and defines the number of K0 values you can configure.

Parameters:
<Value> integer

Range: 0 to 16
*RST: 0

Manual operation: See "Number of Entries" on page 129

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MAOFfset:VAL<gr0> <MinAppOffset>

Defines the value for the minimum applicable offset indicator.

Prerequisites for this command

- Define a number of K0 values > 0 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MAOFfset:NMOFfset`).

Suffix:
<gr0> depends on number of K0 values
Minimum applicable offset

Parameters:
<MinAppOffset> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Value for MinAppOffset" on page 129

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:BTYPe <DlBwpPRBbundlin>

Indicates the PRB bundle type and bundle sizes.

If "dynamic" is chosen, the actual bundle size set to use is indicated via DCI.

Only available if "Precoding" is enabled.

The PRB bundling type supports the UE to reduce the computational effort to receive the information which PRBs use the same precoding. The UE only has to do channel estimation per PRB bundle not per PRB. Without this information, the UE has to decode all the information itself based on the DMRS.

Parameters:

<DlBwpPRBbundlin> NOTC | STATic | DYNamic

NOTC
Default value, PRB bundling is not configured.

STATic
PRB bundling is set to static and can be adjusted by the "Static Bundle Size".

DYNamic
PRB bundling is set to dynamic and can be adjusted by the "Bundle Size Set 1" and "Bundle Size Set 2".

*RST: NOTC

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "PRB Bundling Type " on page 128

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PI11 <PrioIndicator>

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PI12 <Dci12PrioInd>

Turns the "Priority Indicator" DCI field in DCI formats 1_2 on and off.

Parameters:

<Dci12PrioInd> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Priority Indicator DCI1_2" on page 131

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RV12 <Value>

Defines the bit length of the DCI field "Redundancy Version" available in DCI format 1_2.

Parameters:
<Value> integer
Range: 0 to 2
*RST: 0

Manual operation: See "Bits For Redundancy Version DCI1_2" on page 130

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:HA12 <Value>

Defines the bit length of the DCI field "HARQ Process Number" available in DCI formats 1_2.

Parameters:
<Value> integer
Range: 0 to 4
*RST: 0

Manual operation: See "Bits For HARQ DCI1_2" on page 130
See "Bits For HARQ DCI 0_2" on page 178

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:AP12 <Dci12APPresent>

Turns the "Antenna Ports" DCI field in DCI format 1_2 on and off.

Parameters:
<Dci12APPresent> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Antenna Ports Present DCI1_2" on page 130

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DI12 <Dci12DmrsSeqIni>

Turns the "DMRS Sequence Initialization" DCI field in DCI format 1_2 on and off.

Parameters:
<Dci12DmrsSeqIni> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "DMRS Sequence Initialization DCI1_2" on page 130

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:AG12 <State>

Configures the higher layer parameter `resourceAllocationType1GranularityDCI-1-2` as defined in 3GPP 38.331.

Parameters:
<State> NCON | N2 | N4 | N8 | N16

NCON
Not configured.

N2|N4|N8|N16
Granularity as defined by 3GPP.

*RST: NCON

Manual operation: See "Type 1 Allocation Granularity DCI 1_2" on page 131

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:NTCP <Codepoints>

Defines the number of mapped TCI codepoints.

Parameters:
<Codepoints> integer

Range: 0 to 8
*RST: 0

Manual operation: See "Number of Mapped TCI Codepoints" on page 131

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:ID1 <ID>

Defines the value of the state ID 1 for a TCI codepoint.

Parameters:
<ID> integer

Range: 0 to 127
*RST: 0

Manual operation: See "State ID 1" on page 131

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:ID2 <ID>

Defines the value of the state ID 1 for a TCI codepoint.

Prerequisites for this command

- Turn on usage of state ID 2 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:STATe`).

Suffix:
<gr0> 0...8
TCI codepoint

Parameters:
<ID> integer

Range: 0 to 127
*RST: 0

Manual operation: See "State ID 2" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TCI:TCV<gr0>:STATe <State>

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use State ID 2" on page 132

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:XOVerhead <XOverhead>

Selects the value for the "xOverhead" parameter.

Parameters:

<XOverhead> N0 | N6 | N12 | N18

*RST: N0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "xOverhead" on page 126

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:STATe <State>

Enabled or disables precoding.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding " on page 126

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD <PrecMode>

Selects the precoding method.

Parameters:

<PrecMode> **CB**
Precoding based on a codebook.

RDM
Precoding matrix chosen randomly.

*RST: RDM

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding Mode" on page 126

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:SCRambling:STATe <PdschScrambling>

Sets if a data scrambling ID is used for the initialization of the generator of the PDSCH scrambling sequence.

Parameters:

<PdschScrambling> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Use PDSCH Scrambling ID" on page 123

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DSID <DataScrambleId>

If `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:SCRambling:STATe 1`, sets the data scrambling ID.

Parameters:

<DataScrambleId> integer

Range: 0 to 1023

*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Data Scrambling ID" on page 124

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCWDci <MaxCodeWordsPer>

Sets the number of codewords.

Parameters:

<MaxCodeWordsPer>integer

Range: 1 to 2

*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Max. Number of Codewords per DCI" on page 124

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:MCSTable <Modulation>

Sets the MCS table and defines the used modulation scheme.

Parameters:
<Modulation> QAM64 | QAM64LSE | QAM256 | QAM1024
*RST: QAM64

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "MCS Table" on page 125

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RESalloc <ResourceAlloc>

Sets the used resource allocation type.

Parameters:
<ResourceAlloc> T0 | T1 | DS
*RST: T1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Resource Allocation" on page 125

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:RBGSize <UrDlBpPdschRBGS>

Sets the size of the resource block group.

Parameters:
<UrDlBpPdschRBGS>C1 | C2
*RST: C1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Resource Block Group Size" on page 125

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDANum <Allocations>

Sets the number of PDSCH time domain allocations.

Parameters:
<Allocations> integer
Range: 0 to 16
*RST: 0

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Manual operation: See "Time Domain Allocations" on page 137

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:KNULI <K0>

Sets the slot offset K_0.

Parameters:

<K0> integer

Range: 0 to 32
*RST: 0

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Manual operation: See "K0" on page 137

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:MAPPing <MappingType>

Sets the DMRS-mapping type A and B.

Parameters:

<MappingType> A | B

*RST: A

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Manual operation: See "Mapping Type" on page 137

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:STARt <Start>

Sets the start ODFM symbol of the PDSCH allocation.

Parameters:

<Start> integer

Range: 0 to 12
*RST: 0

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Manual operation: See "Start" on page 138

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:LENGth <Length>

Sets the PDSCH allocation length.

Parameters:

<Length> 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14

*RST: 2

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Manual operation: See "Length" on page 138

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TD<grp0>:SLIV?

Queries the resulting start and length indicator SLIV.

Return values:

<SLIV> integer

Range: 0 to 32
*RST: 0

Example: See Example"Configuring PDSCH time domain scheduling with PDSCH time domain allocation list" on page 583.

Usage: Query only

Manual operation: See "SLIV" on page 138

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:VPINter <VrbToPrbInterle>

Queries the mapping method used for the mapping of the virtual resource blocks (VRB) to the physical resource blocks (PRB).

Parameters:

<VrbToPrbInterle> VPN | VP2 | VP4

VPN
Non-interleaved

VP2|VP4
Interleaving is enabled. The value defines the interleaving unit size: `VP2` = 2 and `VP4` = 4.

*RST: VPN

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "VRB-to-PRB Interleaver" on page 124

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists <Lists>

Defines the number of time domain allocation lists.

Parameters:

<Lists> integer

Range: 0 to 16
*RST: 0

Manual operation: See "Number of TD Allocation Lists" on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:LSELected <List>

Selects the allocation list you want to configure.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Parameters:

<List> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Current TD Allocation List" on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TDANum <Allocations>

Defines the number of multi time domain allocations in the selected time domain allocation list.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Suffix:

<grp0> 0...15
Selects a time domain allocation list.

Parameters:

<Allocations> integer

Range: 0 to 16
*RST: 0

Manual operation: See "Multi Time Domain Allocations" on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:KNULI <K0>

Sets the slot offset K_0 for an allocation in a time domain allocation list.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Suffix:

<grp0> 0...15
Selects a time domain allocation list.

<user0> 1...8
Selects an allocation.

Parameters:
<K0> integer
Range: 0 to 32
*RST: 0

Manual operation: See "K0" on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:MAPPing <MappingType>

Sets the DMRS-mapping type for an allocation in a time domain allocation list.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Suffix:
<grp0> 0...15
Selects a time domain allocation list.

<user0> 1...8
Selects an allocation.

Parameters:
<MappingType> A | B
*RST: A

Manual operation: See "Mapping Type" on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:LENGth <Length>

Sets the number of consecutive OFDM symbols (L) the allocation in a time domain allocation list spans.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Suffix:
<grp0> 0...15
Selects a time domain allocation list.

<user0> 1...8
Selects an allocation.

Parameters:
<Length> 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14
*RST: 3

Manual operation: See "No. Sym." on page 139

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:STARt <Start>

Sets the start ODFM symbol (S) of an allocation in a time domain allocation list.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDALists` > 1

Suffix:

<grp0> 0...15
Selects a time domain allocation list.

<user0> 1...8
Selects an allocation.

Parameters:

<Start> integer

Range: 0 to 12
*RST: 0

Manual operation: See "Sym. Offset" on page 140

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:TDML<grp0>:TD<user0>:SLIV?

Queries the resulting start and length indicator SLIV for an allocation in a time domain allocation list.

Suffix:

<grp0> 0...15
Selects a time domain allocation list.

<user0> 1...8
Selects an allocation.

Return values:

<SLIV> integer

Range: 0 to 32
*RST: 0

Usage: Query only

Manual operation: See "SLIV" on page 140

12.20.2 PTRS commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:STATe <TypeAPtrsState>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:STATe <PtrsState>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:STATe <TypeAPtrsState>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:STATe <PtrsState>

Enables the transmission of phase-tracking reference signals.

Parameters:

<PtrsState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "State" on page 135

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:REOF <ResElemOffset>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:REOF <ResElemOffset>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:REOF <ResElemOffset>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:REOF <ResElemOffset>

Sets the parameter resource element offset.

Parameters:
<ResElemOffset> RE00 | RE01 | RE10 | RE11
*RST: RE00

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "RE-offset" on page 136

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:EPRE <EpreRatio>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:EPRE <PtrsEpreRatio>

Sets the parameter EPRE ratio.

Parameters:
<PtrsEpreRatio> RAT0 | RAT1
*RST: RAT0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "EPRE Ratio" on page 136

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:POWer <PtrsPower>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:POWer <PtrsPower>

Sets the parameter `ptrs-Power` and thus defines the PUSCH to PTRS power ratio per layer per resource element.

Parameters:
<PtrsPower> P00 | P01
*RST: P00

Example: `SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:PTRS:POWer P00`

Manual operation: See "Power" on page 184

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:PORT <PtrsMaxNrofPort>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:PORT <PtrsMaxNrofPort>

Sets the maximum number of configured PTRS ports.

Parameters:
<PtrsMaxNrofPort> P1 | P2
*RST: P1

Example: `SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUSCh:DMTB:PTRS:PORT P1`

Manual operation: See "Max Number of Ports" on page 184

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS1 <PtrsImcs1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS2 <PtrsImcs2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:MCS3 <PtrsImcs3>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS1 <PtrsImcs1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS2 <PtrsImcs2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:MCS3 <PtrsImcs3>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS1 <PtrsImcs1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS2 <PtrsImcs2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:MCS3 <PtrsImcs3>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS1 <PtrsImcs1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS2 <PtrsImcs2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:MCS3 <PtrsImcs3>

Sets the threshold values ptrs-MCS_I with I = {1, 2, 3}.

Parameters:

<PtrsImcs3> integer

Range: 0 to 29
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "I_MCS_1/I_MCS_2/I_MCS_3" on page 136

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:RB0 <PtrsNrb0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:RB1 <PtrsNrb1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:RB0 <PtrsNrb0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:RB1 <PtrsNrb1>

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:RB0 <PtrsNrb0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTA:PTRS:RB1 <PtrsNrb1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:RB0 <PtrsNrb0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:DMTB:PTRS:RB1 <PtrsNrb1>

Sets the threshold values NRB_l with l = {0, 1}.

Parameters:

<PtrsNrb1> integer

Range: 1 to 276
*RST: 276

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "N_RB_1/N_RB_2" on page 136

12.20.3 RMC commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:CQI <CQIIndex>

Selects the CQI index available for certain RMCs.

Prerequisites for this command

- Select an RMC that supports the CQI index (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:ID` on page 716).

Parameters:

<CQIIndex> integer

Range: 1 to 15
*RST: 1

Manual operation: See "CQI Index" on page 141

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:ID <RmcId>

This command selects a reference measurement channel.

The availability of RMCs depends on the subcarrier spacing of the bandwidth part you are configuring.

Parameters:

<RmcId> FQ15 | FQ30 | FQ60 | F615 | F630 | F660 | F215 | F230 | F260 | TQ15 | TQ30 | TQ60 | T615 | T630 | T660 | T215 | T230 | T260 | TS38176_FR1A311 | TS38176_FR1A312 | TS38176_FR1A313 | TS38176_FR1A314 | TS38176_FR1A315 | TS38176_FR2A311 | TS38176_FR2A312 | TS38176_FR2A313 | TS38176_FR1A321 | TS38176_FR2A321 | TS38176_FR2A322 | TS38176_FR1A331 | FR2TQ60 | FR2TQ120 | FR2T660 | FR2T6120 | FR2T260 | FR2T2120 | TS38176_FR1A351 | TS38176_FR1A352 | TS38176_FR1A353 | TS38176_FR1A354 | TS38176_FR1A355 | TS38176_FR1A356 | TS38176_FR2A351 | TS38176_FR2A352 | TS38176_FR2A353 | TS38176_FR1A341 | TS38176_FR1A342 | TS38176_FR1A343 | TS38176_FR2A341 | TS38176_FR2A342 | TS38176_FR2A343

The logic of the labels is as follows:
No prefix = 38.521 FR1 RMCs
Prefix FR2 = 38.521 FR2 RMCs
F / T = duplexing (FDD or TDD)
Q / 6 / 2 = modulation (QPSK, 64QAM or 256 QAM)
15 / 30 / 60 = subcarrier spacing (15, 30 or 60 kHz)
For example "T615" corresponds to FR1 RMC with the name "TS 38.521: A.3.3.3-1 (15 kHz)".
The RMCs from 38.176 are basically a shortened form of the names of the RMCs. For example "TS38176_FR1A352" corresponds to RMC with the name "TS 38.176: M-FR1-A3_5_2".

*RST: FQ30

Manual operation: See "RMC" on page 141

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:MODulation?

Queries the modulation of the reference measurement channel (RMC) you have selected.

Prerequisites for this command

- Turn on use of RMCs (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:STATe`).
- Select a RMC (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:ID`).

Return values:

<RmcModulation> QPSK | QAM64 | QAM256

*RST: QPSK

Usage: Query only

Manual operation: See "RMC" on page 141

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:SCS?

Queries the subcarrier spacing of the reference measurement channel (RMC) you have selected.

Prerequisites for this command

- Turn on use of RMCs (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:STATe`).
- Select a RMC (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:ID`).

Return values:

<RmcScs> N15 | N30 | N60

*RST: N30

Usage: Query only

Manual operation: See "RMC" on page 141

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RMC:STATe <State>

Turns reference measurement channels on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "State" on page 141

12.20.4 PDCCH commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:INT <IntRnti>

Sets the INT-RNTI of the user.

Parameters:

<IntRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"DCI format 2_0, 2_1 and 2_2" on page 589.

Manual operation: See "INT-RNTI" on page 142

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NUMPreempt <NumPreEmptionIn>

Sets how many pre-emption indication fields are transmitted in the DCI format 2_1.

Parameters:

<NumPreEmptionIn> integer

Range: 1 to 9
*RST: 1

Example: See Example"DCI format 2_0, 2_1 and 2_2" on page 589.

Manual operation: See "Number of Pre-Emption Indications" on page 146

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UR16 <State>

Turns the higher layer parameter "dmrs-uplink-r16" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use R16 DMRS" on page 164

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:BRINd <BitsResourceInd>

Defines the bit length of the DCI field "PUCCH Resource Indicator" available in DCI format 1_2.

Parameters:

<BitsResourceInd> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Bits for Resource Indicator" on page 166

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:CPEXt:NCPXt <NumCPext>

Defines the number of entries of the "Channel-Access-Cpext" DCI field.

Prerequisites for this command

- Turn on shared spectrum access (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SHSPec` on page 626).

Parameters:

<NumCPext> integer

Range: 0 to 16
*RST: 0

Manual operation: See "Number of Entries" on page 167

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:CPEXt:VAL<gr0> <Value>

Defines the value for each "Channel-Access-Cpext" DCI field.

Prerequisites for this command

- Turn on shared spectrum access (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SHSPec` on page 626).

Suffix:

<gr0> 0...15
Range depends on the number of entries (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:CPEXt:NCPXt`).

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Value <x>" on page 167

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UITL <State>

Configures the higher layer parameter `useInterlacePUCCH-PUSCH` as defined in 3GPP 38.331.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use Interlace" on page 165

12.20.5 DL control information commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PUCCh <PucchTpcRnti>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:PUSCh <PuschTpcRnti>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RNTI:SRS <TpcSrsRnti>

Sets the corresponding RNTI of the user.

Parameters:

<TpcSrsRnti> integer

Range: 1 to 65519
*RST: 1

Example: See Example"DCI format 2_0, 2_1 and 2_2" on page 589.

Manual operation: See "TPC-SRS-RNTI" on page 147

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:TPAS <TwoPcAdjustment>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:TPAS <TwoPcAdjustment>

If enabled, the DCI format 2_2 filed closed loop indicator is transmitted.

Parameters:

<TwoPcAdjustment> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"DCI format 2_0, 2_1 and 2_2" on page 589.

Manual operation: See "TwoPUSCH-PC Adjustment" on page 147

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:BD22 <NumBlocksInDci2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:BD22 <NumBlocksInDci2>

Sets the number of blocks in the DCI format 2_2.

Parameters:

<NumBlocksInDci2> integer
Range: 1 to 22
*RST: 1

Example: See Example"DCI format 2_0, 2_1 and 2_2" on page 589.

Manual operation: See "Number of PUSCH Blocks" on page 146

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSI:LRESponse <State>

Turns the "LSBs of SFN" DCI field in DCI formats 1_0 available for for MsgB-RNTI on and off.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Large Response Window" on page 145

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:DAI2 <BitLength>

Defines the bit length of the "2nd Downlink Assignment Index" field.

Parameters:

<BitLength> L0 | L2 | L4
*RST: L0

Manual operation: See "Max. Bits for 2nd Downlink Assignment Index" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: DAI3 <Value>

Turns the "3rd Downlink Assignment Index" field on and off and defines its size.

Parameters:

<Value> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Bits for 3rd Downlink Assignment Index" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: DS42 <Value>

Defines the number of bits in the DCI format 4_2.

Parameters:

<Value> integer

Range: 20 to 128
*RST: 20

Manual operation: See "Minimum Size" on page 151

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: HAENabler <State>

Turns the DCI field "HARQ-FeedbackEnabler" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "HARQ-FeedbackEnabler" on page 151

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: LTEChan <Subchannels>

Sets the maximum number of LTE subchannels in a V2X transmission.

Parameters:

<Subchannels> S1 | S3 | S5 | S8 | S10 | S15 | S20

*RST: S1

Manual operation: See "Max LTE Subchannels" on page 150

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: PNPPei <FieldNumber>

Selects the higher layer parameter `po-NumPerPEI-r17` that defines the number of "Paging Early Indicator" fields in DCI format 2_7.

Parameters:

<FieldNumber> N1 | N2 | N4 | N8

Parameter availability depends on the payload size (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PS27`).

*RST: N1

Manual operation: See "PO Number per PEI" on page 150

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: PRC2 <Value>

Turns the "2nd Precoding Information and Number of Layer" field on and off and defines its size.

Parameters:

<Value> integer

Range: 0 to 5
*RST: 0

Manual operation: See "Bits for 2nd Precoding Information" on page 143

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: PS27 <Value>

Defines the payload size of DCI format 2_7.

Parameters:

<Value> integer

Range: 1 to 43
*RST: 43

Manual operation: See "Payload Size" on page 150

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: PTPSlots <Slots>

Defines the value of the `sl-PSFCH-ToPUCCH` parameter

Parameters:

<Slots> integer

Range: 2 to 8
*RST: 2

Manual operation: See "Number of sl-PSFCH-ToPUCCH-Slots" on page 150

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: SGPO <Value>

Defines the higher layer parameter `subgroupConfig-r17` that has an effect on the number of bits you can use for the "Early Indicator" DCI fields.

Parameters:

<Value> integer

The value range depends on the payload size (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PS27`).

Range: 1 to 8
*RST: 1

Manual operation: See "Number of Subgroups per PO" on page 149

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: SOIN <Value>

Turns the "SRS Offset Indicator" field on and off and defines its size.

Parameters:

<Value> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Bits for SRS Offset Indicator" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: SRI2 <Value>

Turns the "2nd SRS Resource Indicator" field on and off and defines its size.

Parameters:

<Value> integer

Range: 0 to 4
*RST: 0

Manual operation: See "Bits for 2nd SRS Resource Indication" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI: SRINd <State>

Turns the "SRS Resource Set Indicator" field on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Bits for SRS Resource Set Indication" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:TAINd <Value>

Selects the number of bits that you can use for the "TRS availability indication" DCI field.

Parameters:

<Value> integer

The value range depends on the payload size (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PS27`).

Range: 0 to 6
*RST: 0

Manual operation: See "Bits for TRS Availability Indication" on page 145

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NMADaption <Value>

Defines the size of the "Monitoring Adaption Indication" DCI field.

Parameters:

<Value> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Bits for PDCCH Monitoring Adaptation Indication" on page 143

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NT3C <Value>

Turns the "Enhanced Type 3 Codebook Indicator" field on and off and defines its size.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Bits for Enhanced Type 3 Codebook Indicator" on page 146

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:OI01 <MinAppOffsetInd>

Enables/disables the configuration of the minimum applicable scheduling offset indicator in the DCI format 0_1.

Parameters:

<MinAppOffsetInd> 0 | 1 | OFF | ON

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Options: R&S SMW-K148

12.20.6 ZP and NZP CSI-RS commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSI:RTSize <RepTrigSize>

Sets the trigger size of the CSI (channel state information) request field in DCI (bits).

Parameters:

<RepTrigSize> integer

Range: 0 to 6
*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Report Trigger Size" on page 144

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:STATe <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:STATe <State>

Enables the NZP/ZP CSI-RS transmission.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "State" on page 155

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:NRESources <Resources>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:NRESources <Resources>

Sets the number of CSI-RS resources.

Parameters:

<Resources> integer

Range: 0 to 64
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Resources" on page 155

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:PER <Periodicity>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PER <Periodicity>

Sets the periodicity $T_{CSI\text{-}RS}$ (in slots).

Parameters:

<Periodicity> 4 | 5 | 8 | 10 | 16 | 20 | 32 | 40 | 64 | 80 | 160 | 320 | 640

*RST: 4

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Periodicity" on page 156

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:OFFSet <Offset>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:OFFSet <Offset>

Sets the slot offset T_{offset}.

Parameters:

<Offset> integer

Range: 0 to 639
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Offset" on page 156

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:RBNumber <CsiRsZpNumRB>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:RBNumber <CsiRsNZpNumRB>

Sets the number of resource blocks the CSI-RS spans.

Parameters:

<CsiRsNZpNumRB> integer

Range: 24 to 273
*RST: = number of RB in the BWP

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "No. RBs" on page 156

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:SRBNumber <CsiRsZpStartRb>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:SRBNumber <CsiRsNZpStartRB>

Sets the first resource block the CSI-RS occupies.

Parameters:

<CsiRsNZpStartRB> integer

Range: 0 to 273
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Start RB" on page 156

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:ROW <Row>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:ROW <Row>

Sets the parameter row.

Parameters:

<Row> integer

Range: 1 to 18
*RST: 1

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Row" on page 156

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:PORTs?
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PORTs?

Sets the number of ports X.

Return values:

<Ports> 1 | 2 | 4 | 8 | 12 | 16 | 24 | 32

*RST: 1

Example: See Example"Configuring the CSI-RS settings" on page 584.

Usage: Query only

Manual operation: See "Ports" on page 157

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:DENSity <Density>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:DENSity <Density>

Sets the parameter density.

Parameters:

<Density> EVE5 | ODD5 | DEN1 | DEN3

*RST: DEN3

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Density" on page 157

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:CDMType?
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:CDMType?

Queries the higher-level parameter `cdm-Type`.

The value is automatically, depending on the value set with the command `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:ROW` on page 730

Return values:

<CDMType> NOCDm | CDM2 | CDM4 | CDM8

*RST: NOCDm

Example: See Example"Configuring the CSI-RS settings" on page 584.

Usage: Query only

Manual operation: See "CDM-Type" on page 157

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:BITMap <Pattern>, <BitCount>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:BITMap <Pattern>, <BitCount>

Sets the location of the ZP CSI-RS in the frequency domain.

Parameters:

<Pattern> 12 bits

*RST: #H0

<BitCount> integer

Range: 1 to 12
*RST: 1

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Bitmap" on page 157

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:I0 <I0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:ZP:SET<gr0>:RES<user0>:I1 <I1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:I0 <I0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:I1 <I1>

Sets the parameters I_0 and I_1 and define the ZP CSI-RS location relative to the start of as slot.

Parameters:
<I1> integer

Range: 2 to 12
*RST: 11

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "I0/I1" on page 158

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:SCID <ScramblingId>

Sets the parameter n_{ID} (scrambling ID).

Parameters:
<ScramblingId> integer

Range: 0 to 1023
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Scrambling ID" on page 158

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:PWR <NZpPower>

Sets the power of the NZP resource relative to the PDSCH power.

Parameters:

<NZpPower> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Power" on page 157

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL <APMapDataReal>

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary <APMapDataImag>

Sets the mapping of the antenna ports (AP).

Suffix:

<s2us0> AP3000
Antenna port

<s3us0> 0 to 7
Available basebands

Parameters:

<APMapDataImag> 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

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Mapping table" on page 159

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude <APMapDataMagn>

Sets the mapping of the antenna ports (AP).

Parameters:

<APMapDataMagn> float

Range: 0 to 1
Increment: 0.001
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Mapping table" on page 159

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:CSIRs:NZP:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe <APMapDataPhase>

Sets the mapping of the antenna ports (AP).

Parameters:

<APMapDataPhase> float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example: See Example"Configuring the CSI-RS settings" on page 584.

Manual operation: See "Mapping table" on page 159

12.20.7 Rate match commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:STATe <RateMatchState>

Enables the configuration of rate match groups.

Parameters:

<RateMatchState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "State" on page 160

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM: NRESources <RateMatResource>

Sets the number of rate match resources.

Parameters:

<RateMatResource> integer

Range: 0 to 8
*RST: 0

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Resources" on page 161

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM: GRPNumber <RateMatNoOfGrps>

Sets the number of rate match pattern groups

Parameters:

<RateMatNoOfGrps> integer

Range: 0 to 2
*RST: 0

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Number of Groups" on page 160

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM: RS<gr0>:RBDList <RateRBPattDList>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<RateRBPattDList> string

Filename incl. file extension or complete file path

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "RB Pattern" on page 161

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:RBPatt <Pattern>, <Bitcount>

Sets the resource block level bitmap pattern directly, alternatively to loading a data list with the command `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:RBDList`.

Parameters:

<Pattern> 275 bits
*RST: #H0

<Bitcount> integer
Range: 275 to 275
*RST: 0

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "RB Pattern" on page 161

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:SLOT <RateMatchSlot>

Sets the number of slots.

Parameters:

<RateMatchSlot> integer
Range: 1 to 2
*RST: 1

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Slot" on page 161

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:SLTPatt <RateMatSlotPatt>, <Bitcount>

Set the slots to be used as a pattern.

Parameters:

<RateMatSlotPatt> 28 bits
*RST: #H0

<Bitcount> integer
Range: 14 to 28
*RST: 14

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Slot Pattern" on page 162

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:PER <RateMatchPeriod>

Sets the time-domain pattern.

Parameters:

<RateMatchPeriod> 1 | 2 | 5 | 4 | 8 | 10 | 20 | 40

*RST: 2

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Periodicity" on page 162

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:PERPatt <RateMatPerdPatt>, <BitCount>

Sets the periodicity in a pattern form.

Parameters:

<RateMatPerdPatt> 40 bits

<BitCount> integer

Range: 1 to 40

*RST: 2

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Periodicity Pattern" on page 162

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:RATM:RS<gr0>:GRID <RateMatchGrpID>

Sets the group identifier for the selected rate match pattern.

Parameters:

<RateMatchGrpID> N | G1 | G2

*RST: N

Example: See Example"Configuring the DL BWP rate match settings" on page 586.

Manual operation: See "Group ID" on page 162

12.20.8 PUCCH commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:A12List <Value>

Configures the higher layer parameter `ul-AccessConfigListDCI1-2` as defined in 3GPP 38.331.

Parameters:

<Value> integer

Range: 0 to 16
*RST: 0

Manual operation: See "ul-AccessConfigList DCI1_2" on page 167

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:ADMRs:STATe <AdditionalDMRS>

Defines if additional DMRS is used for PUCCH format 3 and 4.

Parameters:

<AdditionalDMRS> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Additional DMRS" on page 164

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:BPSK:STATe <PiBpsk>

If enabled, the π/2 - BPSK modulation order is used for PUCCH, instead of the default QPSK.

Parameters:

<PiBpsk> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "π/2 - BPSK" on page 164

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:HACK:STATe <PucchHarAckCSI>

Reserved for future use.

Parameters:
<PucchHarAckCSI> 0
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Simultaneous HARQ-ACK-CSI" on page 165

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:NTMentry <NumUlBpPucchACK>

Sets the number of entries in the sequence of PDSCH to HARQ timing values.

The value set here defines the available suffixes in the command `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:TMIValue<gr0>`.

Parameters:
<NumUlBpPucchACK> float
Range: 0 to 8

Example: See `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:TMIValue<gr0>` on page 739.

Manual operation: See "Number of Entries" on page 166

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:TMIValue<gr0> <UserUlBwpPucchD>

Sets the individual timing values.

Suffix:
<gr0> 0 to 7
Indicator number
Value range depends on the value set with the command `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:PDSHarq:NTMentry`.

Parameters:
<UserUlBwpPucchD> float
Range: 0 to 15

Example:
```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:PDSHarq:NTMentry 3
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:PDSHarq:TMIValue0 1
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:PDSHarq:TMIValue1 0
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PUCCh:PDSHarq:TMIValue2 15
```

Manual operation: See "Value of Indicator x" on page 166

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:U2TPc <State>

Turns the "2nd TPC Command for Scheduled PUCCH" DCI field on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use 2nd TPC Command" on page 167

12.20.9 FRC commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:STATe <FrcState>

Enables the fixed reference measurement channels (FRC), as defined in TS 38.141.

Parameters:

<FrcState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Fixed reference channels" on page 579.

Manual operation: See "FRC State" on page 168

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:TYPE <FrcType>

Selects the fixed reference measurement channel (FRC).

The currently available FRCs depend on the selected BWP subcarrier spacing SCS) and selected number of resource blocks.

Parameters:

<FrcType>

FR1A11 | FR1A12 | FR1A13 | FR1A14 | FR1A15 | FR1A16 | FR1A17 | FR1A18 | FR1A19 | FR2A11 | FR2A12 | FR2A13 | FR2A14 | FR2A15 | FR1A21 | FR1A22 | FR1A23 | FR1A24 | FR1A25 | FR1A26 | NA | FR1A38 | FR1A39 | FR1A310 | FR1A311 | FR1A312 | FR1A313 | FR1A314 | FR1A322 | FR1A323 | FR1A324 | FR1A325 | FR1A326 | FR1A327 | FR1A328 | FR1A48 | FR1A49 | FR1A410 | FR1A411 | FR1A412 | FR1A413 | FR1A414 | FR1A422 | FR1A423 | FR1A424 | FR1A425 | FR1A426 | FR1A427 | FR1A428 | FR1A58 | FR1A59 | FR1A510 | FR1A511 | FR1A512 | FR1A513 | FR1A514 | FR1A331 | FR1A332 | FR2A31 | FR2A32 | FR2A33 | FR2A34 | FR2A35 | FR2A36 | FR2A37 | FR2A38 | FR2A39 | FR2A310 | FR2A311 | FR2A312 | FR2A41 | FR2A42 | FR2A43 | FR2A44 | FR2A45 | FR2A46 | FR2A47 | FR2A48 | FR2A49 | FR2A410 | FR2A51 | FR2A52 | FR2A53 | FR2A54 | FR2A55 | FR2A313 | FR2A314 | FR2A315 | FR2A316 | FR2A317 | FR2A318 | FR2A319 | FR2A320 | FR2A321 | FR2A322 | FR2A323 | FR2A324 | FR2A411 | FR2A412 | FR2A413 | FR2A414 | FR2A415 | FR2A416 | FR2A417 | FR2A418 | FR2A419 | FR2A420 | FR2A56 | FR2A57 | FR2A58 | FR2A59 | FR2A510 | FR1A31 | FR1A32 | FR1A33 | FR1A34 | FR1A35 | FR1A36 | FR1A37 | FR1A315 | FR1A316 | FR1A317 | FR1A318 | FR1A319 | FR1A320 | FR1A321 | FR1A329 | FR1A330 | FR1A41 | FR1A42 | FR1A43 | FR1A44 | FR1A45 | FR1A46 | FR1A47 | FR1A415 | FR1A416 | FR1A417 | FR1A418 | FR1A419 | FR1A420 | FR1A421 | FR1A51 | FR1A52 | FR1A53 | FR1A54 | FR1A55 | FR1A56 | FR1A57 | FR1A110 | FR1A111 | FR1A333 | FR1A333A | FR1A334 | FR1A334A | FR2A71 | FR2A72 | FR2A73 | FR2A74 | FR2A75 | FR2A76 | FR2A77 | FR2A78 | FR2A79 | FR2A710 | FR1A429 | FR1A429A | FR1A430 | FR1A430A | FR1A431A | FR1A431 | FR1A432A | FR1A432 | FR1A3A1 | FR1A3A2 | FR1A3A3 | FR1A3A4 | FR1A3B1 | FR1A3B2 | FR1A3B3 | FR1A3B4 | TS381411_FR1A71 | TS381411_FR1A72 | TS381411_FR1A73 | TS381411_FR1A74 | TS381412_FR1A81 | TS381412_FR1A82 | TS381412_FR1A83 | TS381412_FR1A84 | FR2A325 | FR2A326 | FR2A3A1 | FR2A3A2 | FR2A3A3 | FR2A3A4 | FR2A3A5 | FR2A3A6 | FR2A3A7 | FR2A3A8 | TS38176_FR1A211 | TS38176_FR1A212 | TS38176_FR1A213 | TS38176_FR1A214 | TS38176_FR1A215 | TS38176_FR1A216 | TS38176_FR1A217 | TS38176_FR1A218 | TS38176_FR1A219 | TS38176_FR1A2110 | TS38176_FR1A2111 | TS38176_FR1A2112 | TS38176_FR1A2113 | TS38176_FR1A2114 | TS38176_FR1A2115 | TS38176_FR1A2116 | TS38176_FR1A231 | TS38176_FR1A232 | TS38176_FR1A233 | TS38176_FR1A234 | TS38176_FR1A235 |

TS38176_FR1A236 | TS38176_FR1A237 |
TS38176_FR1A238 | TS38176_FR1A239 |
TS38176_FR1A2310 | TS38176_FR1A2311 |
TS38176_FR1A2312 | TS38176_FR1A2313 |
TS38176_FR1A2314 | TS38176_FR1A241 |
TS38176_FR1A242 | TS38176_FR1A243 |
TS38176_FR1A244 | TS38176_FR1A245 |
TS38176_FR1A246 | TS38176_FR1A247 | TS38176_FR2A211 |
TS38176_FR2A212 | TS38176_FR2A213 |
TS38176_FR2A214 | TS38176_FR2A215 |
TS38176_FR2A216 | TS38176_FR2A217 |
TS38176_FR2A218 | TS38176_FR2A219 |
TS38176_FR2A2110 | TS38176_FR2A2111 |
TS38176_FR2A2112 | TS38176_FR2A2113 |
TS38176_FR2A2114 | TS38176_FR2A2115 |
TS38176_FR2A2116 | TS38176_FR2A2117 |
TS38176_FR2A2118 | TS38176_FR2A2119 |
TS38176_FR2A2120 | TS38176_FR2A2121 |
TS38176_FR2A2122 | TS38176_FR2A2123 |
TS38176_FR2A2124 | TS38176_FR2A221 |
TS38176_FR2A222 | TS38176_FR2A223 |
TS38176_FR2A224 | TS38176_FR2A225 |
TS38176_FR2A226 | TS38176_FR2A227 |
TS38176_FR2A228 | TS38176_FR2A229 |
TS38176_FR2A2210 | TS38176_FR2A231 |
TS38176_FR2A232 | TS38176_FR2A233 |
TS38176_FR2A234 | TS38176_FR2A235 |
TS38176_FR2A236 | TS38176_FR2A237 |
TS38176_FR2A238 | TS38176_FR2A239 |
TS38176_FR2A2310 | TS38176_FR2A2311 |
TS38176_FR2A2312 | TS38176_FR2A2313 |
TS38176_FR2A2314 | TS38176_FR2A2315 |
TS38176_FR2A2316 | TS38176_FR2A2317 |
TS38176_FR2A2318 | TS38176_FR2A2319 |
TS38176_FR2A2320 | TS38176_FR2A241 |
TS38176_FR2A242 | TS38176_FR2A243 |
TS38176_FR2A244 | TS38176_FR2A245 |
TS38176_FR2A246 | TS38176_FR2A247 |
TS38176_FR2A248 | TS38176_FR2A249 |
TS38176_FR2A2410 | FR1A112 | FR1A113 | FR1A114 |
FR1A115 | FR1A116 | FR1A117 | FR1A118 | FR1A119 |
FR1A27 | FR1A28 | FR1A29 | FR1A210 | FR1A211 | FR1A212 |
FR1A213 | FR1A214 | FR1A215 | FR1A216 |
TS381411_FR1A82 | TS381411_FR1A83 | TS381411_FR1A84 |
TS381411_FR1A81 | TS381411_FR1A85 | TS381412_FR1A91 |
TS381412_FR1A92 | TS381412_FR1A93 |
TS381412_FR1A94 | TS381412_FR1A95 | TS38181_FR1A11 |
TS38181_FR1A12 | TS38181_FR1A13 | TS38181_FR1A14 |
TS38181_FR1A15 | TS38181_FR1A16 | TS38181_FR1A17 |
TS38181_FR1A18 | TS38181_FR1A19 | TS38181_FR1A21 |

TS38181_FR1A22 | TS38181_FR1A23 | TS38181_FR1A24 | TS38181_FR1A25 | TS38181_FR1A26 | TS38181_FR1A31 | TS38181_FR1A32 | TS38181_FR1A33 | TS38181_FR1A34 | TS38181_FR1A35 | TS38181_FR1A36 | TS38181_FR1A3A1 | TS38181_FR1A3A3 | FR2A101 | FR2A102 | FR2A103 | FR2A105 | FR2A104 | FR2A106 | FR2A107 | FR2A108 | FR2A109 | FR2A1010 | FR2A1011 | FR2A1012 | FR1A335 | FR1A337 | FR1A336 | FR1A338 | FR1A3B5 | FR1A3B6 | FR1A3B7 | FR1A3B8 | FR2A327 | FR2A3B1 | FR2A3B2

*RST: FR1A12

Example: See Example"Fixed reference channels" on page 579.

Manual operation: See "FRC" on page 168

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:SCS?

Queries the SCS of the selected FRC.

Return values:

<SubcarrierSpac> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

*RST: N30

Example: See Example"Fixed reference channels" on page 579.

Usage: Query only

Options: N480 and N960 require R&S SMW-K171

Manual operation: See "Subcarrier Spacing" on page 169

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:ALRB?

Queries the number of used RBs of the selected FRC.

Return values:

<AllocRB> integer

Range: 6 to 273
*RST: 11

Example: See Example"Fixed reference channels" on page 579.

Usage: Query only

Manual operation: See "Allocated Resource Blocks" on page 169

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:BW?

Queries the channel bandwidth of the selected FRC.

Return values:

<ChannelBw> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 | BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 | BW200 | BW400 | BW800 | BW1600 | BW2000

*RST: BW100

Usage: Query only

Manual operation: See "Channel Bandwidth" on page 169

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC: MODulation?

Queries the modulation scheme used by the selected FRC.

Return values:

<Modulation> BPSK | BPSK2 | QPSK | QAM16 | QAM64 | QAM256 | QAM1024

*RST: QPSK

Example: See Example"Fixed reference channels" on page 579.

Usage: Query only

Manual operation: See "Modulation" on page 169

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC: PASize?

Queries the payload size of the selected FRC.

Return values:

<PayloadSize> integer

Range: 528 to 217128
*RST: 984

Example: See Example"Fixed reference channels" on page 579.

Usage: Query only

Manual operation: See "Payload Size" on page 170

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC: RBOFfset <ResourceBlocks>

Sets the RB offset for the selected FRC.

Parameters:

<ResourceBlocks> integer

Range: 0 to dynamic
*RST: 0

Example: See Example"Fixed reference channels" on page 579.

Manual operation: See "RB Offset" on page 170

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:MAPType <MappingType>

Sets the PUSCH mapping type for the selected FRC.

Parameters:

<MappingType> A | B

*RST: A

Example: See Example"Fixed reference channels" on page 579.

Manual operation: See "Mapping Type" on page 170

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:FRC:PTRS:STATe <FrcPtrsState>

Enables PTRS for the selected FRC.

Parameters:

<FrcPtrsState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Fixed reference channels" on page 579.

Manual operation: See "PTRS" on page 170

12.20.10 PUSCH commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:A02List <Value>

Configures the higher layer parameter `ul-AccessConfigListDCI0-2` as defined in 3GPP 38.331.

Parameters:

<Value> integer

Range: 0 to 64
*RST: 0

Manual operation: See "ul-AccessConfigList DCI0_2" on page 178

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:ACCList <Value>

Configures the higher layer parameter `ul-AccessConfigListDCI0-1` as defined in 3GPP 38.331.

Parameters:

<Value> integer

Range: 0 to 64
*RST: 0

Manual operation: See "ul-AccessConfigList DCI0_1" on page 178

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:APPResent <APortsPresent>

Turns the "Antenna Ports" DCI field in DCI format 0_2 on and off.

Parameters:

<APortsPresent> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Antenna Ports Present DCI0_2" on page 179

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:BRV <BitLength>

Defines the bit length of the DCI field "Redundancy Version" available in DCI format 0_2.

Parameters:

<BitLength> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Bits For Redundancy Version DCI0_2" on page 178

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:BHARq <BitLength>

Defines the bit length of the DCI field "HARQ Process Number" available in DCI formats 0_2.

Parameters:
<BitLength> integer
Range: 0 to 4
*RST: 0

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:BSAMe <SameDmrsSetting>

Per default, the same configuration applies for DMRS mapping type A and B. Disable "Same Settings for Type A and Type B" to modify the mapping type B settings.

Mapping type A and B define the DMRS position in the PUSCH, the starting symbol and length. The UE informs the BS about the mapping type supportability via the UE capability information message. Before modifying Mapping Type B settings this state has to be deactivated.

Parameters:
<SameDmrsSetting> 1 | ON | 0 | OFF
*RST: 1

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Same Settings for Type A and Type B" on page 180

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:CTYPe <TypeBConfigType>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:CTYPe <TypeAConfigType>

Sets the configuration type (type 1 or type 2) and defines the mapping of the DMRS to the physical resource elements

Parameters:
<TypeAConfigType> T1 | T2
*RST: T1

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Config Type" on page 180

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:MLENgth <TypeBMaxLength>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:MLENgth <TypeAMaxLength>

Sets if single- or double-symbol DMRS is used.

Parameters:
<TypeAMaxLength> integer
Range: 1 to 2
*RST: 2

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Max Length" on page 181

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PUID <TypeAPuschID>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PUID <TypeBPuschID>

Sets the PUSCH ID value used for DMRS sequence generation.

Parameters:

<TypeBPuschID> integer

Range: 0 to 1007
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "NPusch ID" on page 181

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:APINdex <TypeBAddPosIdx>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:APINdex <TypeAAddPosIdx>

Sets the additional position index.

Parameters:

<TypeAAddPosIdx> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Additional Position Index" on page 181

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:SID0 <ScramID0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:SID1 <ScramID1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:SID0 <ScramID0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:SID1 <ScramID1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MCBGroups <UlMaxCBGperTB>

Limits the number of code block groups per transport block.

In 5G NR a huge TB (transport block) is split into multiple code blocks (CB). Multiples CBs are grouped into one code block group (CBG). The number of code blocks grouped into the CBG can be limited by the "Max Code Block Groups Per Transport Block" setting.

Parameters:

<UlMaxCBGperTB> G2 | G4 | DISabled | G6 | G8

G2
Limits the number of code block groups per transport block to 2.

G4
Limits the number of code block groups per transport block to 4.

DISabled
Default value, which disabled the limitation of code block groups per transport block.

G6
Limits the number of code block groups per transport block to 6.

G8
Limits the number of code block groups per transport block to 8.

*RST: DISabled

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Max Code Block Groups Per Transport Block" on page 126
See "Max Code Block Groups Per Transport Block" on page 174

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:UR16 <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:UR16 <State>

Turns the higher layer parameter "dmrs-uplink-r16" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use R16 DMRS" on page 182

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DSINit <DmrsSeqInit>

Turns the "DMRS Sequence Initialization" DCI field in DCI format 0_2 on and off.

Parameters:

<DmrsSeqInit> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "DMRS Sequence Initialization DCI0_2" on page 179

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:HP5Bits <BitLength>

Selects the size of the "HARQ Process Number" DCI field in DCI format 1_1.

Parameters:

<BitLength>

OFF | 0
4 bits

ON | 1
5 bits

*RST: 0

Manual operation: See "Harq-ProcessNumberSizeDCI0_1" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:TPSTate <TransformPrec>

Enables the precoding operation and thus enables the DFT-s-OFDM.

Parameters:

<TransformPrec>

1 | ON | 0 | OFF

0|OFF
Enables the CP-OFDM.

1|ON
Enables the DFT-s-OFDM.

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Transform Precoding" on page 171

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MRANk <MaximumRank>

Sets the parameter max rank.

Parameters:

<MaximumRank>

integer

Range: 1 to 4
*RST: 4

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Max Rank" on page 171

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:TXConfig <TxConfig>

Sets if codebook-based (CB) or non-codebook-based (NCB) transmission is used.

Parameters:
<TxConfig> NCB | CB
*RST: NCB

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "TxConfig" on page 172

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:CBSubset <CodebookSubset>

Sets the higher layer parameter `codebookSubset`.

Parameters:
<CodebookSubset> FPNC | PNC | NC

FPNC
Fully-and-partial-and-non-coherent

PNC
Partial-non-coherent

NC
Non-coherent

*RST: FPNC

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Codebook Subset" on page 172

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MCSTable <Modulation>

Sets the MSC table and defines the used modulation scheme.

Parameters:
<Modulation> QAM64 | QAM256 | QAM64LSE
*RST: QAM64

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "MCS Table" on page 172

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MTTPrecoding <PuschMcsTableTP>

Sets the MCS table.

Parameters:
<PuschMcsTableTP> QAM64 | QAM256 | QAM64LSE
*RST: QAM64

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "MCS Table Transform Precoding" on page 173

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:RESAlloc <UlBwpPuschResAl>

Sets the used resource allocation type.

Parameters:

<UlBwpPuschResAl> T0 | T1 | DS

*RST: T1

Example: See Example"Scheduling PxSCH type 0 allocation" on page 583.

Manual operation: See "Resource Allocation" on page 125

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:RBGSize <PuschRBGSize>

Sets the size of the resource block group.

Parameters:

<PuschRBGSize> C2 | C1

Example: See Example"Scheduling PxSCH type 0 allocation" on page 583.

Manual operation: See "Resource Block Group Size" on page 125

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:SCRambling:STATe <UseScramblingId>

Sets if a data scrambling ID is used for the initialization of the generator of the PUSCH scrambling sequence.

Parameters:

<UseScramblingId> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Use PUSCH Scrambling ID" on page 172

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DSID <DataScrambleId>

If `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:SCRambling:STATe 1`, sets the data scrambling ID.

Parameters:

<DataScrambleId> integer

Range: 0 to 1023

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Data Scrambling ID" on page 172

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOP <SelFreqHopp>

Disables or enables inter- or intra-slot frequency hopping.

Parameters:

<SelFreqHopp> DIS | INTRA | INTER

DIS
Disable frequency hopping.

INTRA
Enable intra slot frequency hopping. Both intra- and inter-sub-frame hopping are performed. The PUSCH position in terms of used resource blocks is changed each slot and each subframe.

INTER
Enable inter-slot frequency hopping. The PUSCH position in terms of used resource blocks is changed each subframe.

*RST: DIS

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Frequency Hopping" on page 174

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOFfsets:NOFFsets <NumFreqHopOff>

Defines the number off frequency hopping offsets.

- If the size of the active BWP is fewer than 50 PRBs, one of two higher layer configured offsets are indicated in the UL grant.
- If the size of the active BWP is equal to or greater than 50 PRBs, one of four higher layer configured offsets are indicated in the UL grant.

Parameters:

<NumFreqHopOff> integer

Range: 2 to 4
*RST: 4

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Number of Offsets" on page 175

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FHOFfsets:OFFSet<gr0> <FreqHopOffset>

Sets the value of the available frequency hopping offsets.

The number of offsets is set automatically to 2 or 4 depending on the size of the active BWP. See Number of Offsets.

Suffix:
<gr0> 0 to 3
Defines to which offset the frequency hopping value is applied.

Parameters:
<FreqHopOffset> integer
Range: 1 to 274
*RST: 1

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Offset Values" on page 175

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PI01 <State>

Turns the "Priority Indicator" DCI field in DCI formats 0_1 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Priority Indicator DCI0_1 / DCI0_2" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PI02 <State>

Turns the "Priority Indicator" DCI field in DCI formats 0_2 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Priority Indicator DCI0_1 / DCI0_2" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:ISIN <State>

Turns the "Invalid Symbol Pattern Indicator" DCI field in DCI formats 0_1 and 0_2 on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Invalid Symbol Indicator" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:OI01 <Value>

Turns the configuration of the minimum applicable scheduling offset indicator for the DCI format 0_1 on and off.

Parameters:

<Value> integer

Range: 0 to 2
*RST: 0

Manual operation: See "Minimum Scheduling Offset K2" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:OLPC <OlpcParamSet>

Parameters:

<OlpcParamSet> SNC | S1 | S2

*RST: SNC

Manual operation: See "olpc-ParameterSet" on page 177

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:PPSL <Value>

Configures the higher layer parameter `p0-PUSCH-SetList` as defined in 3GPP 38.331.

Parameters:

<Value> integer

Range: 0 to 16
*RST: 0

Manual operation: See "p0-PUSCH-SetList" on page 178

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:T1GRan <State>

Configures the higher layer parameter `resourceAllocationType1GranularityDCI-0-2` as defined in 3GPP 38.331.

Parameters:

<State> NCON | N2 | N4 | N8 | N16

NCON
Not configured.

N2|N4|N8|N16
Granularity as defined by 3GPP.

*RST: NCON

Manual operation: See "Type 1 Allocation Granularity DCI 0_2" on page 179

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:FPTR <State>

Configures the higher layer parameter `ul-FullPowerTransmission` as defined in 3GPP 38.331.

Parameters:

<State> FP | FPM1 | FPM2 | NCON

NCON
Not configured.

FP|FPM1|FPM2
Full power mode type.

*RST: NCON

Manual operation: See "Full Power Transmission" on page 175

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:UITL?

Queries the state of the higher layer parameter `useInterlacePUCCH-PUSCH` as defined in 3GPP 38.331.

Return values:

<State> 1 | ON | 0 | OFF

*RST: 0

Usage: Query only

Manual operation: See "Use Interlace" on page 176

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:STATe <PtrsTpState>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:STATe <PtrsTpPtrsState>

Simulates the transmission of the higher-layer parameter `transformPrecoderEnabled`.

Parameters:

<PtrsTpPtrsState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "State" on page 185

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:TMDensity <PtrsTpTimeDens>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:TMDensity <PtrsTpTimeDens>

Sets the PTRS time density.

Parameters:

<PtrsTpTimeDens> TD1 | TD2

*RST: TD1

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Time Density" on page 186

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:SCID <TpPtrsScramId>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:SCID <TpPtrsScramId>

Sets whether the PTRS Scrambling ID value used for PTRS sequence generation is configured by the NPusch ID (higher layer) or by the cell ID.

Parameters:

<TpPtrsScramId> CID | PUID

CID
Sets the cell ID as the scrambling ID for PTRS sequence generation.

PUID
Sets the NPusch ID as the scrambling ID for PTRS sequence generation.

*RST: CID

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Scrambling ID" on page 186

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB0 <PtrsTpNumRB0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB1 <PtrsTpNumRB1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB2 <PtrsTpNumRB2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB3 <PtrsTpNumRB3>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTA:PTRS:TP:RB4 <PtrsTpNumRB4>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB0 <PtrsTpNumRB0>

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB1 <PtrsTpNumRB0>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB2 <PtrsTpNumRB2>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB3 <PtrsTpNumRB3>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:DMTB:PTRS:TP:RB4 <PtrsTpNumRB4>

Sets the corresponding parameter `sampleDensity`.

Parameters:

<PtrsTpNumRB4> integer

Range: 1 to 276
*RST: RB0 = 1/RB4 = 276

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "N_RB_x" on page 186

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:U2TPc <State>

Turns the "2nd TPC Command for Scheduled PUSCH" DCI field on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Use 2nd TPC Command" on page 179

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:XOVerhead <XOverhead>

Selects the value for the "xOverhead" parameter.

Parameters:

<XOverhead> N0 | N6 | N12 | N18

*RST: N0

Example: See: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "xOverhead" on page 174

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:TDANum <Allocations>

Sets the number of time domain allocations used to calculate the bitwidth of the `Time Domain Resource Assignment` for the UL DCI format 0_1 as specified in TS 38.214.

Parameters:
<Allocations> integer
Range: 0 to 16
*RST: 0

Example: `SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:PDSCh:TDANum 2`

Manual operation: See "Time Domain Allocations DCI0_1" on page 187

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:DC02:TDANum <Allocations>

Sets the number of time domain allocations used to calculate the bitwidth of the `Time Domain Resource Assignment` for the UL DCI format 0_2 as specified in TS 38.214.

Parameters:
<Allocations> integer
Range: 0 to 64
*RST: 0

Manual operation: See "Time Domain Allocations DCI0_2" on page 187

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:MULTi:TDANum <Value>

Configures the higher layer parameter `pusch-TimeDomainAllocationListForMultiPUSCH`.

Parameters:
<Value> integer
Range: 0 to 64
*RST: 0

Manual operation: See "Time Domain Allocations Multi-PUSCH" on page 187

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PDSCh:MULTi:PLEN <Value>

Parameters:
<Value> integer
Range: 1 to 8
*RST: 1

Manual operation: See "Multi-PUSCH Length" on page 187

12.20.11 PUSCH UCI commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:STATe <UCIState>

Enables the transmission and the configuration of the uplink control information (UCI).

Parameters:

<UCIState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "State" on page 188

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:MODE <PuschUciMode>

Defines the information transmitted on the PUSCH.

Parameters:

<PuschUciMode> UCLSch | UCIonly

UCLSch
Control information and data are multiplexed into the PUSCH.

UCIonly
Only uplink control information is transmitted on PUSCH.

*RST: UCLSch

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Mode" on page 188

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:ALPHa <PuschUciAlpha>

Sets the scaling parameter alpha.

Parameters:

<PuschUciAlpha> A0_5 | A0_65 | A0_8 | A1_0

*RST: A05

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Scaling Alpha" on page 189

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF0 <PuschUciHArqOff>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF1 <PuschUciHarqOf1>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:HARQ:OFF2 <PuschUciHarq2Of>

Sets the HARQ information offsets `OFF0|OFF1|OFF2`, each used for the multiplexing of defined number of HARQ-ACK information bits.

Parameters:

<PuschUciHarq2Of> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "I_HARQ_Offset,x" on page 189

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CGUCi:OFFSet <Offset>

Defines an offset for the CG-UCI.

Parameters:

<Offset> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "I_CG-UCI_Offset" on page 189

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CGUCi:STATe <State>

Turns transmission of the configured grant UCI (CG-UCI) on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Use CG-UCI" on page 189

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF10 <PuschUciCsiOf10>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF11 <PuschUciCsiOf11>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF20 <PuschUciCsiOf20>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:CSI:OF21 <PuschUciCsiOf21>

Sets the CSI part 1 (`OF10|OF11`) and CSI part 2 (`OF20|OF21`) information offsets, where the `OF10|OF20` are used if up to 11 CSI bits are multiplexed and `OF11|OF21` otherwise.

Parameters:
<PuschUciCsiOf21> integer
Range: 0 to 18
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "I_CSI1_Offset,x, I_CSI2_Offset,x" on page 190

12.20.12 SRS commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:STATe <SrsState>

Enables the SRS transmission.

Parameters:

<SrsState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "State" on page 192

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:NRSets <SrsResourceSets>

Sets the number of SRS sets.

Parameters:

<SrsResourceSets> integers

Range: 0 to 15

*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Resource Sets" on page 192

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:CONFig <SrsConfig>

Selects the 3GPP release the SRS is based on.

Parameters:

<SrsConfig>

IE
Standard SRS configuration.

IER16
Release 16 SRS configuration, including positioning functionality.

IENPR16
Release 16 SRS configuration, without positioning functionality.

IER17
Release 17 SRS configuration.

*RST: IE

Manual operation: See "Configured By" on page 192

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RE02 <BitLength>

Configures the higher layer parameter `srs-RequestDCI0-2` available for DCI format 0_2.

Parameters:

<BitLength> RNON | R1 | R2

RNON
Not configured.

R1|R2
Number of bits for "SRS Request" DCI field.

*RST: RNON

Manual operation: See "Request DCI0_2" on page 193

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:REQuest <BitLength>

Configures the higher layer parameter `srs-RequestDCI1-2` available for DCI format 0_2.

Parameters:

<BitLength> RNON | R1 | R2

RNON
Not configured.

R1|R2
Number of bits for "SRS Request" DCI field.

*RST: RNON

Manual operation: See "Request DCI1_2" on page 193

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FS:FSFactor <Value>

Selects the frequency scaling factor for the SRS defined in 3GPP 38.211, chapter 6.4.1.4.3.

Parameters:

<Value> PF1 | PF2 | PF4

*RST: PF1

Manual operation: See "Frequency Scaling Factor" on page 197

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FS:SRIDx <Value>

Defines the start RB index defined in 3GPP 38.331.

Parameters:

<Value> integer

Range: 0 to Depends on frequency scaling fator
*RST: 0

Manual operation: See "Start RB Index" on page 197

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RSTYpe <Mode>

Sets the SRS transmission type.

Parameters:

<Mode>

APER
not supported

PER
Periodic transmission of the SRS.

SP
not supported

*RST: PER

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Resource Type" on page 194

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:USAGe <SrsRsSetUsage>

Queries the type of the SRS transmission.

Parameters:

<SrsRsSetUsage> ASW | BM | CB | NCB

`NCB` = non-codebook based
`CB` = codebook
`BM` = beam management (reserved for futute use)
`ASW` = antenna switching (reserved for futute use)

*RST: NCB

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Usage" on page 194

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:NRESources <SrsResPerSet>

Sets the number of SRS resources in the SRS resource set.

Parameters:

<SrsResPerSet> integer

Range: 0 to 63
*RST: 1

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Resources" on page 194

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:PER <SrsRsPeriodicit>

Sets the SRS repetition factor.

Parameters:

<SrsRsPeriodicit> SL1 | SL2 | SL4 | SL5 | SL8 | SL10 | SL16 | SL20 | SL32 | SL40 | SL64 | SL80 | SL160 | SL320 | SL640 | SL1280 | SL2560 | SL81920 | SL40960 | SL10240 | SL5120

*RST: SL1

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Periodicity" on page 195
See "Periodicity" on page 293

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:OFFSet <SrsRsOffset>

Sets time position of first SRS allocation within an SRS periodicity.

Parameters:

<SrsRsOffset> integer

Range: 0 to 81919
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Offset" on page 195

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SPOS <SrsRsSPostion>

Sets the starting position (the OFDM symbol number) of the SRS allocation within a slot.

Parameters:

<SrsRsSPostion> integer

Range: 0 to 13
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Start Pos." on page 195

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SYMNumber <SrsRsNumSymb>

Sets the number of consecutive OFDM symbols the SRS resource spans.

Parameters:

<SrsRsNumSymb> SYM1 | SYM2 | SYM4 | SYM12 | SYM8 | SYM10 | SYM14

*RST: SYM1

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "No. Sym." on page 195

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FPOS <SrsRsFPosition>

Sets the starting position of the SRS allocation in the frequency domain.

Parameters:

<SrsRsFPosition> integer

Range: 0 to 67
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Freq. Pos." on page 195

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:FQSHift <SrsRsFreqShift>

Sets the frequency shift.

Parameters:

<SrsRsFreqShift> integert

Range: 0 to 268
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Freq. Shift" on page 195

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:BSRS <SrsRsBSrs>

Sets the parameter b-SRS needed to define the length of the SRS sequence.

Parameters:

<SrsRsBSrs> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "B SRS" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:CSRS <SrsRsCSrs>

Sets the parameter c-SRS to define the length of the SRS sequence.

Parameters:

<SrsRsCSrs> integer

Range: 0 to 63
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "C SRS" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:BHOP <SrsRsBHop>

Sets the parameter b_{Hop} that defines the frequency hopping of the SRS.

Parameters:

<SrsRsBHop> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "B Hop" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:REFactor <SrsRsRepFactor>

Sets how many times the SRS symbols are repeated.

Parameters:

<SrsRsRepFactor> REP1 | REP2 | REP4 | REP5 | REP6 | REP7 | REP8 | REP10 | REP12 | REP14

*RST: REP1

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Rep. Factor" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:TRTComb <SrsRsTransCombo>

Sets the transmission comb (k_{TC}).

Parameters:

<SrsRsTransCombo> TC2 | TC4 | TC8

*RST: TC2

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Trans. Comb" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:COFFset <SrsRsCombOffset>

Sets the parameter transmission comb offset.

Parameters:

<SrsRsCombOffset> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Comb Offset" on page 196

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:CYCShift <SrsRsCyclicShif>

Sets the number of cyclic shifts, required for the SRS sequence generation.

Parameters:

<SrsRsCyclicShif> float

Range: 0 to 11
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Cyclic Shift" on page 197

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:ID <SrsRsSequId>

Sets the higher-layer parameter sequence ID required for the SRS sequence generation.

Parameters:

<SrsRsSequId> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Sequence ID" on page 197

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:SEQ:HOPPing <SrsRsHopping>

Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group, required for the SRS sequence generation.

Parameters:

<SrsRsHopping> N | GRP | SEQ

N
Neither

GRP
Group hopping (reserved for future use)

SEQ
Sequence hopping (reserved for future use)

*RST: N

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Group or Sequence Hopping" on page 197

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:NAPort <SrsNumAp>

Sets how many antenna ports (AP) are used for every SRS transmission.

Parameters:

<SrsNumAp> AP1 | AP2 | AP4

*RST: AP1

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "No. Ports" on page 198

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:POWer <SrsRsPower>

Sets the SRS power.

Parameters:

<SrsRsPower> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Power" on page 198

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:PTRS <SrsPtrsPortIdx>

Sets the PTRS antenna port index.

Parameters:

<SrsPtrsPortIdx> P1 | P0

*RST: P0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "PTRS Port Idx" on page 198

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:REAL <SrAPMapDataReal>

Define the mapping of the antenna ports to the physical antennas.

Suffix:

<s2us0> 1000 to 1003
Defines the antenna port
Value range depends on the selected number of antenna ports as follows
`<s2us0>` = 1000 + {0 to `NAPort` - 1}

<s3us0> 0 to 1
Available basebands (i.e. rows in the antenna port-mapping table)
Depends on the number of basebands output to carrier mapping (`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`)

Parameters:

<SrAPMapDataReal> 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

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Mapping table" on page 199
See "Mapping table" on page 281
See "Mapping table" on page 296

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:IMAGinary <SrsAPMapDataIma>

Define the mapping of the antenna ports to the physical antennas.

Suffix:

<s2us0> 1000 to 1003
Defines the antenna port
Value range depends on the selected number of antenna ports as follows
`<s2us0>` = 1000 + {0 to `NAPort` - 1}

<s3us0> 0 to 1
Available basebands (i.e. rows in the antenna port-mapping table)
Depends on the number of basebands output to carrier mapping (`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`)

Parameters:

<SrsAPMapDataIma> 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

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Mapping table" on page 199
See "Mapping table" on page 281
See "Mapping table" on page 296

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:MAGNitude <SrsAPMapDataMag>

Defines the mapping of the antenna ports to the physical antennas, cylindrical mapping coordinates are used.

Parameters:

<SrsAPMapDataMag>float

Range: 0 to 1
Increment: 0.001
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Mapping table" on page 199
See "Mapping table" on page 281
See "Mapping table" on page 296

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:RES<user0>:APMap:AP<ap>:ROW<apr>:PHASe <SrsAPMapDataPha>

Defines the mapping of the antenna ports to the physical antennas, if cylindrical mapping coordinates are used.

Parameters:
<SrsAPMapDataPha>float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example: See Example"Configuring one SRS resource set" on page 585.

Manual operation: See "Mapping table" on page 199
See "Mapping table" on page 281
See "Mapping table" on page 296

12.20.13 Bandwidth part configuration for sidelink commands

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:NRESpool <ResourcePools>

Defines the number of resource pools in a sidelink bandwidth part.

Parameters:

<ResourcePools> integer

Range: 1 to 8
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of Resource Pools" on page 200

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:AMCS <AdditionalMCS>

Selects the MCS table additionally used by the resource pool.

Parameters:

<AdditionalMCS> integer

Range: 0 to 2
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Additional MCS Table" on page 202

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF1 <Value>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF2 <Value>

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF3 <Value>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:BOF4 <Value>

Defines beta-offset values to determine the number of coded modulation symbols for second stage SCI (SCI2).

Parameters:

<Value> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "betaOffset1 ... 4" on page 204

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:INDicator <ID>

Defines an ID for the selected resource pool.

Parameters:

<ID> integer

Range: 0 to 639
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "ID" on page 201

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MNPRes <Resources>

Defines the maximum number of reserved PSCCH/PSSCH resources that can be indicated by an SCI.

Parameters:

<Resources> integer

Range: 2 to 3
*RST: 2

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Max Number per Reserve" on page 202

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MREServe <State>

Turns the multi reserve resource for a resource pool on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Multi Reserve Resource" on page 202

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:MSCTable <McsTable>

Selects the modulation (MCS table) for the resource pool.

Parameters:
<McsTable> QAM64 | QAM256 | QAM64LSE
*RST: QAM64

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "MCS Table" on page 202

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NPRB <PRBs>

Defines the number of physical resource blocks a resource pool uses.

Parameters:
<PRBs> integer
Range: 10 to 273
*RST: 10

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of PRBs" on page 201

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NSUBchannels <Subchannels>

Defines the number of subchannels in the resource pool.

Parameters:
<Subchannels> integer
The available number of subchannels depends on the number of PRBs the resource pool uses (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NPRB`) and the size of a subchannel (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:SCHSize`).
Range: 1 to 27
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of Subchannels" on page 201

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT2 <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT3 <State>
[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT4 <State>

Turns DMRS time domain patterns in the first stage SCI (SCI1A) on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "DMRS Pattern 2 ... 4" on page 203

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:REPList <Period>

Defines the possible resource reservation period allowed in the resource pool in the unit of ms.

Parameters:
<Period> integer
Range: 1 to 16
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Reserve Resource Period List" on page 202

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:RESBits <Value>

Defines the number of reserved bits in the first stage SCI pattern (SCI1A).

Parameters:
<Value> integer
Range: 2 to 4
*RST: 2

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Reserved Bits" on page 204

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:SCALing <ScalingFactor>

Selects a scaling factor to limit the number of resource elements assigned to the second stage SCI on PSSCH.

Parameters:

<ScalingFactor> FP5 | FP8 | FP65 | F1

*RST: FP5

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Scaling Factor" on page 203

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:SCHSize <ResourceBlocks>

Selects the size of a resource pool in terms of resource blocks.

Parameters:

<ResourceBlocks> R10 | R12 | R15 | R20 | R25 | R50 | R75

The available sizes depend on the number of PRBs the resource pool uses (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NPRB`).

*RST: R10

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Subchannel Size" on page 201

[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:STRB <ResourceBlock>

Defines the first resource block the resource pool uses.

Parameters:

<ResourceBlock> integer

The value range depends on the number of PRBs the resource pool uses (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NPRB`).

Range: 0 to 265
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Start RB" on page 201

12.21 Scheduling commands

Depending on the allocation you want to configure or query, you have to use a different command syntax.

The logic goes like this:

- Use commands with the following syntax structure to **configure common allocations** (e.g. puncturing allocations):
  `SOURce:NR5G:SCHed:CELL:SUBF:ALLoc:...`
- Use commands with the following syntax structure to **query common allocations** whose characteristics are automatically configured or configured elsewhere in the user interface (e.g. dummy RE allocations):
  `SOURce:NR5G:SCHed:CELL:SUBF:COMMon:ALLoc:...`
  Commands with this syntax are queries only.
  Note that the suffix at `ALLOc` starts a `0` for the first automatically generated allocation.
- Use commands with the following syntax structure to **configure user allocations** (e.g. PDSCH allocations):
  `SOURce:NR5G:SCHed:CELL:SUBF:USER:BWPart:ALLoc:...`
- Use commands with the following syntax structure to **query user allocations** whose characteristics are automatically configured or configured elsewhere in the user interface (e.g. CSI-RS allocations):
  `SOURce:NR5G:SCHed:CELL:SUBF:USER:BWPart:RESulting:ALLoc:...`
  Commands with this syntax are queries only.
  Note that the suffix at `ALLOc` starts at `0` for the first automatically generated allocation.
- Use commands with the following syntax structure to specifically **configure PRACH user allocations**:
  `SOURce:NR5G:SCHed:CELL:SUBF:USER:BWPart:ALLoc:PRACh:...`
  (only for a few selected entries in the scheduling table as indicated by the command list below; most of the PRACH allocation settings work with the commands used to configure other user allocations like the PDSCH)
- Use commands with the following syntax structure to specifically **configure RIM-RS user allocations**:
  `SOURce:NR5G:SCHed:CELL:SUBF:USER:BWPart:ALLoc:RIMRs:...`
  (only for a few selected entries in the scheduling table as indicated by the command list below; most of the RIM-RS allocation settings work with the commands used to configure other user allocations like the PDSCH)

Note that not all allocation types support all four syntax variants, e.g. it is not possible to define the power of puncturing allocations or query the repetition characteristics of common allocations (for common allocations whose repetitions you cannot configure, the repetition is always fix).

[:SOURce<hw>]:BB:NR5G:SCHeduling:MODE <SchedulingMode>

Defines how the scheduling and the content of the different PDSCH allocations is defined and performed.

Parameters:

<SchedulingMode> MANual | AUTO

MANual
No cross-reference between the settings made for the CORESET DCIs and the PDSCHs settings.
Configure the PDSCH allocations manually.

AUTO
Content and scheduling of the PDSCH according to the configuration of the CORESET DCIs.

*RST: MANual

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "PDSCH Scheduling" on page 55

[:SOURce<hw>]:BB:NR5G:SCHeduling:RSSPace <RestrToSSpace>

If enabled, the CCE start index is selected automatically to be within the current search space.

Parameters:

<RestrToSSpace> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Search space configuration" on page 586.

Manual operation: See "Restrict to Search Space" on page 55

[:SOURce<hw>]:BB:NR5G:SCHeduling:SFN:STATe <SysFrameNum>

Enables the full counting of the system frame number carried by the PBCH block from 0 to 1023, independent from the configured ARB Sequence Length.

If `System Frame Number Offset` is set, the counting starts at the configured SFN offset value and restarts when the SFN offset value is reached again as follows: offset, (offset+1), (offset+ 2), ..., 1023, 0, 1, 2, ..., (offset-1).

Parameters:

<SysFrameNum> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the SS/PBCH" on page 576.

Options: R&S SMW-B9/-K148.

Manual operation: See "Count Full System Frame Number" on page 55

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:AGFT <Factor>

Selects the aggregation factor for PUSCH repetitions.

Prerequisites for this command

- Select PUSCH repetition type A (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`).

Parameters:

<Factor> F8 | F4 | F2

*RST: F2

Example: See Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Aggregation Factor" on page 219

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:AGOFfset <Offset>

Defines an offset for for the PUSCH repetitions.

Prerequisites for this command

- Select PUSCH repetition type A (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`).

Parameters:

<Offset> integer

Range: 0 to 7

*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Offset in Aggregation" on page 219

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:CONFlict?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONFlict?

Queries if allocations overlap.

Return values:

<Conflict> 1 | ON | 0 | OFF

*RST: 0

Example:
```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CONFlict?
// 0
// there is no conflict, i.e. allocations are not overlapping
```

Usage: Query only

Manual operation: See "Conflict" on page 208

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:CONTent?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:CONTent?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:CONTent <Content>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONTent <Content>

Selects the allocation type.

Note that the available parameters for this set of commands depends on the allocation you want to configure. For example, you can only configure puncturing allocations in the common allocations. Therefore, the setting command for common allocations only supports the `PUNCturing` parameter. Likewise, the commands to configure or query user allocation only support the parameters that represent user allocations (e.g. `PDSCh`, `COREset` etc.)

For an overview of all allocation types and their availability, see "Content" on page 208. Note that some allocation types require a specific firmware option.

Parameters:

<Content>

PDSCh | COReset | SPBCh | DUMRe | CSIRs | PRS | LTECrs | PUNCturing
Downlink allocation types.

PUSCh | PUCCh | PRACh | DUMRe | SRS | PUNCturing
Uplink allocation types.

SSSPbch | PSBCh | PSCCh | PSSCh | PSFCh | PSCSs
Sidelink allocation types

*RST: depends on command

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Content" on page 208

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:APPLy

Start the copy progress. The selected line from the scheduling settings table will be copied to the selected subframe and slot.

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Usage: Event

Manual operation: See "Apply" on page 211

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:SLOT <UserAllcCpyToSL>

Select the slot the data from the selected line from the scheduling settings table will be copied to.

Parameters:

<UserAllcCpyToSL> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Slot" on page 211

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COPYto:SUBF <UserAllcCpyToSF>

Select the slot the data from the selected line from the scheduling settings table will be copied to.

Parameters:

<UserAllcCpyToSF> integer

Range: 0 to 99
*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Subframe" on page 211

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:DURation <Slots>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:DURation <Slots>

Defines in how many consecutive slots within a frame the allocation is repeated.

Prerequisites for this command

- Select custom repetition type (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`).

Parameters:

<Slots> integer

Range: 1 to 10
*RST: 1

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`.

Manual operation: See "Duration" on page 218

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FMT <Format>

In uplink, selects the PUCCH format.

Parameters:

<Format> F0 | F1 | F2 | F3 | F4

*RST: F0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Format" on page 212

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:INFO?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?

Queries information on the current configuration.

Return values:

<UserAllocInfo> string

Example: `SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:INFO?`

Response:


```
"{
"common_settings": {
"power_dB": 0.0,
"slot_in_frame": 0
},
"content_type": "PXsch",
"content": {
"frequency_domain_allocation_type": "FrequencyAllocationType1",
"frequency_domain_allocation": {
"vrb_offset": 0,
"vrb_num": 273
},
"transport_block_settings_no_coding": [
{
"modulation": "QAM16"
},
{
"modulation": "QAM64"
}
],
"ptrs_settings": {
"antenna_port": [
1002
]
}
}
}"
```


Usage: Query only

Manual operation: See "Info" on page 215
See "Info" on page 245

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:MAPType?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:MAPType <MappingType>

Defines to which symbols of the PDSCH/PUSCH allocation the demodulation reference signals (DMRS) are mapped.

Parameters:

<MappingType> A | B

*RST: A

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Mapping Type" on page 212

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:POWer?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:POWer <Power>

Sets the power for the selected allocation relative to the power of the other allocations.

Parameters:

<Power> float

Range: -80 to 10.0
Increment: 0.01
*RST: 0.0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Power" on page 216

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:PERiod <Slots>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PERiod <Slots>

Sets the repetition periodicity.

Prerequisites for this command

- Select custom repetition type (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`).

Parameters:

<Slots> integer

Range: 1 to max*
*RST: 10
*) Max repetition period is calculated as follows:
$RepPeriod_{max}$ = #SlotsPerFrame * "SequnceLength", where:
#SlotsPerFrame: is the number of available slots and depends on the used subcarrier spacing.
"SequenceLength": is the ARB sequence length as set with the command `[:SOURce<hw>]:BB:NR5G:OUTPut:SEQLen`.

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions`.

Manual operation: See "Period" on page 218

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:RBNumber?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<us>:RBNumber?

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RBNumber?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:RBNumber <ResourceBlocks>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RBNumber <ResourceBlocks>

Sets the number of resource blocks (RB) the allocation uses.

Parameters:

<ResourceBlocks> integer

Note that there are restrictions to the number of resource block you can use for different types of allocations. For more information, see "No. RB" on page 214.

Range: 20 to 275
*RST: 20

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "No. RB" on page 214

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:RBOFfset?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RBOFfset?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:RBOFfset <Offset>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RBOFfset <FrequencyOffset>

Adds a frequency offset and sets the start resource block of the selected allocation.

Parameters:

<FrequencyOffset> integer

Range: 0 to 255
*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "RB Offset" on page 215

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:REPetitions <RepetitionType>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REPetitions <RepetitionType>

Defines if and how often the allocation is repeated.

Parameters:

<RepetitionType> OFF | SLOT | SUBFrame | FRAMe | CUSTom | TA

OFF
Repetition is off.

SLOT | SUBFrame | FRAMe
Repetition every slot / subframe or frame.

CUSTom
Custom repetition pattern.

TA
Repetition based on repetition type A.

*RST: depends on allocation number

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Example:
```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:REPetitions CUSTom
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:PERiod 2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:DURation 5
```

Manual operation: See "Repetition/Repetition Type" on page 217
See "Repetition Type" on page 217

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:RIMRs:SCSPacing <SubcarrierSpacing>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:SCSPacing?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:PRACh:SCSPacing? <SubcarrierSpacing>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:SCSPacing?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:SCSPacing <SubcarrierSpacing>

Defines the subcarrier spacing for the selected allocation.

To define the subcarrier spacings for the complete bandwidth part and thus its user allocations in the various link directions, use the following commands:

- Downlink: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SCSPacing`
- Uplink: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SCSPacing`
- Sidelink: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:SCSPacing`

Parameters:
<SubcarrierSpacing> SCS15 | SCS30 | SCS60 | SCS120 | SCS240 | N15 | N30 | N60 | N120 | N240 | SCS480 | SCS960

Available subcarrier spacings depend on the channel type.

*RST: SCS30

Options: SCS480 and SCS960 require R&S SMW-K171

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQLength <SequenceLength>

Selects the PRACH sequence length.

Prerequisites for this command

- Turn on shared spectrum access (`[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SHSPec`).
  If shared spectrum access is off, the PRACH sequence length is a fix value depending on its subcarrier spacing.

Parameters:

<SequenceLength> L139 | L571 | L839 | L1151

*RST: L139

Manual operation: See "Map Type / Format / Seq. Len." on page 213

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:SLOT?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:SLOT?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:SLOT <Slot>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SLOT <Slot>

Sets the start slot for the selected allocation.

Parameters:

<Slot> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Slot" on page 212

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:RESulting:ALLoc<al>:SOSF?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:SOSF?

Queries the source subframe of automatically generated common or user allocations.

Return values:

<Subframe> float

Usage: Query only

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:STATe?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:STATe <State>

Activates the allocation.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "State" on page 216

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:SYMNumber?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:SYMNumber?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:SYMNumber <Symbols>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SYMNumber <Symbols>

Sets the number of symbols the allocation spans.

Parameters:

<Symbols> integer

Range: 1 to 14
*RST: 13

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "No. Sym." on page 213

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:COMMon:ALLoc<al>:SYMoffset?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:SYMoffset?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:ALLoc<al>:SYMoffset <Offset>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SYMoffset <Offset>

Sets the allocation's start (OFDM symbol) within the slot.

Parameters:

<Offset> integer

Range: 0 to 13
*RST: 1

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "Sym. Offset" on page 213

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TPSTate <TrPrecState>

In UL, enables the optional DFT-s-OFDM instead of CP-OFDM per PUSCH.

Parameters:

<TrPrecState> 0 | 1 | OFF | ON

*RST: 0

Example:

```
SOURce1:BB:NR5G:LINK UP
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER1:BWPart0:ALLoc0:TPSTate 1
```

Manual operation: See "Transform Precoding" on page 215

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:NALLoc <Allocations>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:NALLoc <Allocations>

Sets the number of configurable allocations in the selected `USER<dir0>:BWPart<gr0>` group.

Parameters:

<Allocations> integer

Range: 0 to 64

*RST: 0

Example: See Example"Configuring the configurable allocations in the users and BWPs groups" on page 580.

Manual operation: See "No. of Allocations" on page 210

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:INFO?
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:INFO?

Queries information on the current configuration.

Return values:

<UserAllocInfo> string

Example: `SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:INFO?`

Response:


```
"{
"common_settings": {
"power_dB": 0.0,
"slot_in_frame": 0
},
"content_type": "PXsch",
"content": {
"frequency_domain_allocation_type": "FrequencyAllocationType1",
"frequency_domain_allocation": {
"vrb_offset": 0,
"vrb_num": 273
},
"transport_block_settings_no_coding": [
{
"modulation": "QAM16"
},
{
"modulation": "QAM64"
}
],
"ptrs_settings": {
"antenna_port": [
1002
]
}
}
}"
```


Usage: Query only

Manual operation: See "Info" on page 215
See "Info" on page 245

12.22 PDSCH and PUSCH scheduling commands

12.22.1 General PDSCH and PUSCH scheduling commands

Note that some of the commands in the following list are available for both PDSCH and PUSCH scheduling, while others are exclusive to PDSCH or PUSCH scheduling.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CPEXt <Time>

Defines a cyclic prefix extension for PUCCH allocations.

Parameters:

<Time> float

Range: 0 to 100
Increment: 0.1
*RST: 0
Default unit: s

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Cyclic Prefix Extension" on page 225
See "Cyclic Prefix Extension" on page 285

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:MOD <Modulation>

Sets the modulation scheme.

Parameters:

<Modulation> BPSK | BPSK2 | QPSK | QAM16 | QAM64 | QAM256 | QAM1024

Supported modulations depend on the channel.

*RST: BPSK

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Modulation" on page 226

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PHYSbits?

Queries the size of the selected allocation in bits.

Return values:

<AllocPhysBits> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Usage: Query only

Manual operation: See "Phys. Bits" on page 227

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:NCW <NumUserAllocCW>

For PDSCH, sets if one or two codewords are used.

Parameters:

<NumUserAllocCW> integer

Range: 1 to 2
*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Number of Codewords" on page 222

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PATGrp <RateMatPattGrp>

For PDSCH allocations, selects one of the configured rate match patter groups.

Parameters:

<RateMatPattGrp> N | G1 | G2

`N` = none

*RST: N

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Rate Match Pattern Group" on page 223

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PRECg <UserAllocPDSCHP>

For PDSCH allocations, the precoding granularity can be adjusted. Precondition is that the precoding for the PDSCH is enabled under "User/BWP Settings > DL BWP Config > PDSCH > General Settings > Static Bundle Size".

Parameters:

<UserAllocPDSCHP> N2 | N4 | WIDeband

N2
Precoding granularity is set to N2.

N4
Precoding granularity is set to N4.
This setting is not available if:
- `VRB-to-PRB Interleaver` equals 2 or
- `Resource Block Group Size` equals Config1 and BWP size ≤ 36 RBs

WIDeband
Precoding granularity is set to wideband.

*RST: N2

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding Granularity" on page 224

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:SBCZero:STATe <UserAllocPdschS>

Sets if the PDSCH settings are scheduled by CORESET 0 or not.

Parameters:

<UserAllocPdschS> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Scheduled by CORESET 0" on page 222

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:BMAid <BurstRefAllocID>

Sets the bandwidth of the given allocation as reference for the "Burst" power mode.

Parameters:

<BurstRefAllocID> 1 | ON | 0 | OFF

0|OFF
Disables the given allocation as burst reference for the "Burst" power mode.

1|ON
Sets the given allocation as burst reference for the "Burst" power mode.

*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581 and Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Burst Mode Ref Alloc Identifier" on page 223

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc <UserAllocPXschR>

Sets the resource allocation type.

Parameters:

<UserAllocPXschR> T0 | T1 | T2

*RST: T1

Example: See Example"Scheduling PxSCH type 0 allocation" on page 583.

Manual operation: See "Resource Allocation" on page 223

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc:PATTern <ResAllocType0BM>, <BitCount>

If `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc` on page 801 `T0`, sets the PDSCH resource block groups allocation as bit pattern.

Parameters:

<ResAllocType0BM> 19 bits

*RST: #H0

<BitCount> integer

Range: 0 to 19
*RST: 18

Example: See Example"Scheduling PxSCH type 0 allocation" on page 583.

Manual operation: See "Resource Block Group Bitmap" on page 226

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:TYPE <PXschType>

Defines the PDSCH/PUSCH type by selecting the DCI format by that the PDSCH/PUSCH content is defined.

Parameters:

<PXschType> F00 | F01 | F10 | F11 | F02 | F12

*RST: F00

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "PDSCH Type/PUSCH Type" on page 222

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:FHOI <AllocPuschFHOId>

Sets the frequency hopping offset index.

Parameters:

<AllocPuschFHOId> float

Example: See:Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Index to Frequency Hopping Offset" on page 224

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:FHOP:STATe <AllocPUSCHDoFH>

Enable or disable the frequency hopping.

Parameters:
<AllocPUSCHDoFH> 1 | ON | 0 | OFF
*RST: 0

Example: See:Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Frequency Hopping" on page 224

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:HPRNumber <ProcessNumber>

Sets the HARQ process number for the relevant DCI.

Only accessible when the "HPN Mode" is enabled in the "Node Settings > Feedback".

Parameters:
<ProcessNumber> integer
Range: 0 to 15 (UL) / 31 (DL)
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591

Manual operation: See "HARQ Process Number" on page 227

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:INT<il>:INTL <Interlace>

Defines the interlace value for PUSCH allocations.

Parameters:
<Interlace> integer
Range: 0 to 9
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Value" on page 224

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:NINT <Interlaces>

Defines the number of interlaces for PUSCH allocations.

Prerequisites for this command

- Turn on interlacing (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UITL`).
- Use resource allocation type 2 (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:RESalloc`).

Parameters:

<Interlaces> integer

Range: 1 to 10
*RST: 1

Example: See Example"Configuring the PUSCH settings" on page 591

Manual operation: See "Number of Interlaces" on page 224

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TBM<tbm>:SLOTs <SlotOffset>

Defines the slots that carry the transport block for non-consecutive slot usage.

Suffix:

<tbm> 0 ... 7
Selects one of the slots the transport block uses. The value range depends on the number of slots the transport block is spread over.

Parameters:

<SlotOffset> integer

Offset in slots relative to the previous slot. See the example in "Number of Slots TBoMS" on page 225 for more in information about the logic behind this feature.

Range: 0 to 9
*RST: 0

Manual operation: See "Number of Slots TBoMS" on page 225

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TBOMs <Slots>

Selects the number of slots the PUSCH transport block is transmitted on.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:UCI:MODE` = UCLS
- `[:SOURce<hw>]:BB:NR5G:UBWP:RESTart` on page 672 = COAL
- `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:USCH:CCODing:STATe` = ON

Parameters:

<Slots> N1 | N2 | N4 | N8

*RST: N1

Example: //Select number of slots for PUSCH transport block transmission

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:UL:BWP0:UCI:
MODE UCLS
SOURce1:BB:NR5G:UBWP:RESTart COAL
SOURce1:BB:NR5G:UBWP:USER0:USCH:CCOding:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:USER0:BWPart0:
ALLoc0:TBOMs N4
```

Manual operation: See "Number of Slots TBoMS" on page 225

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TOFFset <Offset>

Defines a time offset for PUSCH allocations.

Parameters:

<Offset> float

Range: -3E-4 to 3E-4
Increment: 1E-8
*RST: 0
Default unit: s

Manual operation: See "Time Offset" on page 225

12.22.2 PDSCH and PUSCH Tx scheme commands

Note that some of the commands in the following list are available for both PDSCH and PUSCH scheduling, while others are exclusive to PDSCH or PUSCH scheduling.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs <AntennaPorts>

Selects the number of antenna ports the CSI-RS is transmitted on.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).

Parameters:

<AntennaPorts>

N1
CSI-RS transmission on one antenna port.

N2
CSI-RS transmission on two antenna ports.

N4
CSI-RS transmission on four antenna ports.

*RST: N1

Manual operation: See "Number of CSI-RS Antenna Ports" on page 229

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:CBMD <CodebookMode>

Selects the "Codebook Mode" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 2 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<CodebookMode> N1 | N2

*RST: N1

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:CBTYpe?

Queries the selected codebook type.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).

Return values:

<CodebookType> T1SP

*RST: T1SP

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Usage: Query only

Manual operation: See "Codebook Type" on page 229

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:TXSCheme:CDMData <CDMGroupData>

For DCI format 0_1, sets the number of DMRS CDM groups without data.

Parameters:

<CDMGroupData> integer

Range: 0 to 2

*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "CDM Groups w/o Data" on page 228

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:INTervp <UserAllocPdschV>

If `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:VPINterVP2|VP4`, enables interleaved VRB-to-PRB mapping.

Parameters:

<UserAllocPdschV> 1 | ON | 0 | OFF

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Example:

```
SOURce1:BB:NR5G:UBWP:USER0:CELL0:DL:BWP0:PDSCh:VPINter VP2
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PDSCh:TXSCheme:INTervp 1
```

Manual operation: See "Interleaved VRB-to-PRB" on page 229

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:TXSCheme:NLAYers <Layers>

For DCI format 0_1, sets the number of precoding layers.

Parameters:

<Layers> integer

Range: 1 to 8
*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:PCN1 <Value>

Selects the "N1" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<Value> N16 | N12 | N8 | N6 | N4 | N3 | N2 | N1

*RST: N1

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:PCN2?

Queries the "N2" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Return values:

<Value> N1 | N2 | N3 | N4

*RST: N1

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Usage: Query only

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I11 <Value>

Selects the "Codebook Index 1_1" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I12 <Value>

Selects the "Codebook Index 1_1" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I13 <Value>

Selects the "Codebook Index 1_1" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:SPCB<s2us0>:I2 <Value>

Selects the "Codebook Index 1_1" precoding parameter.

Prerequisites for this command

- Select precoding based on a codebook (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDSCh:PREC:MOD`).
- Select > 1 CSI-RS antenna ports (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:TXSCheme:APCSirs`).

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See: Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581

Manual operation: See "Precoding configuration" on page 230

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:TXSCheme:SRI <AllocPuschSri>

Selects the SRS resource to be used.

Parameters:

<AllocPuschSri> integer

The max value depends on the number of SRS resources, as set with the command `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:SRS:RS:SET<gr0>:NRESources`.

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "SRS Resource Indicator" on page 229

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:TXSCheme:TPMidx <TxTPMIIndex>

For PUSCH DCI format 0_1, sets the TPMI index, required to select the precoding matrix.

Parameters:

<TxTPMIIndex> integer

Range: 0 to 27
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "TPMI" on page 228

12.22.3 PDSCH and PUSCH DMRS commands

Note that some of the commands in the following list are available for both PDSCH and PUSCH scheduling, while others are exclusive to PDSCH or PUSCH scheduling.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:APIndex <Value>

Defines the additional position index for the DMRS.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE` = MAN

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE`

Manual operation: See "Additional Position Index" on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh[:DMRS]:APSelect<s2us0> <PdschAPSel>

Each layer of a PDSCH allocation is mapped to a certain antenna port. By the command the antenna ports are selected which are used for the transmission of the PDSCH allocation.

Parameters:

<PdschAPSel> AP1000 | AP1001 | AP1002 | AP1003 | AP1004 | AP1005 | AP1006 | AP1007 | AP1008 | AP1009 | AP1010 | AP1011

*RST: AP1000

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "DMRS Antenna Ports ..." on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:CTYPe <Configuration>

Selects the DMRS configuration type.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE` = MAN

Parameters:

<Configuration> T1 | T2

*RST: T1

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE`

Manual operation: See "Config Type" on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:DMR:NIDSel <PuschDmrsIdSel>

Sets whether the variable n_{ID}^{CELL} or n_{ID}^{PUSCH} is used by the generation of the DMRS sequence.

Parameters:

<PuschDmrsIdSel> CID | PUID

CID
n_{ID}^{CELL} is used by the generation of the DMRS sequence

PUID
n_{ID}^{PUSCH} is used by the generation of the DMRS sequence

*RST: CID

Example: Example"Configuring the PUSCH settings" on page 591

Manual operation: See "N_ID^RS" on page 232

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:LENGth <DmrsLen>

Defines whether single- or double-symbol DMRS is used.

Parameters:

<DmrsLen> integer

Range: 1 to 2
*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Length" on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE <Mode>

Selects the DMRS configuration mode.

Parameters:

<Mode>

AUTO
Applies the same DMRS settings to all allocations.

MAN
Each allocation can have different DMRS settings.

*RST: AUTO

Example:

//Define PDSCH DMRS settings for a specific allocation

```
SOURCe1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc1:PDSCH:DMRS:MODE MAN
SOURCe1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc1:PDSCH:DMRS:TAPos 3
SOURCe1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc1:PDSCH:DMRS:CTYPe T2
SOURCe1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc1:PDSCH:DMRS:APINdex 2
```

Manual operation: See "Mode" on page 231

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:NSID <NScid>

Sets the scrambling ID (N_{ID}).

Parameters:

<NScid>

integer

Range: 0 to 1
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "N_SCID" on page 232

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:POWer <DmrsPower>

Sets the power of the PDSCH/PUSCH, relative to the power of the other channels.

Parameters:

<DmrsPower>

float

Range: -80.00 to 10.00
Increment: 0.001
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Power" on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SEQGen <SeqGen>

Sets how the scrambling ID for DMRS is derived.

Parameters:

<SeqGen> CELLid | DMRSid

DMRSid
N_{ID}^{DMRS}: Scrambling ID (i.e. n_{ID}) = DMRS scrambling ID (i.e. N_{ID}^{DMRS})

CELLid
N_{ID}^{Cell}: Scrambling ID (i.e. n_{ID}) = cell ID (i.e. N_{ID}^{Cell})

*RST: CELLid

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Sequence Generation" on page 231

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SEQHopping <DmrsGrpSeqHopp>

Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group, required for the DMRS sequence generation according to TS 38.211.

Parameters:

<DmrsGrpSeqHopp> NEITher | GRP | SEQuence

NEITher
Disables the group and sequence hopping for the DMRS sequence generation.

GRP
Enables the group hopping for the DMRS sequence generation.

SEQuence
Enables the sequence hopping for the DMRS sequence generation.

*RST: NEITher

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Group or Sequence Hopping" on page 232

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:SLTSymbols?

Queries the slot number of DMRS symbols.

Return values:
<PxschDmrsSlotSy> string
Range: 0 char to 256 char

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Usage: Query only

Manual operation: See " Slot Symbols" on page 233

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:TAPos <Value>

Defines the DMRS position.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE` = MAN

Parameters:
<Value> integer
Range: 2 to 3
*RST: 2

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:DMRS:MODE`

Manual operation: See "TypeA Position" on page 232

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh[:DMRS]:APSelect<s2us0> <PuschAPSel>

Each layer of a PUSCH allocation is mapped to a certain antenna port. By the command the antenna ports are selected which are used for the transmission of the PUSCH allocation.

Parameters:
<PuschAPSel> AP0 | AP1 | AP2 | AP3 | AP4 | AP5 | AP6 | AP7 | AP8 | AP9 | AP10 | AP11
*RST: AP0

Example: See:Example"Configuring the PUSCH settings" on page 591

Manual operation: See "DMRS Antenna Ports ..." on page 233

12.22.4 PDSCH and PUSCH channel coding commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:FRCR <State>

Turns custom coderate definition on and off.

If on, you can define the coderate with `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TCRate`.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Manually Defined Coderate" on page 235

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:IMCS <ChanCodingIMCS>

Sets the modulation and coding scheme index.

Parameters:

<ChanCodingIMCS> integer

Range: 0 to 28

*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "I_MCS" on page 235

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:RVIndex <Index>

Sets the redundancy version index.

Parameters:

<Index> integer

Range: 1 to 2
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Redundancy Version Index" on page 236

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TBSFactor <ScalingFactor>

Selects the TB scaling factor S.

Parameters:

<ScalingFactor> S1 | S5 | S25

*RST: S1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "TBS Scaling Factor" on page 236

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TBSize?

Queries the resulting transport block size (TBS).

Return values:

<TransBlockSize> integer

Range: 0 to 3824
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Usage: Query only

Manual operation: See "Transport Block Size" on page 236

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:TCRate <CodeRate>

Queries the target code rate for the selected modulation and coding scheme.

Setting the coderate is possible when you turn on manual coderate definition (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:FRCR` on page 817).

Parameters:

<CodeRate> float

Range: 0.0 to 1.0
Increment: 0.001
*RST: 0.0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Target Code Rate" on page 235

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:RMCStable?

Queries the MCS table that corresponds to the signal configuration.

Prerequisites for this command

- Turn off manual coderate definition (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PDSCh|PUSCh:CCODing:FRCR`).

Return values:

<ResultingMcs> T1 | T2 | T3 | TTP1 | TTP2

*RST: T1

Usage: Query only

Manual operation: See "Resulting MCS Table" on page 236

12.22.5 PUSCH UCI commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI1:BITS <PuschUciCSI1Bit>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI2:BITS <PuschUCICSI2Bit>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:ACK:BITS <PuschUciAckBit>

Sets the number of ACK/CSI 1/CSI 2 bits.

Parameters:

<PuschUciAckBit> float

Range: 0 to 128
Increment: 1
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Number of ACK Bits" on page 237

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI1:PATTern <CSI1Pattern>, <CSI1Bitcount>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CSI2:PATTern <CSI2Pattern>, <CSI2Bitcount>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:ACK:PATTern <AckPattern>, <AckBitcount>

Sets the ACK/CSI 1/CSI 2 bits in pattern form.

Parameters:

<AckPattern> 128 bits

Bit pattern

*RST: #H0

<AckBitcount> integer

Pattern length, should be the same as the length set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:ACK:BITS`.

Range: 0 to 128
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "ACK Pattern" on page 237

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CGUCi:BITS <UciCgUciBits>

Sets the number of CG-UCI bits.

Parameters:

<UciCgUciBits> integer

Range: 0 to 1024
*RST: 1

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "Number of CG-UCI Bits" on page 237

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CGUCi:PATTern <CGUCIPattern>, <CGUCIBitcount>

Sets the ACK/CSI 1/CSI 2 bits in pattern form.

Parameters:

<CGUCIPattern> 1024 bits

Bit pattern

*RST: #H0

<CGUCIBitcount> integer

Pattern length, should be the same as the length set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:UCI:CGUCi:BITS`.

Range: 0 to 1024
*RST: 0

Example: See Example"Configuring the PUSCH settings" on page 591.

Manual operation: See "CG-UCI Pattern" on page 238

12.22.6 PDSCH and PUSCH PTRS commands

Note that some of the commands in the following list are available for both PDSCH and PUSCH scheduling, while others are exclusive to PDSCH or PUSCH scheduling.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh:PTRS:EPRE <EpreRatio>

Sets the parameter EPRE ratio.

Parameters:

<EpreRatio> RAT0 | RAT1

*RST: RAT0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "EPRE Ratio" on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:FRQDen <PtrsFreqDensity>

Sets the parameter frequency density.

Parameters:
<PtrsFreqDensity> FD2 | FD4
*RST: FD2

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Frequency Density (K_PTRS)" on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:MODE <PtrsMode>

Sets if the PTRS configuration is defined, manually (with the `...PDSCH:PTRS:...` commands) or automatically (from the current PDSCH DMRS settings).

Parameters:
<PtrsMode> MANual | AUTO
*RST: MANual

Manual operation: See "Mode" on page 239

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:REOF <PtrsREOffset>

Sets the parameter resource element offset.

Parameters:
<PtrsREOffset> RE00 | RE01 | RE10 | RE11
*RST: RE00

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "RE-offset" on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:STATe <PXschPtrsState>

Enables the transmission of phase-tracking reference signals.

Parameters:
<PXschPtrsState> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "State" on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh:PTRS:TMDen <PtrsTimeDensity>

Sets the parameter time density.

Parameters:

<PtrsTimeDensity> TD1 | TD2 | TD4

*RST: TD1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Time Density (L_PTRS)" on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:PORT <MaxNrofPorts>

Sets the maximum number of configured PTRS ports.

Parameters:

<MaxNrofPorts> P1 | P2

*RST: P1

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc0:PUSCh:PTRS:PORT P1
```

Manual operation: See "Max Number of Ports" on page 241

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:POWer <PtrsPower>

Sets the parameter `ptrs-Power` and thus defines the PUSCH to PTRS power ratio per layer per resource element.

Parameters:

<PtrsPower> P00 | P01

*RST: P00

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:
BWPart0:ALLoc0:PUSCh:PTRS:POWer P00
```

Manual operation: See "Power" on page 241

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:PTDMrs <PtrsDmrsAssocia>

Sets the PTRS-DMRS association.

Parameters:

<PtrsDmrsAssocia> integer

Range: 0 to 3

*RST: 0

Example: `SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:PUSCh:PTRS:PTDMrs 0`

Manual operation: See "PTRS-DMRS Association " on page 240

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:MODE <PtrsTpMode>

Sets if the PTRSconfiguration is defined, manually (with the `...PUSCH:PTRS:TP:...` commands) or automatically (from the current PUSCH DMRS settings).

Parameters:

<PtrsTpMode> MANual | AUTO

*RST: MANual

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Mode" on page 242

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:NGRPs <PtrsTpNumGroups>

Sets the number of PTRS groups.

Parameters:

<PtrsTpNumGroups> G2 | G4 | G8

*RST: G2

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Number of PTRS Groups" on page 242

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:SCID <TpPtrsScramId>

Sets whether the PTRS Scrambling ID value used for the PTRS sequence generation is configured by the NPusch ID (higher layer) or by the cell ID.

Parameters:

<TpPtrsScramId> CID | PUID

CID
Sets the cell ID as the scrambling ID for PTRS sequence generation.

PUID
Sets the NPusch ID as the scrambling ID for PTRS sequence generation.

*RST: CID

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "PTRS Scrambling ID" on page 242

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:SPPG <PtrsTpSamplesPG>

Sets the number of samples per PTRS group.

Parameters:

<PtrsTpSamplesPG> S4 | S2

*RST: S2

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Samples Per PTRS Group" on page 243

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:STATe <PtrsTPState>

Enables the transmission of phase-tracking reference signals.

Parameters:

<PtrsTPState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "State" on page 242

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUSCh:PTRS:TP:TMDensity <PtrsTpTimeDens>

Sets the higher-layer parameter `timeDensity`.

Parameters:

<PtrsTpTimeDens> TD1 | TD2

TD1

$L_{PT\text{-}RS} = 1$

TD2

$L_{PT\text{-}RS} = 2$

*RST: TD1

Example: See Example"Configuring the PUSCH PTRS with enabled transform precoding" on page 593.

Manual operation: See "Time Density (L_PTRS)" on page 242

12.22.7 PDSCH and PUSCH antenna port configuration commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:MAGNitude <Magnitude>

Defines the mapping of the antenna ports to the physical antennas, cylindrical mapping coordinates are used.

Suffix:

<apc> 0 to 7
Defines the antenna port (i.e. the column in the antenna port-mapping table)
Value range depends on the selected number of layers

<apr> 0 to 7
Available basebands (i.e. rows in the antenna port-mapping table)
Depends on the number of basebands output to carrier mapping (`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`)

Parameters:

<Magnitude> float

Range: 0 to 1
Increment: 0.001
*RST: 0

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:PHASe` on page 827.

Manual operation: See "Mapping Table" on page 244

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:PHASe <Phase>

Defines the mapping of the antenna ports to the physical antennas, if cylindrical mapping coordinates are used.

Suffix:

<apc> 0 to 7
Defines the antenna port (i.e. the column in the antenna port-mapping table)
Value range depends on the selected number of layers

<apr> 0 to 7
Available basebands (i.e. rows in the antenna port-mapping table)
Depends on the number of basebands output to carrier mapping (`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`)

Parameters:

<Phase> float

Range: 0 to 360
Increment: 0.1
*RST: 0

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLOc1:APMap:MAPCoordinates CYL
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLOc1:APMap:COL0:ROW0:PHASe 0
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLOc1:APMap:COL0:ROW0:MAGNitude 1
```

Manual operation: See "Mapping Table" on page 244

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:IMAGinary <ImaginaryValue>

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:APMap:COL<apc>:ROW<apr>:REAL <RealValue>

Define the mapping of the antenna ports to the physical antennas.

Suffix:

<apc> 0 to 7
Defines the antenna port (i.e. the column in the antenna port mapping table)
Value range depends on the selected number of layers

<apr> 0 to 7
Available basebands (i.e. rows in the antenna port mapping table)
Depends on the number of basebands output to carrier mapping (`[:SOURce<hw>]:BB:NR5G:NODE:CARMapping:CARRier<st0>[:ROW<apr>]`)

Parameters:

<RealValue> 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

Example: See Example"Antenna port settings" on page 585.

Manual operation: See "Mapping Table" on page 244

12.23 CORESET scheduling commands

12.23.1 General CORESET scheduling commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SCRam:ID <DmrsScramId>

Sets the DMRS scrambling ID.

Parameters:

<DmrsScramId> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "ID" on page 247

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SCRam:STATe <CSDmrsScramStat>

If enabled, the DMRS ID is used to calculate the PUCCH scrambling sequence.

Parameters:

<CSDmrsScramStat> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Use DMRS Scrambling ID" on page 247

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SPACe<s2us0>:AGGLevel?

Queries the possible aggregation levels.

Return values:

<AggrLevel> AL1 | AL2 | AL4 | AL8 | AL16

*RST: AL1

Example: See Example"Configuring the CORESET settings" on page 587.

Usage: Query only

Manual operation: See "Aggregation Level" on page 250

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SPACe<s2us0>:MAXCandidate <MaxCandidate>

Sets the maximum number of candidates allowed for the selected aggregation level.

Parameters:

<MaxCandidate> 1 | 2 | 3 | 4 | 5 | 6 | 8

*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Max Candidates" on page 250

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:REFDmrs <Reference>

Selects the reference point for the DMRS.

Parameters:

<Reference> **CS**
CORESET start

POIN
Reference point A

*RST: POIN

Manual operation: See "DMRS Reference Point" on page 248

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:ID <ID>

Sets the CORESET ID.

Parameters:

<ID> integer

Range: 0 to 11
*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "CORESET ID" on page 247

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:BUNSize <BundleSize>

Sets the bundle size L.

Parameters:

<BundleSize> BS2 | BS3 | BS6

*RST: BS6

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Bundle Size" on page 248

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:SHIDx <CSIntlShiftIdx>

Sets the shift index n_{shift}.

Parameters:

<CSIntlShiftIdx> integer

Range: 0 to 274
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Shift Index" on page 249

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:SIZE <CSIntlSize>

Sets the interleaver size R.

Parameters:

<CSIntlSize> IS2 | IS3 | IS6

*RST: IS2

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Size" on page 249

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:IL:STATe <CSIntlState>

If enabled, the CCE-to-REG mapping is interleaved.

Parameters:

<CSIntlState> 1 | ON | 0 | OFF

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Interleaving State" on page 248

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:PREGran <PrecoderGranula>

Sets the value of the higher-layer parameter `precoderGranularity`, as defined in TS 38.211.

Parameters:

<PrecoderGranula> REG | ACRB

REG
REG bundle (`sameAsREG-bundle`)

ACRB
All contiguous RBs (`allContiguousRBs`)
*RST: REG

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Precoder Granularity" on page 247

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:BITMap <ResAllocBitMap>, <BitCount>

If `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:STATe` 1, sets the CORESET allocation in the frequency domain.

Parameters:

<ResAllocBitMap> 45 bits
*RST: #H0

<BitCount> integer
Range: 45 to 45
*RST: 45

Example: See `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:STATe` on page 833.

Manual operation: See "Frequency Domain Resources" on page 248

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:STATe <State>

If enabled, the CORESET frequency allocation is set as a bitmap, defined with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:RESalloc:BITMap`.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0
Default unit: OFF

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:RESalloc:STATe 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:RESalloc:BITMap #H1FFFFFFFFFFF,45
```

Manual operation: See "Use Bitmap for Resources in Frequency Domain" on page 248

12.23.2 CORESET payload scheduling commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:AULBwp <ActiveULBwp>

Sets the index of the UL BWP used for the calculation of the DCI bit size.

Parameters:

<ActiveULBwp> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Active UL BWP" on page 253

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:DATA <DummyCceDataSrc>

Sets the data source for the dummy CCEs.

Parameters:

<DummyCceDataSrc> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Dummy CCEs Data Source" on page 252

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:DLISt <DummyCceDataLst>

Selects an existing data list file from the default directory or from the specific directory.

Parameters:

<DummyCceDataLst> string

Filename incl. file extension or complete file path

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Dummy CCEs Data Source" on page 252

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:PATTern <Pattern>, <BitCount>

Sets a bit pattern as a data source.

Parameters:

<Pattern> 64 bits

*RST: #H0

<BitCount> integer

Range: 1 to 64
*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Dummy CCEs Data Source" on page 252

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:STATe <DummyCceState>

Defines if unused CORSET resources (CCEs) are used for data transmission or not.

Parameters:

<DummyCceState> 0 | 1 | ALLowpdsch

0
Disables data transmission in the unused CCEs.

1
Fills unused CCEs with dummy data, as set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCCes:DATA`.

ALLowpdsch
Allows PDSCH transmission in the unused CCEs.

*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Unused CCEs" on page 252

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:AGGLevel <DciAggLvl>

Sets the aggregation level for the selected DCI.

Parameters:

<DciAggLvl> AL1 | AL2 | AL4 | AL8 | AL16

*RST: 4

Example: See Example"Search space configuration" on page 586.

Manual operation: See "Aggregation Level" on page 257

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CANDidate <Candidate>

Selects the candidate number for the selected aggregation level, where the maximum number of candidates per aggregation level are set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DMRS:SPACe<s2us0>:MAXCandidate`.

Parameters:

<Candidate> integer

Range: 0 to 8
*RST: 0

Example: See Example"Search space configuration" on page 586.

Manual operation: See "Candidate" on page 257

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CPDSch <CreatePDSCH>

Use this command to create the content and scheduling of the PDSCH automatically, as configured with the DCI format 1_0 parameters.

Parameters:

<CreatePDSCH> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Create PDSCH" on page 257

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSS?

Queries the PDSCH DMRS symbols a DCI uses.

Suffix:

<dci> Index number of the DCI. The range depends on the number of DCIs you have configured.

Return values:

<Symbols> string

Range: 0 char to 256 char

Usage: Query only

Manual operation: See "PDSCH DMRS Symbols" on page 258

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FMT <Format>

Sets the DCI format.

Parameters:

<Format> F00 | F01 | F02 | F10 | F11 | F12 | F20 | F21 | F22 | F23 | F24 | F25 | F26 | F27 | F30 | F31 | F40 | F41 | F42 | CUSTom

*RST: F00

Example: See Example"Configuring the CORESET settings" on page 587.

Options: F24 to F26 require R&S SMW-K148

Manual operation: See "DCI Format" on page 254

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HBTS?

Queries the resulting bit data as selected with the DCI format parameters.

Return values:

<PatternHigh> 64 bits

Example: See Example"Configuring the CORESET settings" on page 587.

Usage: Query only

Manual operation: See "Bit Data > Pattern" on page 258

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INDex <DciCCEIdx>

If `[:SOURce<hw>]:BB:NR5G:SCHeduling:RSSPace 0`, sets the index and thus the position of the first CCE of the PDCCH.

Parameters:

<DciCCEIdx> integer

Range: 0 to 10
*RST: 0

Example: See Example"Search space configuration" on page 586.

Manual operation: See "CCE Index" on page 257

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:MULTable <Table>

Selects the time domain resource allocation table for the PDSCH.

Prerequisites for this command

- Select DCI format 1_0 or 1_1 (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FMT`).

Parameters:

<Table> Available tables depend on the selected search space and RNTI.

TABA | TABB | TABC
Table A, B or C

TDAL
Time domain allocation

*RST: TABA

Manual operation: See "Multiplexing Table" on page 257

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:POWer <DciPower>

Defines the power of PDSCH allocations according to the CORESET DCI.

Prerequisites for this command

- Select Auto DCI mode (`[:SOURce<hw>]:BB:NR5G:SCHeduling:MODE`).
- Select one of the DCI formats for PDSCH scheduling (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FMT`).

Parameters:

<DciPower> float

Range: -80 to 10
Increment: 0.01
*RST: 0

Manual operation: See "PDSCH Power /dB" on page 258

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RNTI <RNTI>

Queries the current applicable RNTI of the associated user

Parameters:

<RNTI> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "RNTI" on page 254

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SSP <SearchSpace>

Sets the search space for the selected DCI.

Parameters:

<SearchSpace> USS | CSS0 | CSS1 | CSS2 | CSS3 | CSS0A

*RST: USS

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Search Space" on page 256

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:TCI <Nr5gCSTCIinDCI>

Enables support of quasi co-location TCI field in DCI format 1_1.

Parameters:

<Nr5gCSTCIinDCI> 1 | ON | 0 | OFF

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:TC 1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc0:CS:DCI0:TCI 1
```

Manual operation: See "TCI Present In DCI" on page 253

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:USAGe <Usage>

Sets the RNTI type used to scramble the CRC.

Parameters:

<Usage>

The RNTI type is defined as follows:

C
Cell RNTI

CS
Configured scheduling RNTI

P
Paging RNTI

SI
System information RNTI

RA
Random access RNTI

TC
Temporary cell RNTI

SPCS
Semi-persistent scheduling cell RNTI

SFI
Slot format indication RNTI

INT
Interruption RNTI

TPUS
Transmit power control-PUSCH RNTI

TPUC
Transmit power control-PUCCH RNTI

TSRS
Transmit power control-SRS RNTI

MCSC
Modulation coding scheme cell RNTI

CI
Cancellation indication RNTI

PS
Power saving RNTI

AI
Availability indication RNTI

MSGB
MsgB RNTI

CUSTom
Custom DCI format

*RST: C

Example: See Example"Configuring the CORESET settings" on page 587.

Options: CI and PS require R&S SMW-K148

Manual operation: See "Usage" on page 254

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:NDCI <NumDci>

Sets the number of DCIs.

Parameters:

<NumDci> integer

Range: 1 to 4
*RST: 1
With R&S SMW-K148, the range increases to 32 DCIs.

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Number of DCIs" on page 253

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:TS12 <TCISizeInDci12>

Defines the bit length of the DCI field "Transmission Configuration Index" available in DCI format 1_2.

Parameters:

<TCISizeInDci12> UNCF | TCI1 | TCI2 | TCI3

UNCF
TCI not configured.

TCI1 | TCI2 | TCI3
1, 2 or 3 bits used for TCI.

*RST: UNCF

Manual operation: See "TCI Size in DCI1_2" on page 253

12.23.3 DCI field configuration commands

12.23.3.1 DCI format 0_0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CACPext <ChanAccessCPext>

Sets the DCI field "Channel-Access-CPext".

Parameters:

<ChanAccessCPext> integer

Range: 0 to 15
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes <FreqDomResAssig>

Sets the DCI field frequency domain resource assignment.

Parameters:

<FreqDomResAssig> integer

Range: 0 to 262143
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRHFlag <FreqHopFlag>

Sets the DCI field frequency hopping flag.

Parameters:

<FreqHopFlag> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc <HarqProc>

Sets the DCI field HARQ process number.

Parameters:

<HarqProc> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier <Identifier>

Queries the identifier flag (first bit of the bit pattern) for DCI formats 0_x and 1_x.

Parameters:

<Identifier> **0**
1st bit is a "0" (identifier for DCI formats 0_x).

1
1st bit is a "1" (identifier for DCI formats 1_x).

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SAI <BitLength>

Defines the bit length of the DCI field "Sidelink Assignment Index" available in DCI formats 3_0.

Parameters:

<BitLength> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS <MCSTB1>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:MCS <MCSTB2>

Sets the DCI field modulation and coding scheme per transport block (TB).

Parameters:

<MCSTB2> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI <NDITB1>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:NDI <NDITB2>

Sets the DCI field new data indicator per transport block (TB).

Parameters:

<NDITB2> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV <RVTB1>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:RV <RVTB2>

Sets the DCI field redundancy version per transport block (TB).

Parameters:

<RVTB2> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes <Value>

Sets the DCI field time domain resource assignment.

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUSch <TpcPusch>

Sets the DCI field TPC command for scheduling PUSCH.

Parameters:

<TpcPusch> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:USINd <UlSulInd>

If `[:SOURce<hw>]:BB:NR5G:NODE:CELL<cc>:SYINfo:SUL:STATe 1`, sets the DCI field UL/SUL indicator.

Parameters:

<UlSulInd> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

12.23.3.2 DCI format 0_1

Commands to configure DCI format 0_1 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CACPext`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DI<x>` (`:DI1` only)
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRHFlag`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUSch
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:USINd

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ANTPorts <AntPorts>

Sets the DCI field antenna ports.

Parameters:

<AntPorts> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BOINd <Value>

Sets the DCI field beta offset indicator.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BWINd <BWPInd>

Sets the DCI field BWP indicator.

Parameters:

<BWPInd> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINd <Value>

Sets the carrier indicator value.

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CBGTi <CBGTI>

Sets the DCI field CBG transmission information (CBGTI).

Parameters:

<CBGTI> integer

Range: 0 to 255
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CSIRequest <Value>

Sets the DCI field CSI request.

Parameters:

<Value> integer

Range: 0 to 63
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI3 <Value>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI2 <DAI2>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1 <DAI1>

Sets the DCI filed DL assignment index.

Parameters:

<DAI1> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DFIFlag <State>

Turns the DCI field "Downlink Feedback Indicator" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSQinit <DmrsSeqInit>

If `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:TPSTate 0`, sets the DCI field DMRS sequence initialization.

Parameters:

<DmrsSeqInit> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INSPatt <State>

Sets the DCI field invalid symbol pattern indicator.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:MOFFs <MinApplOffsInd>

Enables the minimum applicable scheduling offset indicator for the DCIs 0_1 and 1_1.

This 1-bit indicator is used to determine the minimum applicable K0 for the active DL BWP and the minimum applicable K2 for the active UL BWP.

This 1-bit indicator influences the calculation of the PDSCH triggering offsets and A-CSI RS triggering offsets.

Parameters:

<MinApplOffsInd> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587

Options: R&S SMW-K148

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:OLINdicator <OpenLoopPCPInd>

Sets the DCI field "Open-Loop Power Control Parameter Indication".

Parameters:

<OpenLoopPCPInd> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PINDicator <PriorityIndicat>

Sets the DCI field priority indicator.

Parameters:

<PriorityIndicat> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PMADaption <Value>

Defines the bit pattern for the "Monitoring Adaption Indication" DCI field.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRC2 <Value>

Defines the bit pattern for the "2nd Precoding Information and Number of Layers" DCI field.

Parameters:

<Value> integer

Range: 0 to 31
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRECinfo <PrecInfo>

Sets the precoding info and number of layers (TPMI) value.

Parameters:

<PrecInfo> integer

Range: 0 to 63
*RST: 0

Example: See: Example"Configuring the CORESET settings" on page 587

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PTDMrs <PtrsDmrs>

If `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUSCh:MRANk≠1`, sets the DCI field PTRS-DMRS association.

Parameters:

<PtrsDmrs> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SOIN <Value>

Defines the bit pattern for the "SRS Offset Indicator" DCI field.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRI2 <Value>

Defines the bit pattern for the "2nd SRS Resource Indicator" DCI field.

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRINd <Value>

Defines the bit pattern for the "SRS Resource Set Indicator" DCI field.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSRequest <SRSRequest>

Sets the DCI field SRS request.

Parameters:

<SRSRequest> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSResind <SRSResInd>

Sets the SRS resource indicator value.

When multiple SRS resources are configured, an SRS resource indicator field in uplink DCI is used to indicate the selected SRS resource over whose antenna ports are used by the network to derive the precoding for uplink transmission.

Parameters:

<SRSResInd> integer

Range: 0 to 255
*RST: 0

Example: See: Example"Configuring the CORESET settings" on page 587

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T2PS <BitLength>

Defines the bit length of the "2nd TPC Command for Scheduled PUSCH".

Parameters:

<BitLength> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ULSChind <State>

Turns the DCI field "UL-SCH Indicator" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

12.23.3.3 DCI format 0_2

Commands to configure DCI format 0_2 described elsewhere:

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ANTPorts
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BOINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BWINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CSIRequest
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1
  [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI2 on page 848
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI3
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSQinit
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRHFlag
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INSPatt
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:OLINdicator
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PINDicator
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PMADaption
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRC2
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRECinfo
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PTDMrs

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRI2
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSRequest
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SOIN
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSResind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T2PS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUSch on page 845
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ULSChind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:USINd

12.23.3.4 DCI format 1_0

Commands to configure DCI format 1_0 described elsewhere:

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CACPext
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes

---

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:LSBSfn <DciLSBsOfSFN>

Sets the DCI field "LSBs of SFN".

Parameters:

<DciLSBsOfSFN> integer

Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PDSHarq <PdschToHarq>

Sets the DCI field PDSCH-to-HARQ feedback timing Indicator.

Parameters:

<PdschToHarq> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind <PucchResInd>

Sets the DCI field PUCCH resource indicator.

Parameters:

<PucchResInd> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed <Pattern>, <BitCount>

Sets the DCI padding and reserved bits.

Parameters:

<Pattern> 32 bits

*RST: #H0

<BitCount> integer

Range: 1 to 32
*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.
See Example"DCI format 2_6" on page 590.

Options: DCI formats 2_4 and 2_6 require R&S SMW-K148.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SIINd <SiInd>

Sets the DCI field system information indicator.

Parameters:

<SiInd> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SMINd <ShortMsgInd>

Sets the DCI field short message indicator.

Parameters:

<ShortMsgInd> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SMSGs <BitLength>

Sets the DCI field "Short Messages".

Parameters:

<BitLength> integer

Range: 0 to 255
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TBSCaling <TBScaling>

Sets the DCI field new data indicator per transport block (TB).

Parameters:

<TBScaling> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUCch <TpcPucch>

Sets the DCI field TPC command for scheduling PUCCH.

Parameters:

<TpcPucch> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb <VrbToPrb>

Sets the DCI field VRB-to-PRB mapping.

Parameters:

<VrbToPrb> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the CORESET settings" on page 587.

12.23.3.5 DCI format 1_1

Commands to configure DCI format 1_1 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ANTPorts`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BWINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CACPext
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CBGTi
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DI<x> (:DI1 only)
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSQinit
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:MOFFs
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PDSHarq
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PINDicator
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PMADaption
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSRequest
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
  [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
  [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:RV

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUCch
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb

---

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CBGFi <CBGFI>

Sets the DCI field CBG flushing out information (CBGFI).

Parameters:

<CBGFI> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HARTind <State>

Turns the "HARQ-ACK Retransmission Indicator" bit on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HQARequest <State>

Sets the DCI field "One-Shot HARQ-ACK Request".

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:NFIIndicator <NewFbIndicator>

Sets the DCI field "New Feedback Indicator".

Parameters:
<NewFbIndicator> integer
Range: 0 to 3
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:NRPGroups <State>

Sets the DCI field "Number of Requested PDSCH Groups".

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PGIIndex <State>

Sets the DCI field "PDSCH Group Index".

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PCIInd <State>

Turns the "PUCCH Cell Indicator" field on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRBBundling <PRBBundling>

Sets the DCI field PRB bundling size indicator.

Parameters:

<PRBBundling> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RMInd <RMInd>

Sets the DCI field rate matching indicator.

Parameters:

<RMInd> integer

Range: 0 to 3

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T2PC <BitLength>

Defines the bit length of the "2nd TPC Command for Scheduled PUCCH".

Parameters:

<BitLength> integer

Range: 0 to 3

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T3CBind <Type3CbInd>

Parameters:

<Type3CbInd> integer

Range: 0 to 7

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TCI <TCI>

Sets the DCI field transmission configuration indication.

Parameters:

<TCI> integer

Values 1 to 7 are available if `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:TCI` 1.

Range: 0 to 7
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ZCRTrigg <ZpCsiRsTrigg>

Sets the DCI field ZP CSI-RS trigger.

Parameters:

<ZpCsiRsTrigg> integer

Range: 0 to 3
*RST: 0

12.23.3.6 DCI format 1_2

Commands to configure DCI format 1_2 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ANTPorts`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BWINd`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINd`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSQinit`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HARTind`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:IDENtifier`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PCINd`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PDSHarq`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PINDicator
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PMADaption
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRBBundling
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RMINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SRSRequest
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T2PC
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:T3CBind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TCI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TPUCch
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ZCRTrigg

12.23.3.7 DCI format 2_0

Commands to configure DCI format 2_0 described elsewhere:

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed

---

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:AR<x> <Value>

Defines the bit pattern for the "Available RB Set Indicator" DCI field.

Prerequisites for this command

- Select DCI format 2_0.
- Define a number of RB set indicators > 0 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NRBS`).

Suffix:

<x> 1...16
Selects the instance of the DCI field.
The value range depends on the number of RB set indicators you have defined.

Parameters:

<Value> integer

Range: 0 to 31
*RST: 0

Example: //Define bit pattern of 2nd available RB set indicator field

```
BB:NR5G:UBWP:USER:DSCH:NRBS 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:AR2 8
```

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CD<x> <Value>

Defines the bit pattern for the "COT Duration Indicator" DCI field.

Prerequisites for this command

- Select DCI format 2_0.
- Define a number of COT duration indicators > 0 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:CDIN`).

Suffix:

<x> 1...16
Selects the instance of the DCI field.
The value range depends on the number of COT duration indicators you have defined.

Parameters:

<Value> integer

Range: 0 to 63
*RST: 0

Example: //Define bit pattern of 2nd available COT duration indicator field
`BB:NR5G:UBWP:USER:DSCH:CDIN 2`
`BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:CD2 8`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SGS<x> <State>

Turns the "Search Space Group Switching Flag" DCI field on and off.

Prerequisites for this command

- Select DCI format 2_0.
- Define a number of search space switching flags > 0 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:DSCH:NSSF`).

Suffix:

<x> 1...4
Selects the instance of the DCI field.
The value range depends on the number of search space switching flags you have defined.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: //Define state of 2nd search space group switching flag field
`BB:NR5GUBWP:USER:DSCH:NSSF 2`
`BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:SGS2 ON`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SI<x> <Value>

Defines the bit pattern for the "Slot Format Indicator" DCI field.

Prerequisites for this command

- Select DCI format 2_0.

Suffix:

<x> 1...16
Selects the instance of the DCI field.
The value range depends on the number of slot format indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:NUMSfi`).

Parameters:

<Value> integer

Range: 0 to 255
*RST: 0

Example: //Define bit pattern of 2nd slot format indicator field

```
BB:NR5G:UBWP:USER:DSCH:NUMS 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:SI2 8
```

12.23.3.8 DCI format 2_1

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PE<x> <Value>

Defines the bit pattern for the "Pre-Emption Indicator" DCI field.

Prerequisites for this command

- Select DCI format 2_1.

Suffix:

<x> 1...9
Selects the instance of the DCI field.
The value range depends on the number of pre-emption indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PDCCh:NUMPreempt`).

Parameters:

<Value> integer

Range: 0 to 16383
*RST: 0

Example: //Define bit pattern of 2nd pre-emption indicator field

```
BB:NR5G:UBWP:USER:CELL:DL:BWP:PDCC:NUMP 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:PE2
64
```

12.23.3.9 DCI format 2_2

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CL<x> <State>

Turns the "Closed Loop Indicator" DCI field on and off.

Prerequisites for this command

- Select DCI format 2_2.
- Turn on TwoPUSCH PC adjustment for TPC-PUSCH-RNTI (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:TPAS`).
- Turn on TwoPUCCH PC adjustment for TPC-PUCCH-RNTI (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:TPAS`).

Suffix:

<x> 1...22
Selects the instance of the DCI field.
The value range depends on the number of closed loop indicators you have defined.
For TPC-PUSCH-RNTI: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:BD22`.
For TPC-PUCCH-RNTI: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:BD22`

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: //Define state of 2nd closed loop indicator field in TPC-PUSCH-RNTI

```
BB:NR5GUBWP:USER:CELL:DL:BWP:PUSC:TPAS ON
BB:NR5GUBWP:USER:CELL:DL:BWP:PUSC:BD22 4
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:CL2 ON
```

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TP<x> <Value>

Defines the bit pattern for the "TPC command" DCI field.

Prerequisites for this command

- Select DCI format 2_2.

Suffix:

<x> 1...22
Selects the instance of the DCI field.
The value range depends on the number of PUSCH blocks (TPC-PUSCH-RNTI) or PUCCH blocks (TPC-PUCCH-RNTI) you have defined.
PUSCH blocks: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUSCh:BD22`.
PUCCH blocks: `[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:PUCCh:BD22`

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: //Define bit pattern of 2nd TPC command field in TPC-PUSCH-RNTI

```
BB:NR5GUBWP:USER:CELL:DL:BWP:PUSC:TPAS ON
BB:NR5GUBWP:USER:CELL:DL:BWP:PUSC:BD22 4
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:TP2 2
```

12.23.3.10 DCI format 2_3

Commands to configure DCI format 2_3 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TP<x>`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SR<x> <Value>

Defines the bit pattern for the "SRS Request" DCI field.

Suffix:

<x> 1...11
Selects the instance of the DCI field.
The value range depends on the number of blocks you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:BD23`).

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: //Define bit pattern of 2nd slot format indicator field

```
BB:NR5G:UBWP:USER:CELL:DL:BWP:SRS:BD23 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:SR2 2
```

12.23.3.11 DCI format 2_4

Commands to configure DCI format 2_4 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CI<x> <Pattern>, <BitCount>

Defines the bit pattern for the "Cancellation Indication" DCI field.

Prerequisites for this command

- Select DCI format 2_4.

Suffix:

<x> 1...16
Selects the instance of the DCI field.
The value range depends on the number of cancellation indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NCINd`).

Parameters:

<Pattern> 7 bits
Bit pattern for the cancellation indication.
*RST: #H0

<BitCount> integer
Range: 1 to 7
*RST: 1

Example: //Define bit pattern of 2nd cancellation indicator field

```
BB:NR5G:UBWP:USER:CELL:DL:BWP:NCIN 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:CI2
#H33,6
```

Options: R&S SMW-K148.

12.23.3.12 DCI format 2_5

Commands to configure DCI format 2_5 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:AI<x> <Value>

Defines the bit pattern for the "Availability Indication" DCI field.

Prerequisites for this command

- Select DCI format 2_5.

Suffix:

<x> 1...16
Selects the instance of the DCI field.
The value range depends on the number of availability indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:NAINd`).

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

Example: //Define bit pattern of 2nd availability indicator field

```
BB:NR5G:UBWP:USER:DSCH:NAIN 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:AI2 4
```

Options: R&S SMW-K148.

12.23.3.13 DCI format 2_6

Commands to configure DCI format 2_6 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DI<x> <Value>

Defines the bit pattern for the "SCell Dormancy Indication" DCI field.

Prerequisites for this command

- Select DCI format 2_6.
- Define a number of SCell groups outside active time > 0 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:NSCG`).

Suffix:

<x> 1...10
Selects the instance of the DCI field.
The value range depends on the number of SCell dormancy indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:NB26`).

Parameters:

<Value> integer

Range: 0 to 31
*RST: 0

Example: //Define bit pattern of 2nd SCell dormancy indicator field
```
BB:NR5G:UBWP:USER:CELL:DL:BWP:SRS:NSCG 2
BB:NR5G:UBWP:USER:CELL:DL:BWP:SRS:NB26 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:DI2
12
```

Options: R&S SMW-K148.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:WA<x> <State>

Turns the "Wakeup Indication" DCI field on and off.

Prerequisites for this command

- Select DCI format 2_6.

Suffix:

<x> 1...10
Selects the instance of the DCI field.
The value range depends on the number of SCell dormancy indicators you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:SRS:NB26`).

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: //Define state of 2nd wakeup indicator field
```
BB:NR5G:UBWP:USER:CELL:DL:BWP:SRS:NB26 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:WA2
ON
```

Options: R&S SMW-K148.

12.23.3.14 DCI format 2_7

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PEI<x> <Value>

Defines the bit pattern for the "Paging Early Indicator" DCI field.

Prerequisites for this command

- Select DCI format 2_7.

Suffix:

<x> 1...8
Selects the instance of the DCI field.
The value range depends on the PO number per PEI you have defined (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:PNPPei`).

Parameters:

<Value> integer
The value range depends on the number of subgroups per PO (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:SGPO`).

Range: 0 to 255
*RST: 0

Example: //Define bit pattern of 2nd paging early indicator field

```
BB:NR5G:UBWP:USER:CELL:DL:BWP:DCI:SGPO 4
BB:NR5G:UBWP:USER:CELL:DL:BWP:DCI:PNPP 2
BB:NR5G:SCH:CELL:SUBF:USER:BWP:ALL:CS:DCI:PEI2
4
```

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TRAV <TrsAvailability>

Configures the bit pattern for the "TRS availability indication" DCI field.

Prerequisites for this command

- Bits for TRS availability indication must be > 1 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:DL:BWP<bwp>:DCI:TAINd`).

Parameters:

<TrsAvailability> integer
The value range depends on the number of bits for TRS availability indication.

Range: 0 to 63
*RST: 0

12.23.3.15 DCI format 3_0

Commands to configure DCI format 3_0 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI`
  `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:NDI`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINdex <Value>

Sets the DCI field counter sidelink assignment index.

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:COINdex <Value>

Sets the DCI field configuration index.

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FSCHannel <Value>

Sets the DCI field first subchannel.

Parameters:

<Value> integer

Range: 0 to 27
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PTHFeedback <Value>

Sets the DCI field PSFCH-to-HARQ feedback.

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RPINdex <ResPoolIndex>

Sets the DCI field resource pool index.

Parameters:

<ResPoolIndex> integer

Range: 0 to 7
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TGAP <Value>

Sets the DCI field time gap.

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

12.23.3.16 DCI format 3_1

Commands to configure DCI format 3_1 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:CAINd`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FSCHannel`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TGAP`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ARINd <State>

Turns the DCI field activation / release indication on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRRLoc <Value>

Sets the DCI field frequency resource allocation.

Parameters:

<Value> integer

Range: 0 to 7

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SLINdex <Value>

Sets the DCI field SL index.

Parameters:

<Value> integer

Range: 0 to 7

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:SPSConf <Value>

Sets the DCI field SL SPS configuration index.

Parameters:

<Value> integer

Range: 0 to 7

*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TOFFset <Value>

Sets the DCI field timing offset.

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

12.23.3.17 DCI format 4_0

Commands to configure DCI format 4_0 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:MCCH <Value>

Defines the value of the "MCCH Change Notifications" DCI field.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

12.23.3.18 DCI format 4_1

Commands to configure DCI format 4_1 described elsewhere:

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PDSHarq
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed

12.23.3.19 DCI format 4_2

Commands to configure DCI format 4_2 described elsewhere:

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:FRDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TIDRes
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:VTPRb
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PRBBundling
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RMINd
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ZCRTrigg
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:MCS
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB1:RV

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TB2:RV
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAPRoc
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DAI1
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PUCResind
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PDSHarq
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:ANTPorts
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:RESVed
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:TCI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DMSQinit

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:HAFB <State>

Turns the DCI field "Enabling HARQ_ACK Feedback Indication" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

12.23.3.20 Custom DCI format

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BITLength <PatternLength>

If channel coding is enabled (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:STATe 1`), sets the number of DCI bits in the custom DCI.

Parameters:

<PatternLength> integer

Range: 12 to 128
*RST: 84

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Pattern Length" on page 277

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DATA <DataSource>

Sets the data source for the custom DCI.

Parameters:

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

*RST: PN9

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Data Source" on page 276

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:DLISt <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"Configuring the CORESET settings" on page 587.

Manual operation: See "Data Source" on page 276

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:INITpattern <Pattern>

Sets an initialization value for the second m-sequence in the PN sequence of the custom DCI.

Parameters:

<Pattern> integer

Range: 1 to #H7fffff
*RST: 1

Example: See Example"Custom DCI" on page 589.

Manual operation: See "Initialization" on page 277

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:PATTern <Pattern>, <BitCount>

Sets the content of the custom DCI as a bit pattern.

Parameters:

<Pattern> 128 bits

Corresponds to the value set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:BITLength`.

*RST: #H0

<BitCount> integer

Range: 1 to 128
*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Data Source" on page 276

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CS:DCI<dci>:STATe <ChanCodingState>

Enables channel coding for the DCI type custom.

Parameters:

<ChanCodingState> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configuring the CORESET settings" on page 587.

Manual operation: See "Channel Coding" on page 276

12.24 CSI-RS scheduling commands

The following commands configure the CSI-RS in the scheduling table. When you configure the CSI-RS in the "User / BWP" dialog, use the commands referenced in Chapter 12.20.6, "ZP and NZP CSI-RS commands", on page 727.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BITMap <Pattern>,<BitCount>

Defines the bitmap setting for the CSI-RS.

Parameters:

<Pattern> 12 bits
*RST: #H0

<BitCount> integer
Range: 1 to 12
*RST: 1

Manual operation: See "Bitmap" on page 280

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:DENSity <Density>

Selects the density configuration for the CSI-RS.

Parameters:

<Density> EVE5 | ODD5 | DEN1 | DEN3
*RST: DEN3

Manual operation: See "Density" on page 280

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:I0 <Value>

Defines parameter I_0 of the CSI-RS.

Parameters:

<Value> integer
Range: 0 to 13
*RST: 9

Manual operation: See "I0/I1" on page 280

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:I1 <Value>

Defines parameter I_1 of the CSI-RS.

Parameters:

<Value> integer

Range: 2 to 12
*RST: 11

Manual operation: See "I0/I1" on page 280

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:ISZPower <State>

Turns zero power transmission for the CSI-RS on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Zero Power" on page 279

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:ROW <Value>

Defines the location setting for the CSI-RS.

Effects of this command

- Selecting a location setting has effects on the range and availability of the other CSI-RS parameters.

Parameters:

<Value> integer

Range: 1 to 18
*RST: 1

Manual operation: See "Row" on page 279

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCID <ScramblingId>

Defines the seed value for the CSI-RS sequence generation.

Parameters:

<ScramblingId> integer

Range: 0 to 1023
*RST: 0

Manual operation: See "Scrambling ID" on page 280

12.25 RIM-RS scheduling commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:DELTa <Value>

Defines the offset δ as defined in 3GPP 38.211, chapter 7.4.1.6.2 that has an effect on the sequence generation of the RIM-RS.

Parameters:

<Value> integer

Range: 0 to 2147483647
*RST: 0

Manual operation: See "Delta" on page 282

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:GAMMa <Value>

Defines the multiplier factor γ as defined in 3GPP 38.211, chapter 7.4.1.6.2 that has an effect on the sequence generation of the RIM-RS.

Parameters:

<Value> integer

Range: 0 to 2147483647
*RST: 0

Manual operation: See "Gamma" on page 282

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:NTRim <Value>

Defines the number of RIM-RS transmission periods since a certain reference time as defined in 3GPP 38.211, chapter 7.4.1.6.2.

Parameters:

<Value> integer

Range: 0 to 2147483647
*RST: 0

Manual operation: See "NTRim" on page 282

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:RESulting:ALLoc<al>:RIMRs:SCID <ScramblingID>

Defines the scrambling ID for the RIM reference signal sequence generation.

Parameters:

<ScramblingID> integer

Range: 0 to 1023
*RST: 0

Manual operation: See "NScid" on page 282

12.26 PUCCH scheduling commands

12.26.1 General PUCCH scheduling commands

Commands to configure the PUCCH described elsewhere.

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CPEXt`
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TOFFset`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:CYCShift <InitialCyclicSh>

For PUCCH format F0 and F1, sets the initial cyclic shift.

Parameters:

<InitialCyclicSh> integer

Range: 0 to 11
*RST: 0

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:FMT F1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:FS:CYCShift 1
```

Manual operation: See "Initial Cyclic Shift" on page 285

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:OCCindex <OCCindex>

For PUCCH format F4, sets the OCC index.

Parameters:

<OCCindex> integer

Range: 0 to 6
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "OCC Index" on page 286

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:OCCLength <PucchOCCLength>

For PUCCH format F4, sets the OCC length.

Parameters:

<PucchOCCLength> L2 | L4

*RST: L2

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "OCC Length" on page 286

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:FMT2:OCCLength <Fmt2OccLength>

For PUCCH format F2, sets the OCC length.

Parameters:

<Fmt2OccLength> L4 | L2 | L1

*RST: L1

Manual operation: See "OCC Length" on page 286

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:FMT3:OCCLength <Fmt3OccLength>

For PUCCH format F3, sets the OCC length.

Parameters:

<Fmt3OccLength> L4 | L2 | L1

*RST: L1

Manual operation: See "OCC Length" on page 286

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:FS:TDOCc <TimeDomainOccId>

For PUCCH format F1, sets the time domain OCC index.

Parameters:

<TimeDomainOccId> integer

Range: 0 to 6

*RST: 0

Example:

```
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:FMT F1
SOURce1:BB:NR5G:SCHed:CELL0:SUBF0:USER0:BWPart0:ALLoc1:PUCCh:FS:TDOCc 1
```

Manual operation: See "Time Domain OCC Index" on page 286

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:GRPHopping <PucchGrpHopping>

Sets the higher-layer parameter `pucch-GroupHopping`.

Parameters:

<PucchGrpHopping> N | ENA | DIS

`N` = neither

`ENA` = enable

`DIS` = disable

*RST: N

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Group Hopping" on page 284

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:HOPid <PucchHoppingId>

Sets the parameter hopping ID.

Parameters:

<PucchHoppingId> integer

Range: 0 to 1024
Increment: 0
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Hopping ID" on page 284

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:INT<il>:INTL <Interlace>

Defines the interlace value for PUSCH allocations.

Suffix:

<il> Selects the interlace. The range depends on the number of interlaces.

Parameters:

<Interlace> integer

Range: 0 to 9
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Interlace <x>" on page 285

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:ISFHopping <PucchISFreqHop>

Enables intra-slot frequency hopping.

Parameters:

<PucchISFreqHop> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Intra Slot Frequency Hopping" on page 284

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:NINT <Interlaces>

Defines the number of interlaces for PUCCH allocations.

Prerequisites for this command

- Turn on interlacing (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:UL:BWP<bwp>:PUCCh:UITL` on page 720).

Parameters:

<Interlaces> integer

Range: 1 to 2
*RST: 1

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Number of Interlaces" on page 285

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:SHOPping <SecongHoppingPR>

Sets the physical resource block (PRB) of the second hop.

Parameters:

<SecongHoppingPR> float

Range: 0 to 273
Increment: 1
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Second Hop PRB" on page 285

12.26.2 PUCCH payload scheduling commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:SRCount <SrCount>

Sets the number of positive scheduling requests (SR).

Parameters:

<SrCount> integer

Range: 0 to 10
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Positive SR Count" on page 287

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:UCI:BITS <PucchUciBits>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:ACK:BITS <ACKBitSize>

Sets the number of ACK/UCI bits.

Parameters:

<ACKBitSize> float

Range: 0 to 128
Increment: 1
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "Number of ACK Bits" on page 287

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:UCI:PATTern <PucchUciPattern>, <BitCount>
[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:ACK:PATTern <AackPattern>, <Bitcount>

Sets the ACK/UCI bits in pattern form.

Parameters:

<AackPattern> 128 bits

Bit pattern

*RST: #H0

<Bitcount> integer

Pattern length, should be the same as the length set with the command `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PUCCh:PL:ACK:BITS`.

Range: 1 to 128
*RST: 0

Example: See Example"Configuring the PUCCH settings" on page 594.

Manual operation: See "ACK Pattern" on page 287

12.27 PRACH scheduling commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:SCSPacing <PrachNumerology>

Selects a combination of the subcarrier spacing (SCS) and the cyclic prefix (CP) for PRACH.

Parameters:

<PrachNumerology> N1_25 | N5 | N15 | N30 | N60 | N120 | N480 | N960

*RST: N30

Example: See Example"Configuring the PRACH settings" on page 595.

Options: N480 and N960 require R&S SMW-K171

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:BMAid <RefLevelIdentif>

Sets the bandwidth of the given allocation as reference for the "Burst" power mode.

Parameters:

<RefLevelIdentif> 1 | ON | 0 | OFF

0|OFF
Disables the given allocation as burst reference for the "Burst" power mode.

1|ON
Sets the given allocation as burst reference for the "Burst" power mode.

*RST: 0

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Burst Mode Ref Alloc Identifier" on page 291

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:FORMat <PrachFormat>

Selects the PRACH format.

Parameters:

<PrachFormat> F0 | F1 | F2 | F3 | FA1 | FA2 | FA3 | FB1 | FB2 | FB3 | FB4 | FC0 | FC2

*RST: FA1

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Format" on page 289

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RSET <RestrictedSet>

Sets the higher-layer parameter `restrictedSetConfig` that defines the type of restricted sets (unrestricted, restricted type A, restricted type B).

Parameters:

<RestrictedSet> ARES | BRES | URES

`URES` = Unrestricted
`ARES` = Restricted Type A
`BRES` = Restricted Type B

*RST: URES

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Restricted Set" on page 290

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RSEQuence <LogicalRootSeq>

Sets the starting logical root sequence index.

Parameters:

<LogicalRootSeq> integer

Range: 0 to 837
*RST: 0

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Logical Root Sequence" on page 290

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:ZCZone <ZeroCorrZone>

Sets the parameter `zeroCorrelationZoneConfig` according to TS 38.211.

Parameters:

<ZeroCorrZone> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Zero Correlation Zone" on page 290

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:PRINdex <PreambleIndex>

Sets the PRACH preamble index and thus defines which one of the 64 PRACH preambles is used.

Parameters:

<PreambleIndex> integer

Range: 0 to 63
*RST: 0

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Preamble Index" on page 290

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:RBNumber?

Queries the number of resource blocks the PRACH allocation spans.

Return values:

<UserAllocRBNum> integer

Range: 3 to 24
*RST: 12

Example: See Example"Configuring the PRACH settings" on page 595.

Usage: Query only

Manual operation: See "No. RB" on page 214

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PRACh:TOFFset <PrachTimeOffset>

Sets the timing offset base value for PRACH.

Parameters:

<PrachTimeOffset> float

Range: -3E-4 to 3E-4
Increment: 1E-8
*RST: 0

Example: See Example"Configuring the PRACH settings" on page 595.

Manual operation: See "Time Offset" on page 290

12.28 SRS scheduling commands

The following commands configure the SRS in the scheduling table. When you configure the SRS in the "User / BWP" dialog, use the commands referenced in Chapter 12.20.12, "SRS commands", on page 764.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BHOP <SrsBhop>

Sets the parameter b_{Hop} that defines the frequency hopping of the SRS.

Parameters:

<SrsBhop> integer

Range: 0 to 3
*RST: 0

Manual operation: See "B Hop" on page 294

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:BSRS <SrsBSrs>

Sets the parameter b-SRS needed to define the length of the SRS sequence.

Parameters:

<SrsBSrs> integer

Range: 0 to 3
*RST: 0

Manual operation: See "B SRS" on page 294

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:COFFset <ComboOffset>

Sets the parameter transmission comb offset.

Parameters:

<ComboOffset> integer

Range: 0 to 7
*RST: 0

Manual operation: See "Comb Offset" on page 294

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CONFig <SrsConfig>

Parameters:

<SrsConfig> **IE**

Standard SRS configuration.

IER16
Release 16 SRS configuration, including positioning functionality.

IENPR16
Release 16 SRS configuration, without positioning functionality.

IER17
Release 17 SRS configuration.

*RST: IE

Manual operation: See "Config" on page 292

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:CSRS <SrsCSrs>

Sets the parameter c-SRS to define the length of the SRS sequence.

Parameters:
<SrsCSrs> integer

Range: 0 to 63
*RST: 0

Manual operation: See "C SRS" on page 294

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FPOS <FreqPos>

Sets the starting position of the SRS allocation in the frequency domain.

Parameters:
<FreqPos> integer

Range: 0 to 67
*RST: 0

Manual operation: See "Frequency Position" on page 293

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FQSHift <SrsFreqShift>

Sets the frequency shift.

Parameters:
<SrsFreqShift> integer

Range: 0 to 268
*RST: 0

Manual operation: See "Frequency Shift" on page 293

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:FSFactor <Value>

Selects the frequency scaling factor for the SRS defined in 3GPP 38.211, chapter 6.4.1.4.3.

Parameters:

<Value> PF1 | PF2 | PF4

*RST: PF1

Manual operation: See "Frequency Scaling Factor" on page 295

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:OFFSet <Offset>

Sets time position of first SRS allocation within an SRS periodicity.

Prerequisites for this command

- Select periodic SRS transmission (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RSTYpe`).
- Select periodicity > 1 (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PER`).

Parameters:

<Offset> integer

Range: 0 to 81919

*RST: 0

Manual operation: See "Offset" on page 293

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PER <Periodicity>

Sets the SRS repetition factor.

Prerequisites for this command

- Select periodic SRS transmission (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RSTYpe`).

Parameters:

<Periodicity> SL1 | SL2 | SL4 | SL5 | SL8 | SL10 | SL16 | SL20 | SL32 | SL40 | SL64 | SL80 | SL160 | SL320 | SL640 | SL1280 | SL2560 | SL81920 | SL40960 | SL10240 | SL5120

*RST: SL1

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PORTs <SrsPorts>

Selects the number of antenna ports used by the SRS.

Parameters:
<SrsPorts> AP1 | AP2 | AP4
*RST: AP1

Manual operation: See "Ports" on page 296

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:REFactor <SrsRepFactor>

Sets how many times the SRS symbols are repeated.

Parameters:
<SrsRepFactor> REP1 | REP2 | REP4 | REP5 | REP6 | REP7 | REP8 | REP10 | REP12 | REP14
*RST: REP1

Manual operation: See "Repetition Factor" on page 294

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:RSTYpe <Mode>

Sets the SRS transmission type.

Parameters:
<Mode> **APER**
Aperiodic transmission of the SRS.
*RST: PER

Manual operation: See "Resource Type" on page 293

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:CYCShift <SeqCyclicShft>

Sets the number of cyclic shifts, required for the SRS sequence generation.

Parameters:
<SeqCyclicShft> integer
Range: 0 to 11
*RST: 0

Manual operation: See "Sequence Cyclic Shift" on page 295

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:HOPPing <SrsGrpHopping>

Sets the higher-layer parameter `groupOrSequenceHopping` that defines the sequence group, required for the SRS sequence generation.

Parameters:
<SrsGrpHopping> **GRP**
Group hopping.

N
No hopping.

SEQ
Sequence hopping.

*RST: N

Manual operation: See "Group or Sequence Hopping" on page 295

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SEQ:ID <SrsSequenceID>

Sets the higher-layer parameter sequence ID required for the SRS sequence generation.

Parameters:
<SrsSequenceID> integer

Range: 0 to 65535
*RST: 0

Manual operation: See "Sequence ID" on page 295

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SRIDx <Value>

Defines the start RB index defined in 3GPP 38.331.

Parameters:
<Value> integer

Range: 0 to Depends on frequency scaling fator
*RST: 0

Manual operation: See "Start RB Index" on page 295

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:TRTComb <SrsTransComb>

Sets the transmission comb (k_{TC}).

Parameters:
<SrsTransComb> TC2 | TC4 | TC8

*RST: TC2

Manual operation: See "Transmission Comb" on page 294

12.29 PSSCH / PSCCH scheduling commands

12.29.1 PSSCH / PSCCH general configuration commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:BDWidth <ResourceBlocks>

Selects the size of the PSCCH in physical resource blocks.

Parameters:

<ResourceBlocks> RB10 | RB12 | RB15 | RB20 | RB25

10, 12, 15, 20 or 25 resource blocks.

*RST: RB10

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Bandwidth (PRBs)" on page 299

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:SCRid <ScramblingID>

Defines the PSCCH DMRS scramble ID.

Parameters:

<ScramblingID> integer

Range: 0 to 65535

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "DMRS Scramble ID" on page 299

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSCCh:SYMLength <Symbols>

Defines the number of the symbols for the PSCCH (excluding AGC symbols).

Parameters:

<Symbols> integer

Range: 2 to 3
*RST: 2

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Symbol Length" on page 299

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:MOD <Modulation>

Selects the modulation scheme for the PSSCH.

Parameters:

<Modulation> QPSK | QAM16 | QAM64 | QAM256

*RST: QPSK

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Modulation" on page 299

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:NDMRs <DMRSs>

Defines the number of PSSCH DMRS.

Parameters:

<DMRSs> integer

Range: 2 to 4
*RST: 2

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of DMRS" on page 298

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:NSUBchan <Subchannels>

Defines the number of subchannels the PSSCH uses.

Prerequisites for this command

- Configure the bandwidth with more than 1 subchannel (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:NSUBchannels`).

Parameters:

<Subchannels> integer

Range: 1 to 27
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Number of Subchannels" on page 298

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:POOL <ResourcePool>

Selects the resource pool the PSxCH settings apply to.

Prerequisites for this command

- Configure more than one resource pool for a bandwidth part (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:NRESpool` on page 777).

Parameters:

<ResourcePool> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Resource Pool" on page 298

12.29.2 SCI1A configuration commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:AMCSind <Value>

Defines the value for the SCI field "Additional MCS Indicator".

Parameters:

<Value> integer

Range: 0 to 7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:BOINd <Value>

Defines the value for the SCI field "Beta Offset Indicator".

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:DPATterns <Value>

Defines the value for the SCI field "DMRS Patterns".

Parameters:

<Value> integer

Value range depends on active DMRS patterns (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:PAT4`).

Range: 0 to 3
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:DPORts <Value>

Defines the value for the SCI field "DMRS Ports".

Parameters:

<Value> integer

Range: 0 to 1
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:FRDRes <Value>

Defines the value for the SCI field "Frequency Domain Resource Assignment".

Parameters:

<Value> integer

Range: 0 to 8192
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:MCS <Value>

Defines the value for the SCI field "Modulation and Coding Scheme".

Parameters:

<Value> integer

Range: 0 to 31
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "I_MCS" on page 305

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:PAT1 <Pattern>, <BitCount>

Queries the bit pattern for SCI1A.

Parameters:

<Pattern> 23 Bits

<BitCount> Range: 1 to 23
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:PFOVerhead <State>

Turns the SCI field "Additional MCS Indicator" on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:PRTY <Value>

Defines the value for the SCI field "Priority".

Parameters:
<Value> integer
Range: 0 to 7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:RESVed <Value>

Defines the value for the SCI field "Reserved Bits".

Parameters:
<Value> 32 bits

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:RREPeriod <Value>

Defines the value for the SCI field "Resource Reservation Period".

Prerequisites for this command

- Select RRP list > 1 (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:CELL<cc>:SL:BWP<bwp>:RESPool:RES<gr0>:REPList`).

Parameters:
<Value> integer
Range: 0 to 7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:S2FMt <Value>

Defines the value for the SCI field "2nd Stage SCI Format".

Parameters:
<Value> integer
Range: 0 to 7
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:TIDRes <Value>

Defines the value for the SCI field "Time Domain Resource Assignment".

Parameters:

<Value> integer

Range: 0 to 511
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

12.29.3 SCI2A configuration commands

Commands to configure SCI2A described elsewhere.

- SCI2 format selection: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:S2FMt`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:CSIReq <State>

Turns SCI field "CSI Request" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:CTINd <Value>

Turns SCI field "Cast Type Indicator" on and off.

Parameters:

<Value> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:DESTid <Value>

Defines the value for SCI field "Destination ID".

Parameters:

<Value> integer

Range: 0 to 65535
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:HARFb <State>

Turns SCI field "Harq Feedback" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:HARProc <Value>

Defines the value for SCI field "Harq Process".

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:NDI <State>

Turns SCI field "New Data Indicator" on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI2:PATTern <Pattern>, <BitCount>

Queries the bit pattern for SCI2.

Parameters:

<Pattern> 48 bits

<BitCount> Range: 1 to 48

*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:REDundancy <Value>

Defines the value for SCI field "Redundancy Version".

Parameters:

<Value> integer

Range: 0 to 3

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:SOURid <Value>

Defines the value for SCI field "Source ID".

Parameters:

<Value> integer

Range: 0 to 255

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

12.29.4 SCI2B configuration commands

Commands to configure SCI2A described elsewhere.

- Bit pattern: `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI2:PATTern` on page 907
- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:HARProc`

- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:NDI
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:REDundancy
- [:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:SOURid

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:CORReq <Value>

Defines the value for SCI field "Communication Range Requirement".

Parameters:

<Value> integer

Range: 0 to 15
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:ZONeid <Value>

Defines the value for SCI field "Zone ID".

Parameters:

<Value> integer

Range: 0 to 4095
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

12.29.5 TxScheme configuration commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PDSCh|PUSCh|PSSCh:TXSCheme:NLAYers <Layers>

Defines the number of precoding layers.

Parameters:

<Layers> integer

Range: 1 to 8
*RST: 1

Example: See Example"Configuring the PDSCH incl. PTRS and Precoding settings" on page 581.

Manual operation: See "Number of Layers" on page 228
See "Number of Layers" on page 303

12.29.6 DMRS configuration commands

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:PSSCh:DMRS:APSel <AntennaPort>

Selects the antenna port the PSSCH DMRS is transmitted on.

Parameters:

<AntennaPort> **P1000**
Antenna port 1000 (available if number of precoding layers = 1).

P1001
Antenna port 1001 (available if number of precoding layers = 1).

PBOTH
Antenna port 1000 and 1001 (if number of precoding layers = 2).

*RST: P1000

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "DMRS Port" on page 304

12.29.7 PSxCH channel coding commands

Commands to configure PSxCH channel coding described elsewhere.

- `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SCI:MCS`

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>:SL:PHYSbits?

Queries the size of the selected allocation in bits.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).

Return values:

<Bits> integer

Range: 0 to 2147483647
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Usage: Query only

Manual operation: See "Number of Physical Bits" on page 305

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:FRCR <State>

Turns manual definition of the target code rate on and off.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).

Parameters:

<State> 1 | ON | 0 | OFF

0 | OFF
Target code rate is automatically calculated base on the I_MCS.

1 | ON
Definition of target code rate is possible with `[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TCRate`

*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Manually Defined Code Rate" on page 305

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:RVIndex <Index>

Defines the redundancy version index.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).

Parameters:

<Index> integer

Range: 0 to 3
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Redundancy Version Index" on page 306

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TBSFactor <ScalingFactor>

Selects the transport block scaling factor.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).

Parameters:

<ScalingFactor> S1 | S5 | S25

*RST: S1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "TBS Scaling Factor" on page 306

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TBSize?

Queries the transport block size.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).

Return values:

<TransBlockSize> integer

Range: 0 to 2147483647
*RST: 0

Example: See Example"Configuring a sidelink signal" on page 600.

Usage: Query only

Manual operation: See "Transport Block Size" on page 305

[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:TCRate <CodeRate>

Defines the target code rate.

Prerequisites for this command

- Turn on channel coding (`[:SOURce<hw>]:BB:NR5G:UBWP:USER<us>:SSCH:CCODing:STATe`).
- Turn on custom code rate definition (`[:SOURce<hw>]:BB:NR5G:SCHed:CELL<cc>:SUBF<sf>:USER<us>:BWPart<bwp>:ALLoc<al>[:CW<cw>]:PSSCh:CCODing:FRCR`).

Parameters:

<CodeRate> float

Range: 0 to 3
Increment: 0.001
*RST: 1

Example: See Example"Configuring a sidelink signal" on page 600.

Manual operation: See "Target Code Rate" on page 305

12.30 Output commands

[:SOURce<hw>]:BB:NR5G:OUTPut:SEQLen <SeqLen>

Sets the sequence length of the signal in number of frames.

Parameters:

<SeqLen> integer

Range: 1 to depends on settings
*RST: 1
If real-time feedback is enabled, max = 50 frames.

Example: See Example"Output settings" on page 596.

[:SOURce<hw>]:BB:NR5G:OUTPut:SUSLen <Subframes>

Sets the sequence length of the signal in terms of subframes.

Parameters:

<Subframes> integer

Range: 1 to device dependent
*RST: 10

Manual operation: See "Sequence Length" on page 322

[:SOURce<hw>]:BB:NR5G:OUTPut:SSOC:STATe <SupSCOnOPCtr>

If enabled, the subcarriers that use the same frequency as the center frequency of the baseband output are not transmitted.

Parameters:

<SupSCOnOPCtr> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Output settings" on page 596.

Manual operation: See "Suppress Subcarrier on Output Center" on page 322

[:SOURce<hw>]:BB:NR5G:OUTPut:FMODe <FilterBWP>

Defines if and how the filter is applied, on the whole channel bandwidth or on the individual BWPs separately.

Parameters:

<FilterBWP> CBW | BWP | OFF | FAST | 2 | 1 | 0 | USER | EVM

BWP | 1
Applies a filter to each bandwidth part.

CBW | 0
Applies the channel BW filter.

EVM
Applies a filter to optimze the EVM.

FAST | 2
Applies fast filtering.

OFF
No filter.

USER
Applies a custom filter.

*RST: 0

Example: See Example"Output settings" on page 596.

Manual operation: See "Filter Mode" on page 323

[:SOURce<hw>]:BB:NR5G:FMODe:USRFile <FilterFileName>

Loads the file from the default or the specified directory.

Loaded are files with extension `*.vaf` or `*.dat`.

Parameters:

<FilterFileName> string

Complete file path incl. filename and extension

Example:

```
SOURce:BB:NR5G:OUTPut:FMODe USER
SOURce:BB:NR5G:FMODe:USRFile "/var/user/my_filter.dat"
```

Manual operation: See "Load User Filter" on page 323

[:SOURce<hw>]:BB:NR5G:OUTPut:SAMRmode <SampRateMode>

Sets the sample rate mode.

Parameters:
<SampRateMode> MIN | FFT
*RST: FFT

Manual operation: See "Sample Rate Mode" on page 325

[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:SRATe?

Queries the resulting sample rate.

Suffix:
<ch0> 0 to 7

Return values:
<SampleRate> integer
Among others, value range depends on the selected deployment scenario and channel bandwidth.
Range: 4E6 to 5E8
*RST: 4E6

Example: See Example"Output settings" on page 596.

Usage: Query only

Manual operation: See "Sample Rate" on page 325

[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:CONFlict <Conflict>

Queries if there are conflicts caused by mismatch between the nominal sample rate, playback rate and sample rate in the given row.

Parameters:
<Conflict> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Output settings" on page 596.

Manual operation: See "Conflict" on page 325

[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:CONFlict?

Queries if there are existing output conflicts caused by mismatch between the nominal sample rate, playback rate and sample rate in any of the outputs of the baseband block.

Return values:
<AnyOutpConflict> 1 | ON | 0 | OFF
*RST: 0

Example: See: Example"Output settings" on page 596.

Usage: Query only

Manual operation: See "Conflict" on page 325

[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:PBRate <PlaybackRate>

Defines the playback rate.

Prerequisites for this command

- Turn on `[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:VARiation`.

Parameters:

<PlaybackRate> integer

Per default, the playback rate is the same as the calculated sample rate but the value range also depends on the installed options.

Range: 0 to 24e8
*RST: same as the calculated sample rate

Example: See Example"Output settings" on page 596.

Manual operation: See "Playback Rate" on page 326

[:SOURce<hw>]:BB:NR5G:OUTPut:BBConf:ROW<apr>:VARiation <SRateVariation>

Activates sample rate variation.

Parameters:

<SRateVariation> 0 | 1 | OFF | ON

*RST: 0

Example: See Example"Output settings" on page 596.

Manual operation: See "Sample Rate Variation" on page 326

[:SOURce<hw>]:BB:NR5G:OUTPut:CLEVel <ClippingLevel>

Sets the limit for level clipping.

Parameters:

<ClippingLevel> integer

Range: 1 to 100
*RST: 100

Example: See Example"Output settings" on page 596.

Manual operation: See "Clipping Level" on page 324

[:SOURce<hw>]:BB:NR5G:OUTPut:CMODe <ClippingMode>

Sets the method for level clipping.

Parameters:

<ClippingMode> VECTor | SCALar

*RST: VECTor

Example: See Example"Output settings" on page 596.

Manual operation: See "Clipping Mode" on page 324

[:SOURce<hw>]:BB:NR5G:TDWind:STATe <TDWindow>

Enables time domain windowing.

Parameters:

<TDWindow> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Time domain windowing" on page 595.

Manual operation: See "Time Domain Windowing (WOLA)" on page 327

[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:SE60K:TRTime <TransitionTime>
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S15K:TRTime <TransitionTime>
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S30K:TRTime <TransitionTime>
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S60K:TRTime <TransitionTime>
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S120K:TRTime <TransitionTime>
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S240K:TRTime <TransitionTime>

Sets the transition time when time domain windowing is active.

The next to last block in the command syntax indicates the used SCS and CP combination.

- DL: `SE<SCS>K`, where `E` indicates the extended CP or for normal CP, the designation is omitted

Parameters:

<TransitionTime> float

Range: 0 to 1E-5
Increment: 1E-7
*RST: 5E-6

Example: See Example"Time domain windowing" on page 595.

Manual operation: See "Transition Time" on page 327

[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:SE60K:TRTSamples?
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S15K:TRTSamples?
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S30K:TRTSamples?
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S120K:TRTSamples?
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S60K:TRTSamples?
[:SOURce<hw>]:BB:NR5G:OUTPut:TDWind:S240K:TRTSamples?

Queries the number of transition samples.

The next to last block in the command syntax indicates the used SCS and CP combination.

- DL: `SE<SCS>K`, where `E` indicates the extended CP or for normal CP, the designation is omitted

Return values:

<TransitionSampl> integer

Range: 0 to 1000
*RST: 0

Example: See Example"Time domain windowing" on page 595.

Usage: Query only

Manual operation: See "Transition BB A Samples" on page 327

[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:BBConf:ROW<apr>:AVRL?

Queries the available basebands with their average power.

Return values:

<PowPerBBRelLvl> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example"Output settings" on page 596.

Usage: Query only

Manual operation: See "Average Power" on page 335

[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:MODE <PowerMode>

Sets how the first output is leveled.

Parameters:

<PowerMode>

AAS
Average power in the active signal

AVG
Average RMS power

ACTvsf
Average power in the active subframes

PSDConst
The absolute power of a particular allocation is set by multiplying the configured power spectral density (PSD) with the bandwidth of the particular allocation.

Burst
The "Burst" mode is a special case of the “Constant PSD” mode in the sense that it computes automatically a reference bandwidth based on the chosen allocation.

*RST: AVG

Example: `SOURce1:BB:NR5G:OUTPut:POWer:MODE PSDConst`
`SOURce1:BB:NR5G:OUTPut:POWer:RSBW 1000000`

Manual operation: See "Power Mode" on page 334

[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:RSBW <RefSystemBW>

Sets the reference bandwidth used by the leveling of the output signal at the first output.

Parameters:
<RefSystemBW> float

Range: 15E3 to 400E6
Increment: 1
*RST: 1E6

Example: See `[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:MODE` on page 918.

Manual operation: See "Reference System Bandwidth" on page 335

[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:S120K:ACRL?
[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:S15K:ACRL?
[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:S240K:ACRL?
[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:S30K:ACRL?
[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:S60K:ACRL?
[:SOURce<hw>]:BB:NR5G:OUTPut:POWer:BWRef:ACRL?

Queries the bandwidths/numerologies with their power levels.

Return values:
<ActPowRelLvlPBW> float

Range: -80 to 10
Increment: 0.001
*RST: 0

Example: See Example"Output settings" on page 596.

Usage: Query only

Manual operation: See "Active Power" on page 335

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ALGorithm <CFRAlgorithm>

Selects the algorithm used for the crest factor reduction.

Parameters:
<CFRAlgorithm>

CLF
Clipping and filtering algorithm

PC
Peak cancellation algorithm

*RST: CLF

Example: See Example"Output settings" on page 596.

Options: R&S SMW-K548

Manual operation: See "Algorithm" on page 336

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:CPBWidth <CancelPulseBw>

Sets the bandwidth of the cancellation pulse.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ALGorithm` on page 919 = PC

Parameters:

<CancelPulseBw> float

Range: 0 to 500e6
Increment: 0.1
*RST: 98304001.4648438

Example: //Set pulse bandwidth

```
SOURce1:BB:NR5G:OUTPut:CFReduction:ALGorithm PC
SOURce1:BB:NR5G:OUTPut:CFReduction:CPBWidth
1228800
```

Manual operation: See "Cancellation Pulse Bandwidth" on page 337

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:TRBWidth <TransitBw>

Sets the transition bandwidth of the cancellation pulse.

Prerequisites for this command

- `[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ALGorithm` on page 919 = PC

Parameters:

<TransitBw> float

Range: 0 to 500e6
Increment: 0.1
*RST: 1228799.97253418

Example: //Set transition bandwidth

```
SOURce1:BB:NR5G:OUTPut:CFReduction:ALGorithm PC
SOURce1:BB:NR5G:OUTPut:CFReduction:TRBWidth
98304000
```

Manual operation: See "Transition Bandwidth" on page 337

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:ITERations <MaxIteration>

Sets the number of iterations that are used for calculating the resulting crest factor. The iteration process is stopped when the desired crest factor is achieved by 0.1 dB.

Parameters:

<MaxIteration> integer

Range: 0 to 20
*RST: 5

Example: See Example"Output settings" on page 596.

Options: R&S SMW-K548

Manual operation: See "Max Iterations" on page 337

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:OCFactor?

Queries the original crest factor of the waveform after the calculation of the resulting crest factor is completed.

The original crest factor is calculated as an average over the whole waveform, including any idle periods that might be present in TDD waveforms.

Return values:

<OriginalCFR> integer

Range: 0 to 100
*RST: 0

Example: See Example"Output settings" on page 596.

Usage: Query only

Options: R&S SMW-K548

Manual operation: See "Original Crest Factor" on page 337

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:RCFactor?

Queries the resulting crest factor of the waveform after the calculations are completed. The resulting crest factor is calculated as an average over the whole waveform, including any idle periods that might be present in TDD waveforms.

Return values:

<ResultingCFR> integer

Range: 0 to 100
*RST: 0

Example: See Example"Output settings" on page 596.

Usage: Query only

Options: R&S SMW-K548

Manual operation: See "Resulting Crest Factor" on page 337

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:STATe <CrestFactorStat>

Enables the crest factor reduction calculation.

Parameters:

<CrestFactorStat> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Output settings" on page 596.

Options: R&S SMW-K548

Manual operation: See "State" on page 336

[:SOURce<hw>]:BB:NR5G:OUTPut:CFReduction:TCRFactor <TargetCRF>

Sets the desired crest factor value.

Parameters:

<TargetCRF> float

Range: 0 to 30
Increment: 0.1
*RST: 10

Example: See Example"Output settings" on page 596.

Options: R&S SMW-K548

Manual operation: See "Target Crest Factor" on page 337

12.31 Trigger commands

[:SOURce<hw>]:BB:NR5G[:TRIGger]:SEQuence <TrigMode>

Sets the trigger mode.

Parameters:

<TrigMode> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

*RST: AUTO

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "Mode" on page 309

[:SOURce<hw>]:BB:NR5G:TRIGger:SOURce <TrigSource>

Selects the trigger signal source and determines the way the triggering is executed. Provided are:

- Internal triggering by a command (`INTernal`)
- External trigger signal via one of the local or global connectors
  - `EGT1|EGT2`: External global trigger
  - `EGC1|EGC2`: External global clock
  - `ELTRigger`: External local trigger
  - `ELCLock`: External local clock
- Internal triggering by a signal from the other basebands (`INTA|INTB`)
- In primary-secondary instrument mode, the external baseband synchronization signal (`BBSY`)
- `OBASeband|BEXTernal|EXTernal`: Setting only
  Provided only for backward compatibility with other Rohde & Schwarz signal generators.
  The R&S SMW accepts these values and maps them automatically as follows:
  `EXTernal = EGT1`, `BEXTernal = EGT2`, `OBASeband = INTA or INTB`
  (depending on the current baseband)

Parameters:

<TrigSource> INTB|INTernal|OBASeband|EGT1|EGT2|EGC1|EGC2|ELTRigger|INTA|ELCLock|BEXTernal|EXTernal | BBSY

*RST: INTernal

Example: See Example"Configure and enable triggering" on page 597.

Options: ELTRigger|ELCLock require R&S SMW-B10
BBSY require R&S SMW-B9

Manual operation: See "Source" on page 311

[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:SYNChronize:OUTPut <TrigSyncOutpSta>

Enables signal output synchronous to the trigger event.

Parameters:

<TrigSyncOutpSta> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "Sync. Output to External Trigger/Sync. Output to Trigger" on page 312

[:SOURce<hw>]:BB:NR5G:TRIGger:DELay:UNIT <TrigDelUnit>

Sets the units the trigger delay is expressed in.

Parameters:

<TrigDelUnit> SAMPle | TIME

*RST: SAMPle

Example: See Example"Specifying delay and inhibit values in time units" on page 597.

Manual operation: See "(External) Delay Unit" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger[:EXTernal]:DELay <TrigExtDelay>

Sets the trigger delay.

Parameters:

<TrigExtDelay> float

Range: 0 to 2147483647
Increment: 0.01
*RST: 0

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "(Specified) External Delay/(Specified) Trigger Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger[:EXTernal]:INHibit <TrigExtInhibit>

Specifies the duration by which a restart is inhibited.

Parameters:

<TrigExtInhibit> integer

Range: 0 to dynamic
*RST: 0

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "External Inhibit/Trigger Inhibit" on page 312

[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:RDELay?

Queries the time (in seconds) an external trigger event is delayed for.

Return values:

<ResExtDelaySec> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

Example: See Example"Specifying delay and inhibit values in time units" on page 597.

Usage: Query only

Manual operation: See "Actual Trigger Delay/Actual External Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger:EXTernal:TDELay <TrigExtTimeDel>

Specifies the trigger delay for external triggering. The value affects all external trigger signals.

Parameters:

<TrigExtTimeDel> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

Example: See Example"Specifying delay and inhibit values in time units" on page 597.

Manual operation: See "(Specified) External Delay/(Specified) Trigger Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:DELay <TrigIntOthDelay>

Sets the trigger delay for triggering by the trigger signal from the other path.

Parameters:

<TrigIntOthDelay> float

Range: 0 to 2147483647
Increment: 0.01
*RST: 0

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "(Specified) External Delay/(Specified) Trigger Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:INHibit <IntOthInhibit>

For triggering via the other path, specifies the duration by which a restart is inhibited.

Parameters:

<IntOthInhibit> integer

Range: 0 to 67108863
*RST: 0

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "External Inhibit/Trigger Inhibit" on page 312

[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:RDELay?

Queries the time a trigger event form the other path is delayed.

Return values:

<IntOthRDelaySec> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

Example: See Example"Specifying delay and inhibit values in time units" on page 597.

Usage: Query only

Manual operation: See "Actual Trigger Delay/Actual External Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger:OBASeband:TDELay <IntOthDelaySec>

Specifies the trigger delay for triggering by the signal from the other path.

Parameters:

<IntOthDelaySec> float

Range: 0 to 688
Increment: 250E-12
*RST: 0
Default unit: s

Example: See Example"Specifying delay and inhibit values in time units" on page 597.

Manual operation: See "(Specified) External Delay/(Specified) Trigger Delay" on page 313

[:SOURce<hw>]:BB:NR5G:TRIGger:ARM:EXECute

Stops signal generation; a subsequent trigger event restarts signal generation.

Example:

```
SOURce1:BB:NR5G:TRIGger:SOURce INT
SOURce1:BB:NR5G:TRIGger:SEQuence ARETrigger
SOURce1:BB:NR5G:TRIGger:EXEcute
// executes a trigger, signal generation starts
SOURce1:BB:NR5G:TRIGger:ARM:EXECute
// signal generation stops
SOURce1:BB:NR5G:TRIGger:EXEcute
// executes a trigger, signal generation starts again
```

Usage: Event

Manual operation: See "Arm" on page 311

[:SOURce<hw>]:BB:NR5G:TRIGger:EXECute

Executes a trigger.

Example: See Example"Configure and enable triggering" on page 597.

Usage: Event

Manual operation: See "Execute Trigger" on page 311

[:SOURce<hw>]:BB:NR5G:TRIGger:RMODe?

Queries the signal generation status.

Return values:

<TrigRunMode> STOP | RUN

*RST: STOP

Example:

```
SOURce1:BB:NR5G:TRIGger:RMODe?
```

Usage: Query only

Manual operation: See "Running/Stopped" on page 311

[:SOURce<hw>]:BB:NR5G:TRIGger:SLENgth <TrigSeqLen>

Defines the length of the signal sequence that is output in the `SINGle` trigger mode.

Parameters:

<TrigSeqLen> integer

Range: 1 to dynamic

*RST: 1

Example: See Example"Configure and enable triggering" on page 597.

Manual operation: See "Signal Duration" on page 310

[:SOURce<hw>]:BB:NR5G:TRIGger:SLUNit <TrigSeqLenUnit>

Defines the unit for the entry of the signal sequence length.

Parameters:

<TrigSeqLenUnit> SEQuence | SAMPle

*RST: SEQuence

Example:

```
SOURce1:BB:NR5G:TRIGger:SEQuence SING
SOURce1:BB:NR5G:TRIGger:SLUNit SEQ
SOURce1:BB:NR5G:TRIGger:SLENgth 2
```

Manual operation: See "Signal Duration Unit" on page 310

[:SOURce<hw>]:BB:NR5G:TRIGger:TIME:DATE <Year>, <Month>, <Day>

Sets the date for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this date via the following command:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

<Year> integer

Range: 1980 to 9999

<Month> integer

Range: 1 to 12

<Day> integer

Range: 1 to 31

Example: See R&S SMW user manual.

Manual operation: See "Trigger Time" on page 310

[:SOURce<hw>]:BB:NR5G:TRIGger:TIME:TIME <Hour>, <Minute>, <Second>

Sets the time for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this time via the following command:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

<Hour> integer

Range: 0 to 23

<Minute> integer

Range: 0 to 59

<Second> integer

Range: 0 to 59

Example: See R&S SMW user manual.

Manual operation: See "Trigger Time" on page 310

[:SOURce<hw>]:BB:NR5G:TRIGger:TIME[:STATe] <State>

Activates time-based triggering with a fixed time reference. If activated, the R&S SMW triggers signal generation when its operating system time matches a specified time.

Specify the trigger date and trigger time with the following commands:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:DATE`

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:TIME`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See R&S SMW user manual.

Manual operation: See "Time Based Trigger" on page 310

12.32 Marker commands

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:MODE <MarkMode>

Defines the signal for the selected marker output.

Parameters:

<MarkMode> SUBFram | FRAM | RESTart | PERiod | RATio | SFNRestart | ULDL

*RST: FRAM

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Marker Mode" on page 315

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DELay <MarkDelay>

Defines the delay between the signal on the marker outputs and the start of the signals.

Parameters:

<MarkDelay> float

Range: 0 to 16777215
Increment: 1E-3
*RST: 0

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Marker x Delay" on page 316

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DINSec?

Queries the marker delay in microseconds.

You can define a marker delay in samples with `[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DELay`.

Return values:

<Delay> float

Range: 0 to 16777215
Increment: 1E-3
*RST: 0

Usage: Query only

Manual operation: See "Delay (Time)" on page 316

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:PERiod <MarkUsrPer>

Sets the period of the user-defined period marker.

Parameters:
<MarkUsrPer> integer

Range: 1 to 4294967295
*RST: 2

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Marker Mode" on page 315

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ROFFset <MarkRiseOffs>
[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:FOFFset <MarkFallOffs>

Sets the rise/fall offset.

Parameters:
<MarkFallOffs> integer

Range: -640000 to 640000
*RST: 0

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Rise/Fall Offset" on page 315

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ONTime <MarkTimeOn>
[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:OFFTime <MarkTimeOff>

Sets the number of samples during which the marker output is on or off.

*) If R&S SMW-B9 is installed, the minimum marker duration depends on the sample/symbol rate.

See chapter "Basics on ..." in the R&S SMW user manual.

Parameters:
<MarkTimeOff> integer

Range: 1 to 16777215
*RST: 1

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Marker Mode" on page 315

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:INVert <Invert>

Turns inversion of the marker signal on and off.

Parameters:
<Invert> 1 | ON | 0 | OFF

1 | ON
Marker is on a falling edge.

0 | OFF
Marker is on a rising edge.

*RST: 0

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Invert" on page 316

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:DUPLexing <Duplexing>

Defines the duplexing mode for a UL/DL pattern containing a marker.

Parameters:

<Duplexing> TDD | FDD

TDD
Sets TDD (time division duplex) as the duplexing mode.

FDD
Sets FDD (frequency division duplex) as the duplexing mode.

*RST: FDD

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Duplexing" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:ECPState <ScsECPState>

Enables/disables the extended cyclic prefix (ECP) for a UL/DL pattern containing a marker.

Parameters:

<ScsECPState> 1 | ON | 0 | OFF

0|OFF
Disables the ECP.

1|ON
Enables the ECP.

*RST: 0

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Use Extended Cyclic Prefix" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:MMODe <Mode>

Queries the marker configuration mode.

The configuration mode is always "ULDL" ("UL/DL Configuration").

Parameters:
<Mode> ULDL
*RST: ULDL

Manual operation: See "Configuration Mode" on page 317

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NDLSlots <NumDlSlots>

Sets the number of DL slots in a UL/DL pattern containing a marker.

Parameters:
<NumDlSlots> integer
Range: 0 to 10
*RST: 10

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Number of DL Slots" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NSSLots?

Queries the number of special slots in a UL/DL pattern containing a marker.

Return values:
<NumSpecialSlots> integer
Range: 0 to 1
*RST: 0

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Usage: Query only

Manual operation: See "Number of Special Slots" on page 319

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:NULSlots <Slots>

Sets the number of UL slots in a UL/DL pattern containing a marker.

Parameters:
<Slots> integer
Range: 0 to 10
*RST: 0

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Number of UL Slots" on page 319

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SCSPacing <Scs>

Defines the subcarrier spacing (SCS) value for a UL/DL pattern containing a marker.

The available values depend on the set Deployment value.

Parameters:

<Scs> SCS15 | SCS30 | SCS60 | SCS120 | SCS240 | SCS480 | SCS960

*RST: SCS30

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Subcarrier Spacing" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SLINt <Slots>

Sets the duration of a UL/DL pattern containing a marker.

Parameters:

<Slots> integer

Range: 1 to 20

*RST: 10

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Slot Period" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:IAB:STATe <State>

Turns usage of the IAB frame format on and off.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Configure and enable standard marker signals" on page 598.

Manual operation: See "Use IAB Format" on page 318

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NDLSymbols <Symbols>

Defines the number of uplink symbols in a special slot that contains a marker.

Prerequisites to define the number of downlink symbols:

- Enter uplink mode (`[:SOURce<hw>]:BB:NR5G:LINK`).
- Turn off usage of special slot format (`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SFI:STATe`).

Otherwise, the command is a query only.

Parameters:

<Symbols> integer

Range: 0 to 14
*RST: 14

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Number of DL Symbols" on page 319

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NGSYmbols?

Queries the number of guarded symbols in the special slot of a UL/DL pattern containing a marker.

Return values:

<GuardedSymbols> integer

Range: 0 to 14
*RST: 0

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Usage: Query only

Manual operation: See "Number of Guarded Symbols" on page 320

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NULSymbols <Symbols>

Defines the number of uplink symbols in a special slot that contains a marker.

Prerequisites to define the number of downlink symbols:

- Enter uplink mode (`[:SOURce<hw>]:BB:NR5G:LINK`).
- Turn off usage of special slot format (`[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SFI:STATe`).

Otherwise, the command is a query only.

Parameters:

<Symbols> integer

Range: 0 to 14
*RST: n.a. (no preset. default: 0)

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Number of UL Symbols" on page 320

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SFI:STATe <State>

Turns usage of the special slot format on and off.

If on, select a special frame as defined by 3GPP with `[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SLFMt`.

If off, select the number of symbols with

- Downlink: `[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NDLSymbols`
- Uplink: `[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:NULSymbols`

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 1

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Use Special Format Index" on page 319

[:SOURce<hw>]:BB:NR5G:TRIGger:OUTPut<ch>:SSC:SLFMt <SpecSlotFmtIdx>

Sets the special slot format index of the special slot included in a UL/DL pattern containing a marker according to TS 38.213.

Parameters:

<SpecSlotFmtIdx> integer

Range: 0 to 45

*RST: 0

Example: See Example"Configure and enable an UL/DL marker" on page 598.

Manual operation: See "Slot Format Index" on page 319

12.33 Clock commands

[:SOURce<hw>]:BB:NR5G:CLOCk:SOURce <ClockSour>

Selects the clock source:

- `INTernal`: Internal clock reference
- `ELCLock`: External local clock
- `EXTernal = ELCLock`: Setting only
  Provided for backward compatibility with other Rohde & Schwarz signal generators

Parameters:

<ClockSour> INTernal|ELCLock|EXTernal

*RST: INTernal

Example: See Example"Clock settings" on page 599.

Options: ELCLock requires R&S SMW-B10

Manual operation: See "Clock Source" on page 321

[:SOURce<hw>]:BB:NR5G:CLOCk:MODE <ClockMode>

Sets the type of externally supplied clock.

Parameters:

<ClockMode> SAMPle

*RST: SAMPle

Example: See Example"Clock settings" on page 599.

Manual operation: See "Clock Mode" on page 321

12.34 Real-time feedback

Option: see "Required options" on page 550.

Example: Real-time feedback configuration (serial 3x8 mode)

```
SCONfiguration:MODE STAN
SCONfiguration:OUTPut:MODE ALL
SCONfiguration:APPLy

SOURce1:BB:NR5G:LINK UP

SOURce1:BB:NR5G:HFB:MODE S3X8
SOURce1:BB:NR5G:HFB:HPNMode 1
SOURce1:INPut:TM3:DIRection INPut
SOURce1:INPut:TM3:SIGNal FEEDback
SOURce1:BB:NR5G:HFB:CONNector LOCal
SOURce1:BB:NR5G:HFB:ADUDelay 0
SOURce1:BB:NR5G:HFB:BBSelector 0
SOURce1:BB:NR5G:HFB:SERate R1M6
SOURce1:BB:NR5G:HFB:TAMode 1
SOURce1:BB:NR5G:HFB:PDELay -2
SOURce1:BB:NR5G:HFB:LOGPath "/var/user/"
SOURce1:BB:NR5G:HFB:LOGState 1
```

[:SOURce<hw>]:BB:NR5G:HFB:CSRate <SerialRate>

Defines a custom serial rate.

Prerequisites for this command

- Select a custom serial rate (`[:SOURce<hw>]:BB:NR5G:HFB:SRATe`).

If you have defined one of the predefined serial rates, the command queries the selected serial rate.

Parameters:

<SerialRate> integer

Range: 1E5 to 25E5
*RST: 192E4

Example: //Define serial rate

```
BB:NR5G:HFB:SRATe CUST
BB:NR5G:HFB:CSRate 250000
```

Manual operation: See "Serial Rate" on page 559

[:SOURce<hw>]:BB:NR5G:HFB:LOGPath <LogGenOutpPath>

Defines the output folder on the device for the log files.

Parameters:

<LogGenOutpPath> string

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937

Manual operation: See "Output Path" on page 562

[:SOURce<hw>]:BB:NR5G:HFB:LOGState <LogGenState>

Enables the R&S SMW to create and store debug reports, i.e. log files with detailed information on the real-time feedback.

The instrument generates two types of reports:

- Transmission report
  - This file contains information about what is *sent* (e.g. redundancy versions) during the first 100 slots after triggering.
  - File is created after the 100 slots are sent.
- Reception report
  - This file contains information about the first 100 *received* serial commands.
  - File is created after 100 commands are successfully received.

Use these debug files for troubleshooting of complex real-time feedback tests.

Parameters:
<LogGenState> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937

Manual operation: See "Logging State" on page 561

[:SOURce<hw>]:BB:NR5G:HFB:HPNMode <HpnMode>

Enables or disables the HARQ process number (HPN) mode.

When the "HPN Mode" is set to active, the additional user delay is set to -1.00 Slots and made unchangeable. An additional "HARQ Process Number"parameter is accessible in the PUSCH settings (Chapter 12.22, "PDSCH and PUSCH scheduling commands", on page 797).

Parameters:
<HpnMode> 1 | ON | 0 | OFF
*RST: 0

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937

Manual operation: See "HPN Mode" on page 560

[:SOURce<hw>]:BB:NR5G:HFB:MODE <FbMode>

Enables real-time feedback and determines the mode of the feedback line.

Parameters:
<FbMode> OFF | SERial | S3X8
*RST: OFF

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Manual operation: See "Closed Loop Feedback Mode" on page 559

[:SOURce<hw>]:BB:NR5G:HFB:CONNector <Connector>

Sets the feedback line connector.

Return values:
<Connector> LOCal

LOCal
T/M 3 connector

*RST: LOCal

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Manual operation: See "Connector" on page 559

[:SOURce<hw>]:BB:NR5G:HFB:DELay <FbUserDelay>

Sets the point in time when the feedback can be sent to the instrument.

Parameters:

<FbUserDelay> float

Range: -20 to -1.0
Increment: 0.01
*RST: -2.0

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Manual operation: See "Feedback Delay" on page 560

[:SOURce<hw>]:BB:NR5G:HFB:BASeband <FbBaseband>

In serial mode, required for multiplexing serial commands for different basebands to one feedback line.

See also Example"Configuring the "Baseband Selector" for the 2 Tx antenna ports test cases" on page 560.

Parameters:

<FbBaseband> integer

Range: 0 to 3
*RST: 0 (for Baseband A); 1 (for Baseband B)

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Manual operation: See "Baseband Selector" on page 560

[:SOURce<hw>]:BB:NR5G:HFB:SRATe <SerialRate>

Sets the bit rate of the serial transmission.

For test cases with high subcarrier spacing (SCS) and short slot duration, a serial rate of 115.2 kbps is insufficient. We recommend that you use higher serial rate so that at least one feedback command per slot is received.

Parameters:

<SerialRate>

R115 | R1M6 | R1M9
115.2 kbps, 1.6 Mbps, 1.92 Mbps

CUST
Custom serial rate. You can define the serial rate with `[:SOURce<hw>]:BB:NR5G:HFB:CSRate`.

*RST: R1M9

Example: See Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Manual operation: See "Serial Rate" on page 559

[:SOURce<hw>]:BB:NR5G:HFB:TAMode <TaMode>

Enables timing advance (TA) adjustment for the selected feedback mode.

The TA adjustment uses the Processing Delay to define a new timing advance value for advancing or delaying the UL transmission.

Parameters:

<TaMode> 1 | ON | 0 | OFF

*RST: 0

Example: See: Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Options: R&S SMW-K144/-K145/-K148.

Manual operation: See "TA State" on page 560

[:SOURce<hw>]:BB:NR5G:HFB:PDELay <ProcessingDelay>

Sets a delay to the slot to which the timing adjustment command (T_A) is applied.

For example, if "Processing Delay" is set to -2.00 and the T_A is received in slot number 6, after processing, the T_A is transmitted in slot number 8.

If TA State > "Off", the value set for Feedback Delay is used for "Processing Delay".

Parameters:

<ProcessingDelay> float

Range: -20 to -1
Increment: 0.01
*RST: -2

Example: See: Example"Real-time feedback configuration (serial 3x8 mode)" on page 937.

Options: R&S SMW-K144/-K145/-K148.

Manual operation: See "Processing Delay" on page 561

12.35 Logging commands

Option: R&S SMW-K81

Example: Activating logfile generation

To start logfile generation with the default settings:

```
SOURce1:BB:NR5G:PRESet
SOURce1:BB:NR5G:STATe 1
SOURce1:BB:NR5G:LOGGen:OUTPut "/var/user/"
SOURce1:BB:NR5G:LOGGen:STATe 1
```

[:SOURce<hw>]:BB:NR5G:LOGGen:STATe <LogGenState>

Activates the logfile generation.

Parameters:

<LogGenState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example"Activating logfile generation" on page 942.

Manual operation: See "Logging State" on page 565

[:SOURce<hw>]:BB:NR5G:LOGGen:OUTPut <LogGenOutPath>

Sets the directory the files are saved in.

Parameters:

<LogGenOutPath> string

Example: See Example"Activating logfile generation" on page 942.

Manual operation: See "Output Path" on page 565

12.36 Test case wizard remote-control commands

The signal generator gives you the opportunity to use predefined settings which enable base station tests in line with the 3GPP standard. In particular, it allows you to execute 5G test cases described in the specifications TS 38.141-1 and TS 38.141-2. The settings take effect only after execution of command `[:SOURce<hw>]:BB:NR5G:TCW:APPLy`.

[:SOURce<hw>]:BB:NR5G:TCW:APPLy

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,OK" on page 355

[:SOURce<hw>]:BB:NR5G:TCW:ANT:RXANtennas <RXAntennas>

Shows or sets the number of Rx antennas used for test case.

Parameters:

<RXAntennas> ANT1 | ANT2 | ANT4 | ANT8

*RST: ANT2

Manual operation: See "Rx Antennas" on page 361

[:SOURce<hw>]:BB:NR5G:TCW:ANT:TXANtennas <TXAntennas>

Shows or sets the number of Tx antennas used for test case.

Parameters:

<TXAntennas> ANT1 | ANT2

*RST: ANT1

Manual operation: See "Tx Antennas" on page 361

[:SOURce<hw>]:BB:NR5G:TCW:AWGN:PLEVel?

Queries the AWGN power level.

Return values:
<AwgnPowLev> string
Default unit: dBm

Usage: Query only

Manual operation: See "Power Level" on page 377

[:SOURce<hw>]:BB:NR5G:TCW:BEWPhi <BeWPhiRefsens>

Sets the angle of the beamwidth for to the OTA REFSENS RoAoA in the φ-axis ($BeW_{\theta,REFSENS}$), applicable for FR1 only.

Parameters:
<BeWPhiRefsens> float
Range: 0.1 to 360
Increment: 0.1
*RST: 300

Manual operation: See "BeW(φ REFSENS)" on page 358

[:SOURce<hw>]:BB:NR5G:TCW:BEWThet <BeWThetRefsens>

Sets the angle of the beamwidth for to the OTA REFSENS RoAoA in the θ-axis ($BeW_{\theta,REFSENS}$), applicable for FR1 only.

Parameters:
<BeWThetRefsens> float
Range: 0.1 to 360
Increment: 0.1
*RST: 300

Manual operation: See "BeW(θ REFSENS)" on page 358

[:SOURce<hw>]:BB:NR5G:TCW:BSCLass <BSClass>

Sets the NR base station class.

Parameters:
<BSClass> WIDE | MED | LOC
*RST: WIDE

Example:
```
SOURce1:BB:NR5G:TCW:TC TS381411_TC741
SOURce1:BB:NR5G:TCW:BSCLass LOC
SOURce1:BB:NR5G:TCW:WS:PLEVel?
```
Response: `"-87.8 dBm"`

Manual operation: See "Base Station Class" on page 356

[:SOURce<hw>]:BB:NR5G:TCW:BSTYpe <BsType>

Sets the base station type for the OTA settings as specified in TS 38.141-2 D.5.

Parameters:

<BsType> BT1H | BT1O | BT2O

BT1
Sets the BS type 1-H (FR1, hybrid) for the OTA settings.

BT1O
Sets the BS type 1-O (FR1) for the OTA settings.

BT2O
Sets the BS type 2-O (FR2) for the OTA settings.

*RST: BT1O

Manual operation: See "Base Station Type" on page 357

[:SOURce<hw>]:BB:NR5G:TCW:DCLDirection <DeclaredDir>

Sets the reference for the OSDD.

Parameters:

<DeclaredDir> OTHD | MREFD | OREFD

OTHD
Sets a value different than the minSENS and REFSENS as the reference for the OSDD.

MREFD
Sets the OTA minimum sensitivity (minSENS) value as the reference for the OSDD.

OREFD
Sets the OTA reference sensitivity (REFSENS) value as the reference for the OSDD.

*RST: MREFD

Manual operation: See "Declared Direction" on page 357

[:SOURce<hw>]:BB:NR5G:TCW:IS:DISTance <Distance>

Sets the distance between the test object and test antenna injecting the interferer signal.

Parameters:

<Distance> integer

Range: 1 to 300
*RST: 100

Manual operation: See "Distance" on page 372

[:SOURce<hw>]:BB:NR5G:TCW:E50 <EIS50M>

Sets the $EIS_{REFSENS\_50M}$ level value applicable in the OTA REFSENS RoAoA as specified in TS 38.141-2 D.28.

The $EIS_{REFSENS\_50M}$ value is the declared OTA reference sensitivity basis level for FR2 based on a reference measurement channel with 50MHz BS channel bandwidth.

Parameters:

<EIS50M> float

Range: -119 to -86
Increment: 0.1
*RST: -101

Manual operation: See "EIS 50M" on page 358

[:SOURce<hw>]:BB:NR5G:TCW:FR <FreqRange>

Sets the frequency range FR2 for the BS type 2-O.

To reach the frequency range FR2, connect an external RF device to your instrument, e.g. an R&S SGS100A.

Parameters:

<FreqRange> FR2LT334 | FR2GT37

FR2LT334
Sets the FR2 range to 24.24 GHz < f ≤ 33.4 GHz

FR2GT37
Sets the FR2 range to 37 GHz < f ≤ 52.6 GHz

*RST: FR2LT334

Manual operation: See "Frequency Range" on page 358

[:SOURce<hw>]:BB:NR5G:TCW:FA:FRALlocation <FreqAlloc>

Sets the frequency allocation to FR1 or FR2.

Parameters:

<FreqAlloc> LOW | HIGH

*RST: HIGH

Manual operation: See "Frequency Allocation of the Interfering signal" on page 367

[:SOURce<hw>]:BB:NR5G:TCW:GENSignal <Signal>

Selects the generated signal.

Parameters:

<Signal>

ALL
Generates both the wanted and the interferer signal.

IF
Generates only the interferer signal.

WS
Generates only the wanted signal.

*RST: ALL

Manual operation: See "Generated Signal" on page 360

[:SOURce<hw>]:BB:NR5G:TCW:INSTsetup <Ports>

Selects the number of RF ports used for the test case.

Prerequisites for this command

- Select an OTA test case that supports different number of RF ports.

Parameters:

<Ports>

U1PORT | U2PORT

U1PORT
Use 1 RF port.

U2PORT
Use 2 RF ports.

*RST: U2PORT

Manual operation: See "Instrument Setup" on page 360

[:SOURce<hw>]:BB:NR5G:TCW:IS:BAND <Band>

Set the frequency band (n1 to n86) for the interfering signal.

Parameters:

<Band>

N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86

*RST: N1

Manual operation: See "Band" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS:CHBW?

Queries the channel bandwidth of the interfering signal.

Return values:

<ISCHBW> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 | BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 | BW200 | BW400 | BW800 | BW1600 | BW2000

*RST: BW5

Usage: Query only

Manual operation: See "Channel Bandwidth" on page 371

[:SOURce<hw>]:BB:NR5G:TCW:IS:CLID <ISCellId>

Sets the cell ID of the interfering signal.

Parameters:

<ISCellId> integer

Range: 0 to 1007
*RST: 0

Manual operation: See "Cell ID" on page 371

[:SOURce<hw>]:BB:NR5G:TCW:IS:DUPLex <ISDuplexing>

The duplexing mechanism used for the interfering signal can be switched between FDD and TDD.

Parameters:

<ISDuplexing> FDD | TDD

*RST: FDD

Manual operation: See "Duplexing" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS:FRSHift <ISFreqShift>

Sets the parameter "Frequency Shift m" for the interfering signal. With this setting, the allocated RB can be offset to a different center frequency.

Parameters:

<ISFreqShift> FS0 | FS1 | FS2 | FS3 | FS4 | FS9 | FS14 | FS19 | FS24 | FS29 | FS54 | FS79 | FS99

*RST: FS0

Manual operation: See "Frequency Shift m" on page 372

[:SOURce<hw>]:BB:NR5G:TCW:IS2:IFTYpe <InterfererType2>

Selects the type of the interfering signal. The second interfering signal is always a CW signal.

Parameters:
<InterfererType2> CW
*RST: CW

Manual operation: See "Interferer Type" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS:IFTYpe <InterfererType1>

Selects the type of the interfering signal:

- For **out-of-band blocking** tests, the interfering signal is fixed, set to a CW signal. (`CW`)
- For **receiver intermodulation** tests, the first interfering signal can be an 5G NR signal (`NR`) or narrow-band 5G NR signal (`NNR`).

Parameters:
<InterfererType1> NR | NNR | CW
*RST: NR

Manual operation: See "Interferer Type" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS:NRBLock?

Queries the No. of resource blocks of the interfering signal.

Return values:
<ISNumRB> integer
Range: 0 to 100
*RST: 25

Usage: Query only

Manual operation: See "Number of Resource Blocks" on page 371

[:SOURce<hw>]:BB:NR5G:TCW:IS:OFN <OffsetFactorN>

Set the offset factor for the interfering signal.

Parameters:
<OffsetFactorN> OFN_1 | OFN_2 | OFN_3
*RST: OFN_1

Manual operation: See "n" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS2:PLEVel?
[:SOURce<hw>]:BB:NR5G:TCW:IS:PLEVel?

Queries the power level of the interfering signal.

Return values:
<ISPowLevel> float

Range: -145 to 20
Increment: 0.1
*RST: -52
Default unit: dBm

Usage: Query only

Manual operation: See "Power Level" on page 372
See "Power Level" on page 375

[:SOURce<hw>]:BB:NR5G:TCW:IS:RBCFrequency?

Queries the center frequency of the interfering signal.

Return values:
<ISRbCenterFreq> integer

Range: 100e+03 to 6e+09
*RST: 1.95e+09
Default unit: Hz

Usage: Query only

Manual operation: See "Interfering RB Center Frequency" on page 372

[:SOURce<hw>]:BB:NR5G:TCW:IS2:RFFRequency?
[:SOURce<hw>]:BB:NR5G:TCW:IS:RFFRequency <ISRFFreq>

Queries the center frequency of the interfering signal 1 and 2.

Parameters:
<ISRFFreq> integer

Range: 100e+03 to 6e+09
*RST: 1.9575075e+09
Default unit: Hz

Manual operation: See "RF Frequency" on page 370

[:SOURce<hw>]:BB:NR5G:TCW:IS:RBOFfset <ISRBOffset>

Sets the RB offset of the interfering signal.

Parameters:
<ISRBOffset> integer

Range: 0 to 273
*RST: 0

Manual operation: See "RB Offset" on page 371

[:SOURce<hw>]:BB:NR5G:TCW:IS:SCSPacing?

Queries the sub-carrier spacing for the interfering signal.

Return values:

<ISSCS> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

N15, N30, N60, N120, N240, N480, N960
Normal cyclic prefix, value in kHz

E60
Extended cyclic prefix, 60 kHz

*RST: N15

Usage: Query only

Manual operation: See "Sub Carrier Spacing" on page 371

[:SOURce<hw>]:BB:NR5G:TCW:IS:TMODel?

Shows the test model set for the test case. The NR-TMs for FR1 are defined in TS 38.141-1 section 4.9.2.

Return values:

<TestModel> TM1_1

*RST: TM1_1

Usage: Query only

Manual operation: See "Test Model" on page 369

[:SOURce<hw>]:BB:NR5G:TCW:IS:TREQuire <ISTestRequire>

Selects whether the standard out-of-band blocking requirements test is performed (`BLPE`) or the optional blocking scenario, when the BS is co-located with another BS in a different operating band (`COBS`).

Parameters:

<ISTestRequire> BLPE | COBS

*RST: BLPE

Manual operation: See "Test Requirement" on page 370

[:SOURce<hw>]:BB:NR5G:TCW:IS:UEID <ISUEID>

Sets the UE ID/n_RNTI for the interfering signal.

Parameters:

<ISUEID> integer

Range: 0 to 65535
*RST: 0

Manual operation: See "UE ID" on page 371
See "UE ID" on page 375

[:SOURce<hw>]:BB:NR5G:TCW:MARKerconfig <MarkerConfig>

Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

Parameters:

<MarkerConfig> FRAM | UNCH

FRAM
The marker settings are customized for the selected test case. "Radio Frame Start" markers are output; the marker delays are set equal to zero.

UNCH
The current marker settings of the signal generator are retained unchanged.

*RST: FRAM

Manual operation: See "Marker Configuration" on page 359

[:SOURce<hw>]:BB:NR5G:TCW:MEIS <MinimumEIS>

Sets the lowest equivalent isotropic sensitivity value ($EIS_{minSENS}$) for the OSDD as specified in TS 38.141-2 D.27.

Parameters:

<MinimumEIS> float

Range: -145 to -10
Increment: 0.1
*RST: -101

Manual operation: See "Minimum EIS" on page 358

[:SOURce<hw>]:BB:NR5G:TCW:MUE:TSRS <TransmitSRS>

Turns transmission of the sounding reference signal for 3GPP test cases on and off.

Parameters:

<TransmitSRS> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Transmit SRS" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:OUTPut:MODE <SignalOutputs>

Selects the signal outputs used for the test case.

Prerequisites for this command

- Select a performance characteristics test case (3GPP 38.141-1 / -2, chapter 8).

Parameters:

<SignalOutputs> ALL | HSAL

ALL
Analog & digital output on the digital I/Q interface.

HSAL
Analog & digital output on the high speed digital I/Q interface.

*RST: ALL

Manual operation: See "Signal Outputs" on page 360

[:SOURce<hw>]:BB:NR5G:TCW:RELease <Release>

Sets the 3GPP test specification used as a guideline for the test cases.

Parameters:
<Release> REL15 | REL16 | REL17

*RST: REL15

Manual operation: See "Release" on page 356

[:SOURce<hw>]:BB:NR5G:TCW:SPEC <TestSpec>

Specifies the 3GPP test specification.

Parameters:
<TestSpec> TS38141_1 | TS38141_2 | TS38104

*RST: TS38141_1

Manual operation: See "Test Specification" on page 356

[:SOURce<hw>]:BB:NR5G:TCW:RTF:AUSDelay <AddUserDelay>

Defines the delay added to the real-time feedback.

Parameters:
<AddUserDelay> float

Range: -20 to -1
Increment: 0.01
*RST: -2

Manual operation: See "Additional User Delay" on page 376

[:SOURce<hw>]:BB:NR5G:TCW:RTF:BBSelector <BBSelector>

Defines which baseband selector index is used in the serial messages to address the baseband.

For some test case that test a moving UE, the command sets the connector of the moving UE.

Parameters:

<BBSelector> integer

Range: 0 to 3
*RST: 0

Manual operation: See "(Moving UE) Baseband Selector" on page 377

[:SOURce<hw>]:BB:NR5G:TCW:RTF:CONNector <Connector>

Queries the connector used for the real-time feedback.

For some test case that test a moving UE, the command queries the connector of the moving UE.

Note that the result of the query is always `LOCal`, because feedback always uses the local connector.

Return values:

<Connector> LOCal

*RST: LOCal

Manual operation: See "(Moving UE) Connector" on page 376

[:SOURce<hw>]:BB:NR5G:TCW:RTF:MODE <RTFMode>

Defines the serial line mode used for the real-time feedback.

- Serial
  Sets the serial line to 16 bits width.
- Serial 3x8
  Sets the serial line to an array with 3 times 8 bits width (24 bits).

Parameters:

<RTFMode> SERial | S3X8

*RST: SERial

Manual operation: See "Realtime Feedback Mode" on page 376

[:SOURce<hw>]:BB:NR5G:TCW:RTF:SUE:BBSelector <BBSelector>

Defines which baseband selector index is used in the serial messages to address the baseband for a stationary UE.

Parameters:

<BBSelector> integer

Range: 0 to 3
*RST: 1

Manual operation: See "Stationary UE Baseband Selector" on page 377

[:SOURce<hw>]:BB:NR5G:TCW:RTF:SUE:CONNector <Connector>

Queries the connector used for the real-time feedback of the stationary UE.

Note that the result of the query is always `LOCal`, because feedback always uses the local connector.

Return values:

<Connector> LOCal

*RST: LOCal

Manual operation: See "Stationary UE Connector" on page 377

[:SOURce<hw>]:BB:NR5G:TCW:RTF:SERRate <SerialRate>

Sets the bit rate of the serial transmission.

For test cases with high subcarrier spacing (SCS) and short slot duration, a serial rate of 115.2 kbps is insufficient. We recommend that you use higher serial rate so that at least one feedback command per slot is received.

Parameters:

<SerialRate> **R115 | R1M6 | R1M9**
115.2 kbps, 1.6 Mbps, 1.92 Mbps

CUST
Custom serial rate. You can define the serial rate with `[:SOURce<hw>]:BB:NR5G:TCW:RTF:CSRate` on page 956.

*RST: R1M9

Manual operation: See "Serial Rate" on page 376

[:SOURce<hw>]:BB:NR5G:TCW:RTF:CSRate <SerialRate>

Defines a custom serial rate.

Prerequisites for this command

- Select a custom serial rate (`[:SOURce<hw>]:BB:NR5G:TCW:RTF:SERRate`).

Parameters:

<SerialRate> integer

Range: 1E5 to 25E5
*RST: 192E4

Example: //Define custom serial rate

```
BB:NR5G:TCW:RTF:SERR CUST
BB:NR5G:TCW:RTF:CSR 250000
```

Manual operation: See "Serial Rate" on page 376

[:SOURce<hw>]:BB:NR5G:TCW:TC <TestCase>

Selects the test case.

Parameters:

<TestCase> TS381411_TC72 | TS381411_TC73 | TS381411_TC741 | TS381411_TC742A | TS381411_TC742B | TS381411_TC75 | TS381411_TC77 | TS381411_TC78 | TS381411_TC821 | TS381411_TC822 | TS381411_TC823 | TS381411_TC831 | TS381411_TC8321 | TS381411_TC8322 | TS381411_TC8331 | TS381411_TC8332 | TS381411_TC834 | TS381411_TC835 | TS381411_TC8361A | TS381411_TC8361B | TS381411_TC841 | TS381411_TC67 | TS381412_TC72 | TS381412_TC73 | TS381412_TC74 | TS381412_TC751 | TS381412_TC752A | TS381412_TC752B | TS381412_TC76 | TS381412_TC78 | TS381412_TC79 | TS381412_TC821 | TS381412_TC822 | TS381412_TC823 | TS381412_TC831 | TS381412_TC8321 | TS381412_TC8322 | TS381412_TC8331 | TS381412_TC8332 | TS381412_TC834 | TS381412_TC835 | TS381412_TC8361A | TS381412_TC8361B | TS381412_TC841 | TS381412_TC68 | TS381411_TC824 | TS381411_TC825 | TS381411_TC826 | TS381411_TC827 | TS381411_TC828 | TS381411_TC829 | TS381412_TC824 | TS381412_TC825 | TS381412_TC826 | TS381412_TC827 | TS381412_TC828 | TS381412_TC829 | TS381411_TC8210 | TS381412_TC8210 | TS381411_TC8211 | TS381412_TC8211 | TS381411_TC837 | TS381412_TC837 | TS381411_TC8381 | TS381412_TC8381 | TS381411_TC8382 | TS381412_TC8382 | TS381411_TC839 | TS381412_TC839 | TS381411_TC8310 | TS381412_TC8310 | TS381411_TC8212 | TS381412_TC8212 | TS381411_TC8213 | TS381412_TC8213 | TS381411_TC8311 | TS381412_TC8311 | TS381411_TC83122 | TS381411_TC83121 | TS381412_TC83121 | TS381411_TC8313 | TS381412_TC83122 | TS381412_TC8313

The first part of the parameter indicates the standard document and the second part the chapter in which the test case is defined. For example, `TS381411_TC72` defines the test case specified in TS 38.141-1 chapter 7.2.

*RST: TS381411_TC72

Manual operation: See "Test Case" on page 356

[:SOURce<hw>]:BB:NR5G:TCW:TRIGgerconfig <TrigConfig>

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

Parameters:

<TrigConfig> AAUT | UNCH

AAUT
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.

UNCH
The current trigger settings of the signal generator are retained unchanged.

*RST: AAUT

Manual operation: See "Trigger Configuration" on page 359

[:SOURce<hw>]:BB:NR5G:TCW:WS:ADMRs:STATe <AddDmrs>

Enables or disabled the additional DMRS.

Additional DMRS signals increase the probability that the UE receives the demodulation reference symbols. It leads to a support of lower SNR conditions.

Parameters:
<AddDmrs> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "Additional DMRS" on page 362

[:SOURce<hw>]:BB:NR5G:TCW:WS:CBW <WSChBw>

Selects the channel bandwidth.

Parameters:
<WSChBw> BW5 | BW10 | BW15 | BW20 | BW25 | BW30 | BW35 | BW40 | BW45 | BW50 | BW60 | BW70 | BW80 | BW90 | BW100 | BW200 | BW400 | BW800 | BW1600 | BW2000

Bandwidth in MHz

*RST: BW10

Manual operation: See "Channel Bandwidth" on page 363
See "Channel Bandwidth" on page 373

[:SOURce<hw>]:BB:NR5G:TCW:WS:CELLid <WSCellId>

Sets the cell ID.

Parameters:
<WSCellId> integer

Range: 0 to 1007
*RST: 0

Manual operation: See "Cell ID" on page 362
See "Cell ID" on page 373

[:SOURce<hw>]:BB:NR5G:TCW:WS:DUPLex <Duplexing>

The duplexing mechanism used can be switched between FDD and TDD.

Parameters:

<Duplexing> FDD | TDD

*RST: FDD

Manual operation: See "Duplexing" on page 363
See "Duplexing" on page 373

[:SOURce<hw>]:BB:NR5G:TCW:WS:FMTHroughput <FMT>

The required throughput is expressed as a fraction of maximum throughput for the FRC. The performance requirements assume HARQ retransmissions.

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs at the given SNR.

Parameters:

<FMT> FMT70 | FMT30

*RST: FMT70

Manual operation: See "Fraction of Max. Throughput" on page 363

[:SOURce<hw>]:BB:NR5G:TCW:WS:FRC:TYPE <WSFrc>

Queries the fixed reference channel (FRC) used.

See also 3GPP TS 138 141-1, annex A (normative): Reference measurement channels.

Parameters:

<WSFrc>

FR1A11 | FR1A12 | FR1A13 | FR1A14 | FR1A15 | FR1A16 | FR1A17 | FR1A18 | FR1A19 | FR2A11 | FR2A12 | FR2A13 | FR2A14 | FR2A15 | FR1A21 | FR1A22 | FR1A23 | FR1A24 | FR1A25 | FR1A26 | NA | FR1A38 | FR1A39 | FR1A310 | FR1A311 | FR1A312 | FR1A313 | FR1A314 | FR1A322 | FR1A323 | FR1A324 | FR1A325 | FR1A326 | FR1A327 | FR1A328 | FR1A48 | FR1A49 | FR1A410 | FR1A411 | FR1A412 | FR1A413 | FR1A414 | FR1A422 | FR1A423 | FR1A424 | FR1A425 | FR1A426 | FR1A427 | FR1A428 | FR1A58 | FR1A59 | FR1A510 | FR1A511 | FR1A512 | FR1A513 | FR1A514 | FR1A331 | FR1A332 | FR2A31 | FR2A32 | FR2A33 | FR2A34 | FR2A35 | FR2A36 | FR2A37 | FR2A38 | FR2A39 | FR2A310 | FR2A311 | FR2A312 | FR2A41 | FR2A42 | FR2A43 | FR2A44 | FR2A45 | FR2A46 | FR2A47 | FR2A48 | FR2A49 | FR2A410 | FR2A51 | FR2A52 | FR2A53 | FR2A54 | FR2A55 | FR2A313 | FR2A314 | FR2A315 | FR2A316 | FR2A317 | FR2A318 | FR2A319 | FR2A320 | FR2A321 | FR2A322 | FR2A323 | FR2A324 | FR2A411 | FR2A412 | FR2A413 | FR2A414 | FR2A415 | FR2A416 | FR2A417 | FR2A418 | FR2A419 | FR2A420 | FR2A56 | FR2A57 | FR2A58 | FR2A59 | FR2A510 | FR1A31 | FR1A32 | FR1A33 | FR1A34 | FR1A35 | FR1A36 | FR1A37 | FR1A315 | FR1A316 | FR1A317 | FR1A318 | FR1A319 | FR1A320 | FR1A321 | FR1A329 | FR1A330 | FR1A41 | FR1A42 | FR1A43 | FR1A44 | FR1A45 | FR1A46 | FR1A47 | FR1A415 | FR1A416 | FR1A417 | FR1A418 | FR1A419 | FR1A420 | FR1A421 | FR1A51 | FR1A52 | FR1A53 | FR1A54 | FR1A55 | FR1A56 | FR1A57 | FR1A110 | FR1A111 | FR1A333 | FR1A333A | FR1A334 | FR1A334A | FR2A71 | FR2A72 | FR2A73 | FR2A74 | FR2A75 | FR2A76 | FR2A77 | FR2A78 | FR2A79 | FR2A710 | FR1A429 | FR1A429A | FR1A430 | FR1A430A | FR1A431A | FR1A431 | FR1A432A | FR1A432 | FR1A3A1 | FR1A3A2 | FR1A3A3 | FR1A3A4 | FR1A3B1 | FR1A3B2 | FR1A3B3 | FR1A3B4 | TS381411_FR1A71 | TS381411_FR1A72 | TS381411_FR1A73 | TS381411_FR1A74 | TS381412_FR1A81 | TS381412_FR1A82 | TS381412_FR1A83 | TS381412_FR1A84 | FR2A325 | FR2A326 | FR2A3A1 | FR2A3A2 | FR2A3A3 | FR2A3A4 | FR2A3A5 | FR2A3A6 | FR2A3A7 | FR2A3A8 | TS38176_FR1A211 | TS38176_FR1A212 | TS38176_FR1A213 | TS38176_FR1A214 | TS38176_FR1A215 | TS38176_FR1A216 | TS38176_FR1A217 | TS38176_FR1A218 | TS38176_FR1A219 | TS38176_FR1A2110 | TS38176_FR1A2111 | TS38176_FR1A2112 | TS38176_FR1A2113 | TS38176_FR1A2114 | TS38176_FR1A2115 | TS38176_FR1A2116 | TS38176_FR1A231 | TS38176_FR1A232 | TS38176_FR1A233 | TS38176_FR1A234 | TS38176_FR1A235 |

TS38176_FR1A236 | TS38176_FR1A237 |
TS38176_FR1A238 | TS38176_FR1A239 |
TS38176_FR1A2310 | TS38176_FR1A2311 |
TS38176_FR1A2312 | TS38176_FR1A2313 |
TS38176_FR1A2314 | TS38176_FR1A241 |
TS38176_FR1A242 | TS38176_FR1A243 |
TS38176_FR1A244 | TS38176_FR1A245 |
TS38176_FR1A246 | TS38176_FR1A247 | TS38176_FR2A211 |
TS38176_FR2A212 | TS38176_FR2A213 |
TS38176_FR2A214 | TS38176_FR2A215 |
TS38176_FR2A216 | TS38176_FR2A217 |
TS38176_FR2A218 | TS38176_FR2A219 |
TS38176_FR2A2110 | TS38176_FR2A2111 |
TS38176_FR2A2112 | TS38176_FR2A2113 |
TS38176_FR2A2114 | TS38176_FR2A2115 |
TS38176_FR2A2116 | TS38176_FR2A2117 |
TS38176_FR2A2118 | TS38176_FR2A2119 |
TS38176_FR2A2120 | TS38176_FR2A2121 |
TS38176_FR2A2122 | TS38176_FR2A2123 |
TS38176_FR2A2124 | TS38176_FR2A221 |
TS38176_FR2A222 | TS38176_FR2A223 |
TS38176_FR2A224 | TS38176_FR2A225 |
TS38176_FR2A226 | TS38176_FR2A227 |
TS38176_FR2A228 | TS38176_FR2A229 |
TS38176_FR2A2210 | TS38176_FR2A231 |
TS38176_FR2A232 | TS38176_FR2A233 |
TS38176_FR2A234 | TS38176_FR2A235 |
TS38176_FR2A236 | TS38176_FR2A237 |
TS38176_FR2A238 | TS38176_FR2A239 |
TS38176_FR2A2310 | TS38176_FR2A2311 |
TS38176_FR2A2312 | TS38176_FR2A2313 |
TS38176_FR2A2314 | TS38176_FR2A2315 |
TS38176_FR2A2316 | TS38176_FR2A2317 |
TS38176_FR2A2318 | TS38176_FR2A2319 |
TS38176_FR2A2320 | TS38176_FR2A241 |
TS38176_FR2A242 | TS38176_FR2A243 |
TS38176_FR2A244 | TS38176_FR2A245 |
TS38176_FR2A246 | TS38176_FR2A247 |
TS38176_FR2A248 | TS38176_FR2A249 |
TS38176_FR2A2410 | FR1A112 | FR1A113 | FR1A114 |
FR1A115 | FR1A116 | FR1A117 | FR1A118 | FR1A119 |
FR1A27 | FR1A28 | FR1A29 | FR1A210 | FR1A211 | FR1A212 |
FR1A213 | FR1A214 | FR1A215 | FR1A216 |
TS381411_FR1A82 | TS381411_FR1A83 | TS381411_FR1A84 |
TS381411_FR1A81 | TS381411_FR1A85 | TS381412_FR1A91 |
TS381412_FR1A92 | TS381412_FR1A93 |
TS381412_FR1A94 | TS381412_FR1A95 | TS38181_FR1A11 |
TS38181_FR1A12 | TS38181_FR1A13 | TS38181_FR1A14 |
TS38181_FR1A15 | TS38181_FR1A16 | TS38181_FR1A17 |
TS38181_FR1A18 | TS38181_FR1A19 | TS38181_FR1A21 |

TS38181_FR1A22 | TS38181_FR1A23 | TS38181_FR1A24 | TS38181_FR1A25 | TS38181_FR1A26 | TS38181_FR1A31 | TS38181_FR1A32 | TS38181_FR1A33 | TS38181_FR1A34 | TS38181_FR1A35 | TS38181_FR1A36 | TS38181_FR1A3A1 | TS38181_FR1A3A3 | FR2A101 | FR2A102 | FR2A103 | FR2A105 | FR2A104 | FR2A106 | FR2A107 | FR2A108 | FR2A109 | FR2A1010 | FR2A1011 | FR2A1012 | FR1A335 | FR1A337 | FR1A336 | FR1A338 | FR1A3B5 | FR1A3B6 | FR1A3B7 | FR1A3B8 | FR2A327 | FR2A3B1 | FR2A3B2

FRxAyz: FRC G-FRx-Ay-z

*RST: FR1A12

Example: `SOURce1:BB:NR5G:TCW:WS:FRC:TYPE?`
`FR1A23` means `G-FR1-A2-3`

Manual operation: See "FRC" on page 363
See "FRC" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:FROFfset <FreqOffset>

Sets the frequency offset used for the PRACH.

Parameters:

<FreqOffset> FO_0 | FO_400 | FO_4000 | FO_625 | FO_1340 | FO_1740 | FO_2334 | FO_3334

*RST: FO_0

Manual operation: See "Frequency Offset" on page 364

[:SOURce<hw>]:BB:NR5G:TCW:WS:MAPType <MapType>

Sets the mapping type A or B for the PUSCH.

Parameters:

<MapType> A | B

*RST: A

Manual operation: See "Mapping Type" on page 364
See "Mapping Type" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:MODE <Mode>

Switches between the detection rate (Pd) and the false detection rate (Pfa).

Parameters:

<Mode> DRAT | FDR

DRAT
Pd is defined as the probability of detection of preamble.

FDR
Pfa is defined as the total probability of false detection of the preamble.

*RST: DRAT

Manual operation: See "Mode" on page 364

[:SOURce<hw>]:BB:NR5G:TCW:WS:PLEVel <WSPowLev>

Specifies the power level of the wanted signal.

Parameters:
<WSPowLev> float

Range: -145 to 20
Increment: 0.1
*RST: -101.1
Default unit: dB

Manual operation: See "Power Level" on page 364
See "Power Level" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:PRACh:FORMat <PrachFormat>

Sets the designated PRACH preamble format.

The preamble is used to obtain the UL synchronization. In 5G NR, there are 64 preambles defined in each time-frequency PRACH occasion. The preamble consists of two parts cyclic prefix (CP) and preamble sequence.

In 5G NR, there are 13 types of preamble format supported known as format 0, format 1, format 2, format 3, format A1, format A2, format A3, format B1, format B2, format B3, format B4, format C0, format C1.

Parameters:
<PrachFormat> F0 | FA1 | FA2 | FA3 | FB4 | FC0 | FC2

*RST: FA1

Manual operation: See "Preamble Format" on page 364

[:SOURce<hw>]:BB:NR5G:TCW:WS:PRACh:SCSPacing <PrachSCS>

Sets the subcarrier spacing using normal cyclic prefix (NCP) or extended cyclic prefix (ECP).

Parameters:
<PrachSCS> N1_25 | N15 | N30 | N60 | N120

*RST: N30

Manual operation: See "Sub Carrier Spacing (PRACH)" on page 365

[:SOURce<hw>]:BB:NR5G:TCW:WS:PROCondition <PropagCond>

The propagation conditions define the multipath fading environment.

They indicated as a combination of channel model name and maximum Doppler frequency, i.e. TDLA<DS>-<Doppler> where <DS> indicates the desired delay spread and <Doppler> indicates the maximum Doppler frequency.

Parameters:

<PropagCond> TDLB100D400 | TDLC300D100 | TDLA30D10 | AWGN | TDLA30D300 | TDLA30D75 | HST1NR350 | HST3NR350 | HST1NR500 | HST3NR500 | TDLC300D600 | TDLC300D1200 | MPX | MPY | MPZ

*RST: TDLB100D400

Manual operation: See "Propagation Conditions" on page 365
See "Propagation Conditions" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:PTRS:STATe <PTRS>

Enables PTRS (phase-tracking reference signal) for the wanted signal of the Test Cases"8.2.1 OTA PUSCH" and "8.2.3 OTA UCI multiplexed on PUSCH" with Base Station Type"2-O".

Parameters:

<PTRS> 1 | ON | 0 | OFF

*RST: 0

Manual operation: See "PTRS" on page 365

[:SOURce<hw>]:BB:NR5G:TCW:WS:RBOFfset <WSRbOffset>

Sets the resource block offset of the wanted signal.

Parameters:

<WSRbOffset> integer

Number of resource blocks.

Range: 0 to 273
*RST: 0

Manual operation: See "RB Offset" on page 365

[:SOURce<hw>]:BB:NR5G:TCW:WS:RFFRequency <WSRFFreq>

Sets the RF frequency of the wanted signal.

Parameters:

<WSRFFreq> integer

Range: 100e+03 to 6e+09
*RST: 1.95e+09

Manual operation: See "RF Frequency" on page 365
See "RF Frequency" on page 373

[:SOURce<hw>]:BB:NR5G:TCW:WS:RSET <RestrictedSet>

Selects the restricted set type for the PRACH.

Prerequisites for this command

- Select high speed train mode (`[:SOURce<hw>]:BB:NR5G:TCW:WS:TREQuire`).
- Select preamble format 0 (`[:SOURce<hw>]:BB:NR5G:TCW:WS:PRACh:FORMat`).

Parameters:

<RestrictedSet> ARES | BRES

ARES
Restricted set type A.

BRES
Restricted set type B.

*RST: ARES

Example:

```
//Configure restricted set
SOURce:BB:NR5G:TCW:SPEC TS38141_1
SOURce:BB:NR5G:TCW:TC TS381411_TC841
SOURce:BB:NR5G:TCW:WS:TREQuire HST
SOURce:BB:NR5G:TCW:WS:PRAC:FORM 0
SOURce:BB:NR5G:TCW:WS:RSET ARES
```

Manual operation: See "Restricted Set" on page 365

[:SOURce<hw>]:BB:NR5G:TCW:WS:SCSPacing <WSSubCarSpacing>

Sets the subcarrier spacing.

Parameters:

<WSSubCarSpacing> N15 | N30 | N60 | X60 | N120 | N240 | N480 | N960

N15, N30, N60, N120, N240, N480, N960
Normal cyclic prefix, value in kHz

E60
Extended cyclic prefix, 60 kHz

*RST: N30

Manual operation: See "Sub Carrier Spacing / Sub Carrier Spacing (BWP)" on page 365
See "Sub Carrier Spacing" on page 373

[:SOURce<hw>]:BB:NR5G:TCW:WS:SYMNumber <SymbolNumber>

Sets the number of used OFDM symbols.

The starting symbol index is 13 for 1 OFDM symbol and 12 for 2 OFDM symbols.

Parameters:
<SymbolNumber> integer
Range: 1 to 14
*RST: 14

Manual operation: See "Number of OFDM Symbols" on page 364

[:SOURce<hw>]:BB:NR5G:TCW:WS:TAPos <WSTypeAPos>

Sets the position of first DM-RS symbol for PUSCH (and PDSCH) mapping type A (`dmrs-TypeA-Position`).

Parameters:
<WSTypeAPos> integer
Range: 2 to 3
*RST: 2

Manual operation: See "DMRS Type A Position" on page 363

[:SOURce<hw>]:BB:NR5G:TCW:WS:TIOBase?

Queries the timing off base value.

Return values:
<TimingOffBase> float
Range: 0 to 6.2
Increment: 0.1
*RST: 0

Usage: Query only

Manual operation: See "Timing Offset Base Value" on page 366

[:SOURce<hw>]:BB:NR5G:TCW:WS:TSETup <TestSetup>

With the test setup selector, the signal definitions can be switched.

Parameters:
<TestSetup> TS_1 | TS_2
*RST: TS_1

Manual operation: See "Test Setup" on page 366

[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:BITS <UCIBits>

Set the number of UCI bits used.

Defines the size of the uplink control information bits carried in the PUCCH channel. They consist of the HARQ feedback, CSI and SR.

Parameters:
<UCIBits> B_7 | B_40
*RST: B_7

Manual operation: See "UCI Bits" on page 366

[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CGUCi:PATTern <CGUCIPattern>, <CGUCIBitCount>

Defines the CG-UCI pattern.

Parameters:
<CGUCIPattern> 18 bits
Bit pattern.
*RST: #H04800

<CGUCIBitCount> integer
Pattern length.
Range: 18 to 18
*RST: 18

Manual operation: See "CG-UCI Pattern" on page 366

[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSI1:PATTern <CSI1Pattern>

Defines the frequency and time domain of the CSI part 1 subcarrier location.

Parameters:
<CSI1Pattern> Nr5gPUCCHUcidataPattLenMax bits

Manual operation: See "CSI 1 Pattern" on page 363

[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSI2:PATTern <CSI2Pattern>

Defines the frequency and time domain of the CSI part 2 subcarrier location.

Parameters:
<CSI2Pattern> Nr5gPUCCHUcidataPattLenMax bits

Manual operation: See "CSI 2 Pattern" on page 363

[:SOURce<hw>]:BB:NR5G:TCW:WS:UCI:CSIPart <CSIPart>

Defines the CSI part selected for the test case.

The PUCCH-based CSI and the PUSCH-based CSI reporting, always padding the CSI report to the worst-case UCI payload size would result in too large overhead. For these cases, the CSI content is instead divided into two CSI parts.

Parameters:
<CSIPart> CSIP_1 | CSIP_2
*RST: CSIP_1

Manual operation: See "CSI Part" on page 362

[:SOURce<hw>]:BB:NR5G:TCW:WS:UEID <WSUeId>

Sets the UE ID.

Parameters:
<WSUeId> integer
Range: 0 to 65535
*RST: 0

Manual operation: See "UE ID" on page 367
See "UE ID" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:TREQuire <TestRequirement>

Selects the test requirement for 3GPP test cases.

Parameters:
<TestRequirement> NORM | HST
*RST: NORM

Manual operation: See "Test Requirement" on page 365
See "Test requirement" on page 374

[:SOURce<hw>]:BB:NR5G:TCW:WS:VDRF <VirtualDlRF>

Sets the virtual downlink RF frequency

Parameters:
<VirtualDlRF> integer
Range: 100e+03 to 6e+09
*RST: 1.00e+09

Manual operation: See "Virtual Downlink RF Frequency" on page 367

[:SOURce<hw>]:BB:NR5G:TCW:SUE:TSRS <State>

Turns transmission of the sounding reference signal for 3GPP test cases on and off.

Parameters:
<State> 1 | ON | 0 | OFF
*RST: 0

Manual operation: See "Transmit SRS" on page 375

Glossary: Abbreviations

Symbols

5G NR: 5G new radio

B

BW: Bandwidth

BWP: Carrier bandwidth part

C

CP: Cyclic prefix

CP-OFDM: Cyclic prefix OFDM, as known from LTE

D

DFT-s-OFDM: Discrete Fourier transform spread OFDM

DMRS: Demodulation reference signal

E

ECP: Extended cyclic prefix

F

FR: Frequency range

G

gNB: 5G NR base station

N

NCP: Normal cyclic prefix

P

PSS: Primary synchronisation signal

PTRS: Phase tracking reference signal

R

RB: Resource block

RE: Resource element

RS: Reference signal

S

SCS: Subcarrier spacing

SRS: Sounding reference signal

SS: Synchronisation signal

SSS: Secondary synchronisation signal

Glossary: 5G NR 3GPP specification references

Symbols

[1]: Rohde & Schwarz
Poster "Be ahead in 5G. Demystifying 5G NR"

T

TS 38.101: "User Equipment (UE) radio transmission and reception"

TS 38.104: "Base Station (BS) radio transmission and reception"

TS 38.133: "Requirements for support of radio resource management"

TS 38.141: "Base Station (BS) conformance testing"

TS 38.141-1: "Base Station (BS) conformance testing Part 1: Conducted conformance testing"

TS 38.141-2: "Base Station (BS) conformance testing Part 2: Radiated conformance testing"

TS 38.176: "Integrated Access and Backhaul (IAB) conformance testing"

TS 38.201: "Physical layer; General description"

TS 38.211: "Physical channels and modulation"

TS 38.212: "Multiplexing and channel coding"

TS 38.213: "Physical layer procedures for data"

TS 38.214: "Physical layer measurements"

TS 38.306: "User Equipment (UE) radio access capabilities"

TS 38.331: "Radio Resource Control (RRC) protocol specification "

TS 38.521: "Radio transmission and reception; Part 1, 2, 3"

TS 38.523: "User Equipment (UE) conformance specification; Part 1, 2, 3"

List of commands

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