

R&S[®]SMM-K60/-K117/-K178 Bluetooth[®] Signal Generation User Manual



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Version 07

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This document describes the following software options:

- R&S®SMM-K60 Bluetooth EDR (1441.1918.xx)
- R&S®SMM-K117 Bluetooth 5.x (1441.1799.xx)
- R&S®SMM-K178 Bluetooth 5.4 + Channel Sounding (1441.0886.xx)

This manual describes firmware version FW 5.30.175.xx and later of the R&S®SMM100A.

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Throughout this document, R&S® is indicated as R&S.

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1 Welcome to the Bluetooth options

The Bluetooth options R&S SMM-K60/-K117/-K178 are firmware applications that add functionality to generate signals in accordance with the Bluetooth standard.

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 SMM100A user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMM100A

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMM100A service manual.

1.1 Key features

R&S SMM-K60 key features

Option R&S SMM-K60 provides Bluetooth signals for basic rate (BR) and enhanced data rate (EDR) signals. These signals are in line with Bluetooth Core Specification v4.2. Also, the option provides low energy (LE) signals for the LE 1 Msymbol/s physical layer.

R&S SMM-K60 supports the following BR and EDR features:

- Support for three transport modes ACL+EDR, SCO and eSCO+EDR
- Support of all packet types for both the basic rate and the enhanced data rate modes.
- Generation of signals with up to 5238 frames sequence length
- Configuration of the packet contents with a convenient packet editor or all data packets, both with optional data whitening
- Generation of signals in line with the "Dirty Transmitter Test" specification. The test enables you to change the start phase, the frequency drift rate and the frequency drift deviation.
- Power ramp control with possibilities to choose ramp time, rise and fall offset
- Configuration of the clipping, filter and modulation settings

R&S SMM-K60 supports the following LE features:

- Support for two channel types, the "Advertising" and "Data" channel types
- Support of all Bluetooth packet types for LE 1 Msymbol/s physical layer (LE 1M PHY).
- Convenient packet editor for all supported packet types including optional data whitening

- Dirty transmitter test, compliant to the RF test specification with options to change start phase, frequency drift rate and frequency drift deviation
- Support of CRC corruption for every 2nd packet
- Power ramp control with configurable ramp time, rise and fall offsets
- Clipping, filter and modulation settings supported

R&S SMM-K117 key features

Option R&S SMM-K117 is an extension to option R&S SMM-K60. It provides Bluetooth LE signals in line with Bluetooth Core Specification v5.4.

Option R&S SMM-K117 supports the following LE features:

- Support for two channel types "Advertising" and "Data"
- Support of all Bluetooth packet types for uncoded LE 2 Msymbol/s physical layer (LE 2M PHY)
- Support of all Bluetooth packet types for LE coded 1 Msymbol/s physical layer (LE coded PHY)
- Support of CRC corruption for every 2nd packet
- Convenient packet editor for all supported packet types including optional data whitening.
- Dirty transmitter test, compliant to the RF test specification with options to change start phase, frequency drift rate, frequency drift deviation, and modulation index mode.
- Support of Bluetooth Direction Finding using Constant Tone Extension methods Angle of Arrival or Angle of Departure

R&S SMM-K178 key features

Option R&S SMM-K178 is an extension to option R&S SMM-K117. It provides Channel Sounding of Bluetooth LE signals in line with the Bluetooth Channel Sounding specification [2].

Option R&S SMM-K178 supports the following LE Channel Sounding features:

- Support of channel type "Channel Sounding"
- Support of Channel Sounding packet types CS SEQUENCE, Test Packet and CS LL CONTROL PDUs
- Support of LE uncoded PHY "LE 2M 2BT" with PHY 2 Msymbol/s modulation and bandwidth time product $BT = 2$
- Support CS subevent configuration
- Support CS step configuration including Mode-0, Mode-1, Mode-2 and Mode-3 configurations
- CS steps with user-defined random sequence or sounding sequence

For more information, refer to the Bluetooth Core Specification [1].

1.2 Accessing the Bluetooth dialog

To open the dialog with Bluetooth settings

- ▶ In the block diagram of the R&S SMM100A, select "Baseband > Bluetooth".

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".

1.3 What's new

This manual describes firmware version FW 5.30.175.xx and later of the R&S®SMM100A.

Compared to the previous version, it provides the new features listed below:

- Option Bluetooth 5.4 + Channel Sounding (R&S SMM-K178) related to the Bluetooth release providing Channel Sounding (CS) for Bluetooth LE devices, see [Chapter 2.3, "About Bluetooth LE Channel Sounding"](#), on page 25.
- CS settings of option R&S SMM-K178:
 - [Chapter 5.1, "Channel settings"](#), on page 44 including settings to configure the channel type, packet type, packet PHY, CS event and CS role.
 - [Chapter 5.4, "CS subevent configuration"](#), on page 91 including settings to configure the CS subevent, channel table, CS security and channel selection.
 - [Chapter 5.4.5, "CS step configuration"](#), on page 99 including CS step settings to configure the main mode and the submode for subevent 0.
 - [Chapter 5.4.6, "CS step info"](#), on page 108 including CS step information for individual CS steps per subevent
 - [Chapter 5.5, "CS control data payload settings"](#), on page 112 including settings to configure the payload of CS_CONTROL_DATA PDUs.
- User-defined Sync Word in the test packet header for LE uncoded PHYs, see ["Sync Word"](#) on page 131 and ["User Pattern\(hex\)"](#) on page 131.
- Payload type "Data List" added for a test packet, see ["Payload Type"](#) on page 131.
- Command for querying common filter type and EDR-specific filter type, see [\[:SOURCE<hw>\]:BB:BT0oth:FILTer:FILTerS?](#) on page 282.
- Editorial changes

1.4 Documentation overview

This section provides an overview of the R&S SMM100A user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/smm100a

1.4.1 Getting started manual

Introduces the R&S SMM100A 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.

1.4.2 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 SMM100A is not included.

The contents of the user manuals are available as help in the R&S SMM100A. 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.

1.4.3 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>

1.4.4 Instrument security procedures

Deals with security issues when working with the R&S SMM100A in secure areas. It is available for download on the internet.

1.4.5 Printed safety instructions

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

1.4.6 Specifications and product brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S SMM100A. It also lists the firmware applications 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/smm100a

1.4.7 Calibration certificate

The document is available on <https://gloris.rohde-schwarz.com/calcert>. You need the device ID of your instrument, which you can find on a label on the rear panel.

1.4.8 Release notes and open source acknowledgment

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

The software uses several valuable open source software packages. An open source acknowledgment document provides verbatim license texts of the used open source software.

www.rohde-schwarz.com/firmware/smm100a

1.4.9 Application notes, application cards, white papers, etc.

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

For some application sheets, see also:

www.rohde-schwarz.com/application/smm100a

1.4.10 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

1.5 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 SMM100A user manual.

1.6 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 Bluetooth options

The R&S SMM100A provides you with the ability to generate signals in accordance with the core specification 5.4 for Bluetooth wireless technology.

This section lists required options and provides background information on basic terms and principles used in Bluetooth technology.

2.1 Required options

The basic equipment layout for generating Bluetooth signals includes the:

- Baseband Generator(R&S SMM-B9)
- Frequency option (e.g. R&S SMM-B1006)
- Baseband real-time extension (R&S SMM-K520)
- Option Bluetooth EDR (R&S SMM-K60)
- Option Bluetooth 5.x (R&S SMM-K117), requires R&S SMM-K60
- Option Bluetooth 5.4 + Channel Sounding (R&S SMM-K178), requires R&S SMM-K117

You can generate signals via playback of waveform files at the signal generator. To create the waveform file with 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, for example, R&S SMM-K255 for playing LTE waveforms.
- If supported, install the real-time option of the digital standard, for example, R&S SMM-K55 for playing LTE waveforms.

For more information, refer to the specifications document.

2.2 About Bluetooth LE

The R&S SMM100A provides you with the ability to generate signals in accordance with the Low Energy (LE) specification for Bluetooth wireless technology.

Bluetooth LE provides data transfer from low-power devices running on the smallest of batteries to a larger device, for example, a PC or a mobile phone. Bluetooth LE establishes a connection, for example, to a wristwatch, a heart rate sensor, or a data transfer from a digital camera. The generated packets do not support audio content.

A time division duplex (TDD) scheme for duplex transmission is defined. The frequency band defined for Bluetooth devices is the unlicensed 2.4 GHz "Industrial, Scientific and Medical" (ISM) frequency band.

Table 2-1: Operating band

Frequency range	RF channels k and center frequencies f
2400.0 MHz to 2483.5 MHz	k = 0 to 39, f = k * 2 MHz + 2402 MHz

Table 2-2: Channel index

RF channel	RF center frequency	Data channel index	Advertising channel index
0	2402 MHz	-	37
1 to 11	2404 MHz to 2424 MHz	0 to 10	-
12	2426 MHz	-	38
13 to 38	2428 MHz to 2478 MHz	11 to 36	-
39	2480 MHz	-	39

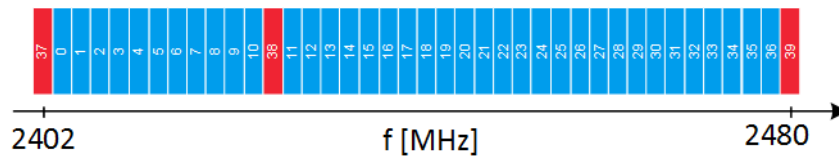


Figure 2-1: RF channels

red = primary advertising channels
 blue = data channels and secondary advertising channels

The minimum output power is -20 dBm. The maximum output power for LE is 20 dBm. For more information on the limits of the output power level, see [1].

The following sections provide a detailed overview on LE signal characteristics:

- Packet formats for LE..... 14
- Packet types for LE..... 16
- Advertising channel packet structure..... 18
- Data channel packet structure..... 20
- Modulation scheme..... 20
- Direction finding..... 21

2.2.1 Packet formats for LE

Packet formats for LE uncoded PHY

The following packet format defines the LE uncoded physical layers (PHYs) LE 1M and LE 2M. Advertising channel packets and data channel packets use this format.

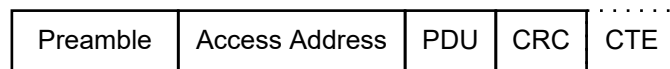


Figure 2-2: LE uncoded PHY packet format

Each packet consists of four mandatory fields: Preamble, Access Address, Protocol Data Unit (PDU) and Cyclic Redundancy Check (CRC). For Bluetooth direction finding, the optional field Constant Tone Extension (CTE) is at the end of the packet. See also [Chapter 2.2.6, "Direction finding"](#), on page 21.

Table 2-3: LE uncoded PHYs and field lengths

PHY	Preamble	Access address	PDU	CRC	CTE
LE 1M	1 octet	4 octets	2 octets to 257 octets	3 octets	16 µs to 160 µs
LE 2M	2 octets	4 octets	2 octets to 257 octets	3 octets	16 µs to 160 µs

When transmitting a packet, a Bluetooth receiver receives the preamble first and CTE last. For packet transmission, the symbol rate stays the same but is different for different PHYs. The table below provides an overview including the required option.

PHY	Symbol rate	Required options
LE 1M	1 Msymbol/s	R&S SMM-K60
LE 2M	2 Msymbol/s	R&S SMM-K117

The transmit time for an LE uncoded PHY packet is between 44 µs and 2120 µs. The period extends by an additional period of 16 µs to 160 µs, if CTE is active.

Packet formats for LE coded PHY

The following packet format defines the PHY LE Coded. Advertising channel packets and data channel packets use this format.

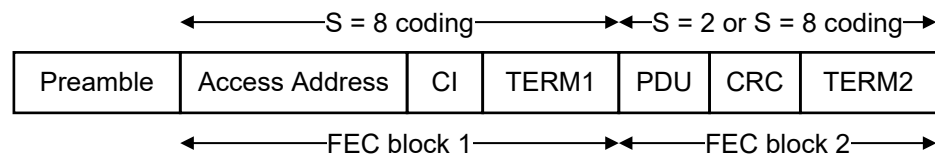


Figure 2-3: LE coded PHY packet format

Each packet consists of the Preamble, a Forward Error Correction (FEC) block 1, and FEC block 2. The preamble is not coded. The FEC block 1 consists of three fields: Access Address, Coding Indicator (CI), and TERM1. These fields use the S=8 coding scheme. The CI field determines the coding scheme for the FEC block 2. The FEC block 2 consists of three fields: PDU, CRC, and TERM2. These fields use either the S=2 or S=8 coding scheme, depending on the value of the CI field.

The entire packet is transmitted with 1 Msymbol/s modulation. The following table captures the size and duration of the data packet fields.

Table 2-4: Packet format for LE coded PHY

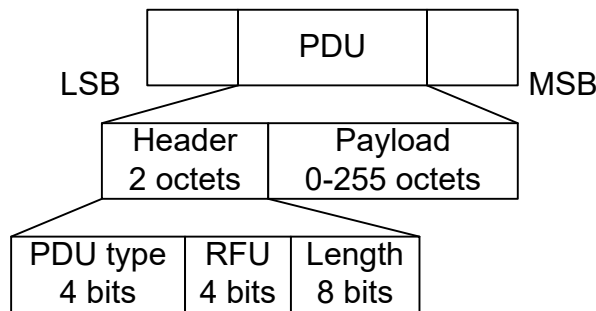
	Pream- ble	Access address	CI	TERM1	PDU	CRC	TERM2
Number of uncoded bits	80	32	2	3	16 - 2056	24	3
Duration in μ s for S=8 coding	80	256	16	24	128 - 16448	192	24
Duration in μ s for S=2 coding	80	256	16	24	32 - 4112	48	6

Packets take between 462 μ s and 17040 μ s to transmit.

2.2.2 Packet types for LE

Test packet types

The test packet PDU consists of a PDU header and the payload field. The PDU header indicates the payload content type and the payload length expresses in octets. RFU field means reserved for future use.



LE test packets are described in the "Air Interface Packets" section of the core specification for Bluetooth wireless technology, volume 6, part B.

Advertising channel packet types

The advertising channel PDU has a 16-bit header and a variable-size payload. The header fields of the advertising channel PDU are as shown in "Header" on page 18.

Table 2-5: Advertising packets for R&S SMM-K60

ADV_IND	SCAN_REQ
ADV_DIRECT_IND	SCAN_RSP
ADV_NONCONN_IND	CONNECT_IND
ADV_SCAN_IND	

Table 2-6: Advertising packets for R&S SMM-K117

ADV_EXT_IND	AUX_SCAN_REQ
AUX_ADV_IND	AUX_SCAN_RSP

AUX_CHAIN_IND	AUX_CONNECT_REQ
AUX_SYNC_IND	AUX_CONNECT_RSP

Data channel packet types

The data channel PDU has a 16-bit header, a variable size payload, and can include a message integrity check (MIC) field as shown in "Header" on page 20.

The MIC field is not included in an unencrypted link layer (LL) connection, or in an encrypted LL connection with a data channel PDU with a zero length payload. The MIC field is included in an encrypted LL connection, with a data channel PDU with a non-zero length payload. The MIC calculation is specified in the section 1 of the core specification for Bluetooth wireless technology, volume 6, part E.

Besides the data packet type, the instrument supports the following CONTROL_DATA packet types.

Table 2-7: Control data packets for R&S SMM-K60

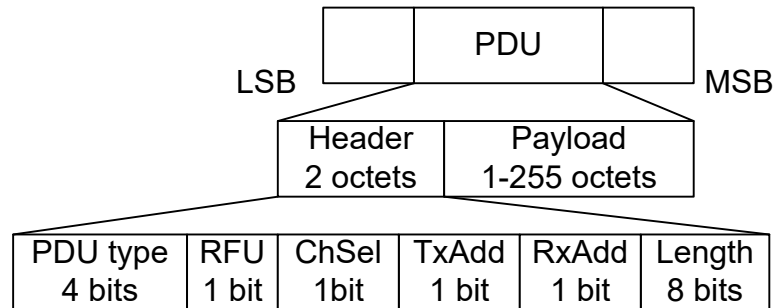
Opcode	CONTROL_DATA	Opcode	CONTROL_DATA
0x00	LL_CONNECTION_UPDATE_IND	0x07	LL_UNKNOWN_RSP
0x01	LL_CHANNEL_MAP_IND	0x08	LL_FEATURE_REQ
0x02	LL_TERMINATE_IND	0x09	LL_FEATURE_RSP
0x03	LL_ENC_REQ	0x0A	LL_PAUSE_ENC_REQ
0x04	LL_ENC_RSP	0x0B	LL_PAUSE_ENC_RSP
0x05	LL_START_ENC_REQ	0x0C	LL_VERSION_IND
0x06	LL_START_ENC_RSP	0x0D	LL_REJECT_IND

Table 2-8: Control data packets for R&S SMM-K117

Opcode	CONTROL_DATA	Opcode	CONTROL_DATA
0x0E	LL_PERIPHERAL_FEAT_REQ	0x14	LL_LENGTH_REQ
0x0F	LL_CONNECTION_PARAM_REQ	0x15	LL_LENGTH_RSP
0x10	LL_CONNECTION_PARAM_RSP	0x16	LL_PHY_REQ
0x11	LL_REJECT_EXT_IND	0x17	LL_PHY_RSP
0x12	LL_PING_REQ	0x18	LL_PHY_UPDATE_IND
0x13	LL_PING_RSP	0x19	LL_MIN_USED_CHANNELS_IND

2.2.3 Advertising channel packet structure

Header



- The possible **PDU types**, indicated in the header of advertising channel PDU, are listed in the previous tables, see [Table 2-5](#).

Table 2-9: PDU types and PHYs

PDU type	PDU name	Physical channel	LE 1M	LE 2M	LE Coded
0000 _b	ADV_IND	Primary advertising	Yes	No	No
0001 _b	ADV_DIRECT_IND	Primary advertising	Yes	No	No
0010 _b	ADV_NONCONN_IND	Primary advertising	Yes	No	No
0011 _b	SCAN_REQ	Primary advertising	Yes	No	No
0011 _b	AUX_SCAN_REQ	Secondary advertising	Yes	Yes	Yes
0100 _b	SCAN_RSP	Primary advertising	Yes	No	No
0101 _b	CONNECT_IND	Primary advertising	Yes	No	No
0101 _b	AUX_CONNECT_REQ	Secondary advertising	Yes	Yes	Yes
0110 _b	ADV_SCAN_IND	Primary advertising	Yes	No	No
0111 _b	ADV_EXT_IND	Primary advertising	Yes	No	Yes
0111 _b	AUX_ADV_IND	Secondary advertising	Yes	Yes	Yes
0111 _b	AUX_SCAN_RSP	Secondary advertising	Yes	Yes	Yes
0111 _b	AUX_SYNC_IND	Secondary advertising	Yes	Yes	Yes
0111 _b	AUX_CHAIN_IND	Secondary advertising	Yes	Yes	Yes
1000 _b	AUX_CONNECT_RSP	Secondary advertising	Yes	Yes	Yes
Others	Reserved for future use				

- The **ChSel**, **TxAdd** and **RxAdd** fields contain information specific to the PDU type. If the ChSel, TxAdd or RxAdd fields are not defined as used in a given PDU then they are reserved for future use.
- The **Length** field indicates the payload field length in octets.

Payload

The advertising channel PDU types consist of three groups.

Table 2-10: Advertising channel PDU types

PDU type	PDU name	Option
Advertising PDU (legacy)	ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_SCAN_IND	R&S SMM-K60
Advertising PDU (extended)	ADV_EXT_IND, AUX_ADV_IND, AUX_SYNC_IND, AUX_CHAIN_IND	R&S SMM-K117
Scanning PDU	SCAN_REQ, SCAN_RSP	R&S SMM-K60
Scanning PDU	AUX_SCAN_REQ, AUX_SCAN_RSP	R&S SMM-K117
Initiating PDUs	CONNECT_IND	R&S SMM-K60
Initiating PDUs	AUX_CONNECT_REQ, AUX_CONNECT_RSP	R&S SMM-K117

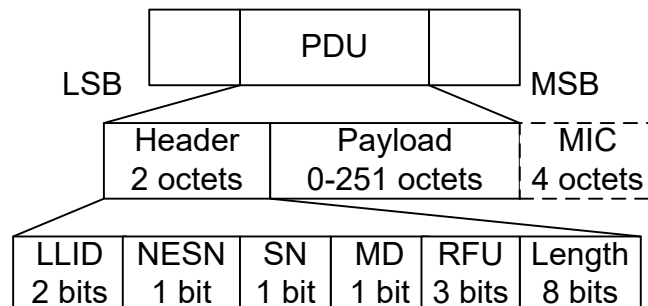
Table 2-11: Advertising channel PDU fields and subfields

PDU name	Field and parameter	Option
ADV_IND, ADV_NON-CONN_IND, ADV_SCAN_IND	AdvA, AdvData	R&S SMM-K60
ADV_DIRECT_IND	AdvA, TargetA (formerly InitA)	R&S SMM-K60
ADV_EXT_IND, AUX_ADV_IND, AUX_SYNC_IND, AUX_CHAN_IND	Extended Header Length, AdvMode, Extended Header, AdvData Extended Header subfields: AdvA, TargetA, ADI, AuxPtr, SyncInfo, Tx Power, ACAD, AdvData	R&S SMM-K117
SCAN_REQ	ScanA, AdvA	R&S SMM-K60
SCAN_RSP	AdvA, ScanRspData	R&S SMM-K60
AUX_SCAN_REQ	ScanA, AdvA Extended Header Length, AdvMode, Extended Header, AdvData Extended Header subfields: see above	R&S SMM-K117
CONNECT_IND	InitA, AdvA, LLData LLData subfields: AA, CRCinit, WinSize, WinOffset, Interval, Latency, Timeout, ChM, Hop, and SCA fields	R&S SMM-K60
AUX_CONNECT_REQ	InitA, AdvA, LLData LLData subfields: see above	R&S SMM-K117
AUX_CONNECT_RSP	Extended Header Length, AdvMode, Extended Header, AdvData Extended Header subfields: see above	R&S SMM-K117

For more information, refer to the section Advertising channel PDU in [1].

2.2.4 Data channel packet structure

Header



The 16-bit header field consists of five fields:

- The **LLID** field of the header specifies the payload format, see "[Payload](#)" on page 20.
- The **NESN** bit indicates a nextExpectedSeqNum used by the peer to acknowledge the last PDU sent, or to request resending.
- The **SN** bit indicates a transmitSeqNum to identify packets sent by the link layer.
- The **MD** bit indicates, whether the device has more data to send.
- The **Length** field indicates the length of the payload and MIC if included.

Payload

- An **LL data PDU** is used to send L2CAP data. The LLID field is set to either 01b or 10b.
 - For the LLID field set to 01b, the LL data PDU is a continuation fragment of an L2CAP message, or an empty PDU. The LL of the Central sends an empty PDU to the Peripheral to allow the Peripheral to respond with any data channel PDU, including an empty PDU.
 - For the LLID field set to 10b, the LL data PDU is a start of an L2CAP message or a complete L2CAP message with no fragmentation.
- An **LL control PDU** is used to control the LL connection. The payload consists of Opcode and CtrData fields. All LL control PDUs have a fixed length, depending on the Opcode. The Opcode field identifies different types of LL Opcode PDU, see [Table 2-7](#).

For more information, refer to section Data channel PDU in [1].

2.2.5 Modulation scheme

The modulation is Gaussian frequency shift keying (GFSK) with a bandwidth bit period product $BT = 0.5$. The modulation index is between 0.45 and 0.55. The mandatory modulation scheme is 1 Msymbol/s modulation. It uses a shaped, binary FM to minimize transceiver complexity.

Option R&S SMM-K60 supports LE uncoded 1 Msymbol/s (LE 1M) physical layer (PHY).

Option R&S SMM-K117 supports LE Coded 1 Msymbol/s PHY and an optional modulation scheme LE uncoded 2 Msymbol/s (LE 2M) PHY.

2.2.6 Direction finding

Since Bluetooth version 5.1, a Bluetooth LE device can transmit its direction information to a Bluetooth receiver. The information is transmitted in the direction finding enabled packets in the LE uncoded PHY. In combination with location information sent on profile-level, the Bluetooth LE receiver can calculate its position.

Angle of Arrival (AoA) method

A Bluetooth LE transmitter sends direction finding enabled packets using a single antenna. A receiving Bluetooth LE peer device consists of an antenna array linked to an RF switch which forwards the combined antennae signal to a Bluetooth LE receiver.

The peer device switches its antennae while receiving parts of the packets and capturing I/Q samples. The I/Q samples are used to calculate the phase difference of the radio signal received by different antennae of the array.

For an array of two antennae with distance d , frequency f of the radio signal and speed of light c , the phase difference ψ calculates as follows:

$$\Psi = 2\pi d \cos(\Theta) \cdot \frac{f}{c}$$

The angle of arrival Θ is calculated as follows:

$$\Theta = \frac{\arccos(\Psi \cdot c)}{2\pi d \cdot f}$$

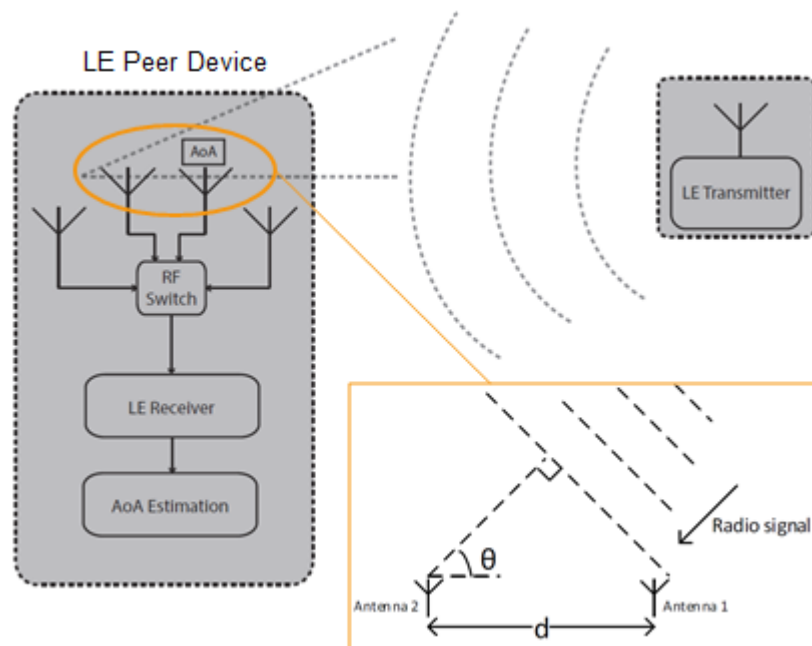


Figure 2-4: Angle of Arrival method

Angle of Departure (AoD) method

A Bluetooth LE transmitter sends direction finding enabled packets using an antenna array. A receiving Bluetooth LE device, consisting of a single antenna, captures I/Q samples and the geometry of the antenna array from profile-level information.

For an array with two antennae with distance d , frequency f of the radio signal and speed of light c , the phase difference ψ calculates as follows:

$$\Psi = 2\pi d \cos(\Theta) \cdot \frac{f}{c}$$

The angle of arrival Θ is calculated as follows:

$$\Theta = \frac{\arccos(\Psi \cdot c)}{2\pi d \cdot f}$$

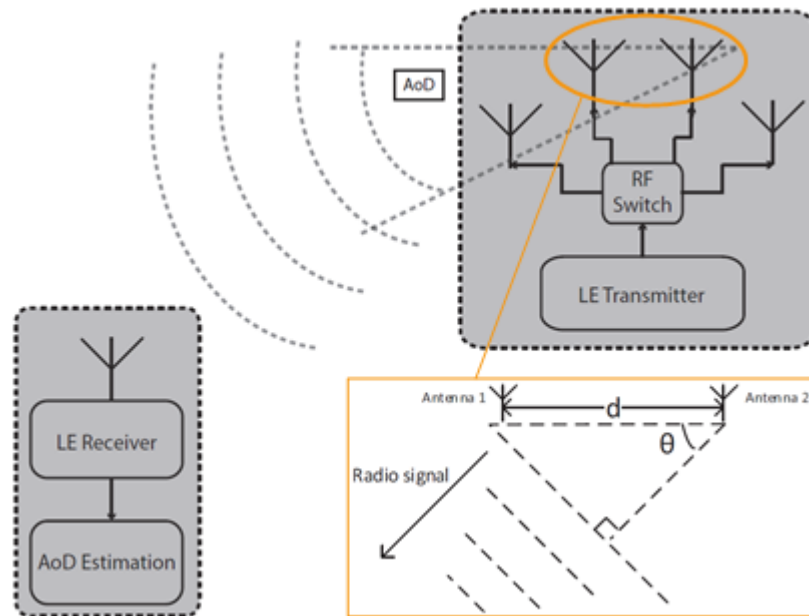


Figure 2-5: Angle of Departure method



The geometry of the antenna array is information that is shared between Bluetooth LE transmitter and receiver on a profile-level. The antenna switching pattern and the method of angle estimation is specified by Constant Tone Extension.

For more information, refer to the section Direction Finding Using Bluetooth Low Energy in [1].

Constant tone extension

To transmit direction finding information in packets in the Bluetooth LE Uncoded PHYs, the link layer packet format is extended by an optional field Constant Tone Extension (CTE) as illustrated in Figure 2-2. The field has a length between 16 μ s and 160 μ s and consists of a constantly modulated series of unwhitened 1s. This modulation results in a CW tone shifted by 250 kHz (LE 1M) or 500 kHz (LE 2M) from the LE channel center frequency.

The presence, type and length of CTE is specified in the CTEInfo field available for ADV_SYNC_IND and ADV_CHAIN_IND PDUs.

CTEInfo (8 bit)		
CTETime	RFU	CTEType

Figure 2-6: CTEInfo field

The parts of the CTEInfo field are described in the table below. CTEType specifies if the AoA or AoD method is used for direction finding.

CTEInfo field	Length	Value	Description
CTETime	5 bit	2 to 20	CTE length = 8 μs * Value Other values are reserved for future use.
RFU	1 bit	1 to 2	Reserved for future use
CTEType	2 bit	0 1 2 3	AoA Constant tone extension AoD Constant tone extension with 1 μs slots AoD Constant tone extension with 2 μs slots Reserved for future use

If Bluetooth LE devices support AoA/AoD CTE, the antennae within the array follow a switching pattern specified by the Host. After a guard and reference period, timeslots of 1 μs or 2 μs provide periods for antenna switching and I/Q sampling.

The following figure illustrates the CTE structure for the AoA method. On the transmitting side, there is no antenna switching. On the receiving side, antenna switching and I/Q sampling alternate in the timeslots after the guard and reference period.

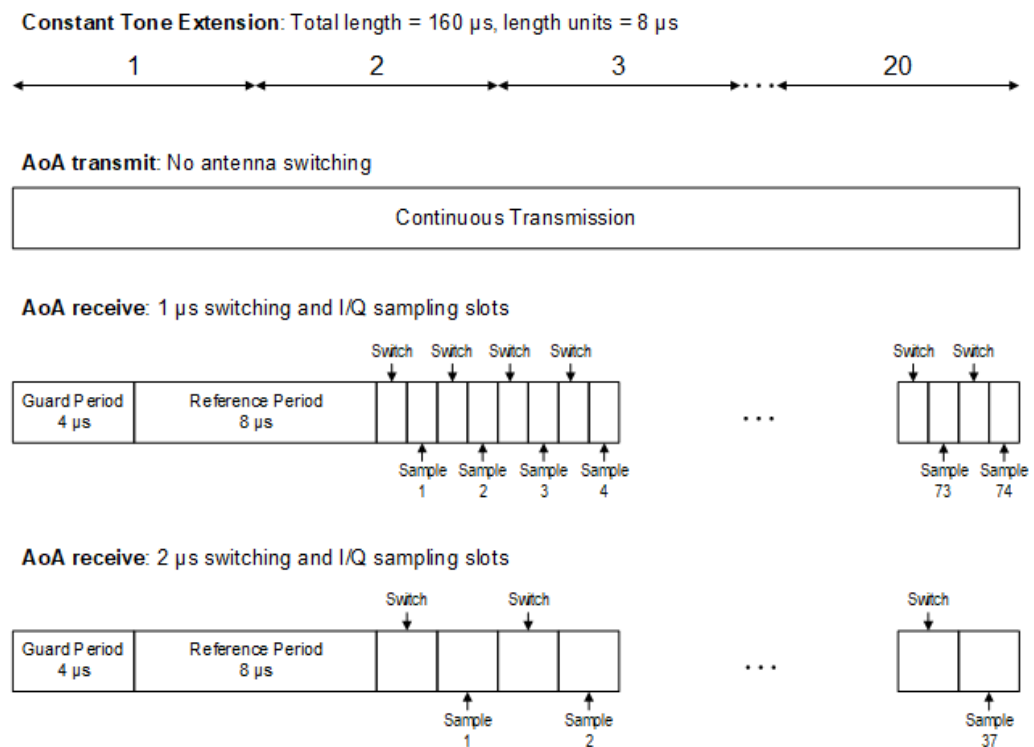


Figure 2-7: CTE structure for AoA method

The following figure illustrates the CTE structure for the AoD method. On the transmitting side, antenna switching and I/Q sampling alternate in the timeslots after the guard and reference period. On the receiving side, I/Q sampling is only in every second time-slot after the guard and reference period.

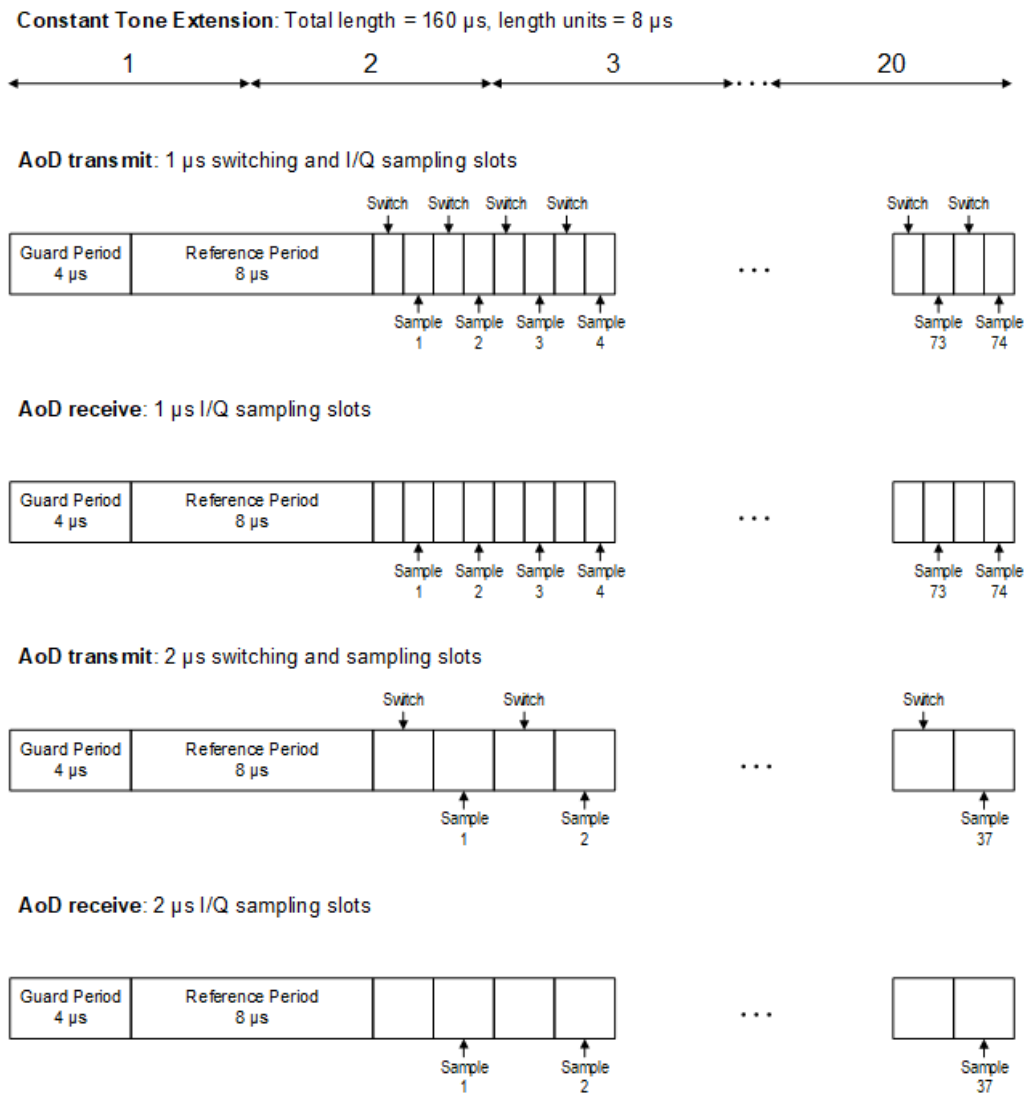


Figure 2-8: CTE structure for AoD method

For more information, refer to section 2.5 Constant Tone Extension and IQ Sampling of core specification for Bluetooth wireless technology, volume 6, part B.

2.3 About Bluetooth LE Channel Sounding

This section provides basic information on Bluetooth LE Channel Sounding technology. For the detailed information, refer to the Bluetooth specifications [2] and [1].

Channel Sounding architecture

Devices can use the LE Channel Sounding (CS) physical link to exchange information for distance estimation calculations. A CS procedure, including the first CS event within that procedure, is started offset from the timing of ACL connection event anchor points.

A CS procedure exists only for a limited duration, and consists of CS events, CS subevents, and CS steps.

CS events may contain one or more subevents. CS subevents contain two or more CS steps. CS steps contain bilateral exchanges between the two CS peers known as the initiator and reflector. The CS initiator transmits first in each step, followed by one or more transmissions from the CS reflector. These transmissions may be a packet-based GFSK-modulated exchange or a tone-based, amplitude shift keying modulated exchange, or both.

Channel Sounding RF channels

Table 2-12: Operating frequency band

Frequency range	RF channels k and center frequencies f
2400.0 MHz to 2483.5 MHz	$k = 0$ to 78, $f = k * 1 \text{ MHz} + 2402 \text{ MHz}$

Some channels are not allowed for CS communication. The table [Table 2-13](#) provides an overview on allowed channels and not allowed channels including the channel index and the center frequency of the channel.

Table 2-13: CS channel index and allowed channels

Channel index	RF center frequency	Channel allowed
0 and 1	2402 MHz and 2403 MHz	No
2 to 22	2404 MHz to 2424 MHz	Yes
23 to 25	2425 MHz to 2427 MHz	No
26 to 76	2428 MHz to 2478 MHz	Yes
77 and 78	2479 MHz and 2480 MHz	No

Fractional frequency offset actuation error (FAE)

The FAE feature allows a device to adapt its frequency hopping pattern to avoid interference from other wireless devices operating in the same frequency band.

The feature uses a list of channels in the FAE table, which is periodically updated based on the results of Channel Sounding procedures. When a device detects interference on a particular channel, it can switch to a different channel from the FAE table to avoid the interference.

2.4 About Bluetooth BR/EDR

The frequency band defined for Bluetooth devices is the unlicensed 2.4 GHz Industrial, Scientific and Medical (ISM) frequency band.

Table 2-14: Operating band

Regulatory range	RF channels k and center frequencies f
2400.0 MHz to 2483.5 MHz	$k = 0$ to 78, $f = k * 1 \text{ MHz} + 2402 \text{ MHz}$

Two modulation formats are used for Bluetooth: the mandatory basic rate (BR) and the optional enhanced data rate (EDR). The BR mode uses binary FM modulation and provides a data rate of 1 Mbit/s. The EDR mode uses two types of PSK modulation, the $\pi/4$ -DQPSK or 8DPSK, and achieves data rates of 2 Mbit/s and 3 Mbit/s, respectively. All modulation schemes have the symbol rate equal to 1 Msymbol/s.

A time division duplex (TDD) scheme for duplex transmission is defined for both modes.

The following sections describe signal characteristics in detail:

- [Bluetooth packet types for BR/EDR](#).....27
- [Bluetooth transport modes](#).....30
- [Packet structure and fields](#).....30
- [Bluetooth modulation schemes](#).....33

2.4.1 Bluetooth packet types for BR/EDR

2.4.1.1 ACL packets

The ACL packets are used for asymmetric links and they contain user data or control data. The table and the figures below give an overview of the ACL packets and their structure.

Table 2-15: ACL packet - basic rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot number
DM1	1	0-17	2/3	Yes, 16-bit	1
DH1		0-27	no		
DM3	2	0-121	2/3		3
DH3		0-183	no		
DM5		0-224	2/3		
DH5		0-339	no		
AUX1	1	0-29		no	5

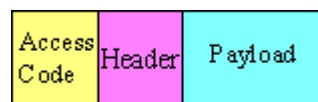


Figure 2-9: Packet structure of ACL packets - basic rate

Table 2-16: ACL packets - enhanced rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot number
2-DH1	2	0-54	no	Yes, 16-bit	1
2-DH3		0-367			3
2-DH5		0-679			5
3-DH1		0-83			1
3-DH3		0-552			3
2-DH5		0-1021			5



Figure 2-10: Packet structure of ACL packets - enhanced data rate

2.4.1.2 SCO and eSCO packets

The SCO and eSCO packets are used for symmetric links. The SCO packets are used for 64 kb/s speech transmission and for transparent synchronous data. The eSCO packets are also used for 64kb/s speech transmission and transparent data at 64 kb/s but also at other rates.

The tables and the figures below give an overview of the SCO and eSCO packets and their structure.

Table 2-17: SCO packets

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot number
HV1	n.a.	10	1/3	no	n.a.
HV2		20	2/3		
HV3		30			
DV	1 (data only)	10+(0-9)	2/3 (data only)	Yes, 16-bit (data only)	



Figure 2-11: Packet structure SCO packets

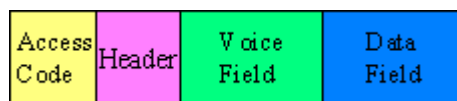


Figure 2-12: Packet structure SCO packets (data only)

Table 2-18: eSCO packets - basic rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot number
EV3	n.a.	1-30	no	Yes, 16-bit (Data only)	1
EV4		1-120	2/3		3
EV5		1-180	no		3

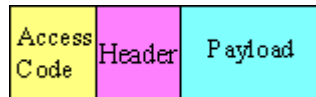


Figure 2-13: Packet structure eSCO packets - basic rate

Table 2-19: eSCO packets - basic rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot number
2-EV3	n.a.	1-60	no	Yes, 16-bit	1
2-EV5		1-360			3
3-EV3		1-90			1
3-EV5		1-540			3



Figure 2-14: Packet structure eSCO packets - enhanced data rate

2.4.1.3 Link control packets for ACL, SCO, eSCO transport modes

There are some common kinds of packet types. An overview of these packet types is given in the table below.

Table 2-20: Common link control packets

Transport modes	Type	Payload Header (bytes)	FEC	CRC	Application
SCO, eSCO, ACL	ID	n.a.	n.a.	n.a.	Paging, inquiry, response
SCO, eSCO, ACL	NULL				Carries Link information to the source, e.g. about successfully received signal (ARQN) or the state of the receiving buffer (FLOW)
SCO, eSCO, ACL	POLL				Similar to NULL packet, used by the Central to poll the Peripheral devices, must be confirmed
SCO, ACL	FHS	18	2/3	Yes	Page Central response, inquiry response, in roll switch

Table 2-21: Common link control packets: packet structure

Packet Type ID	Packet Types NULL and PULL	Packet Types FHS
Access Code (DAK or IAC)	Access Code Header	Access Code Header Payload

2.4.2 Bluetooth transport modes

There are three different transport modes defined in the Bluetooth core specification, each of them with special applications:

- Synchronous connection-oriented (SCO)
The SCO transport mode is used for a symmetric point-to-point link establishment between a Central and a specific Peripheral in the piconet.
- Extended synchronous connection-oriented (eSCO)
The eSCO transport mode is used for a symmetric or asymmetric, point-to-point link establishment between the Central and a specific Peripheral.
- Asynchronous connection less (ACL)
The ACL transport mode is used for a point-to-multipoint link establishment between the Central and all Peripheral participating on the piconet.

There are some common transmitted packets used by all transport modes and some specific packets defined for each transport mode.

2.4.3 Packet structure and fields

Almost all Bluetooth transmitted packets have standard format and consist of the access code, the header and the payload with useful information. The exceptions are the ID packet which consists of the access code only and NULL and POLL packets which carry only the access code and the header.

2.4.3.1 Access code

The access code is used for synchronization, DC offset compensation and identification. The fields of the access code are shown in the figure below and their meaning is explained in the table below.

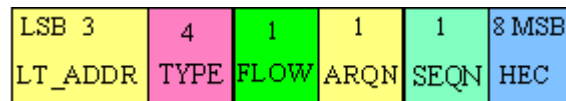
LSB 4	64	4 MSB
Preamble	Sync word	Trailer

Table 2-22: The access code fields

Field	Description	Packets
Preamble	A fixed zero-one pattern of 4 symbols, used to facilitate DC compensation	All packets
Sync word	A 64-bit code word derived from a 24-bit address, improves timing acquisition	All packets
Trailer	A fixed zero-one pattern of four symbols, extended DC compensation	All packets, except ID

2.4.3.2 Header

The header contains link control information. The fields of the header are shown in the figure and their meaning is explained in the table below.

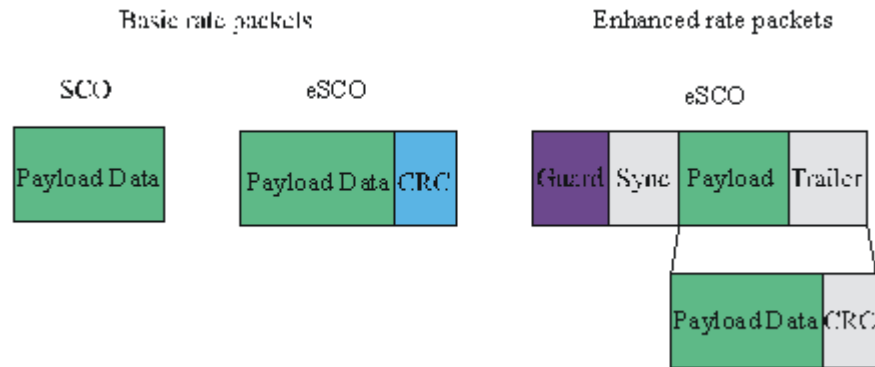
**Table 2-23: The header fields**

Field	Description	Packets
LT_ADDR	Logical transport address, indicates the destination Peripheral for a packet in a Central-to-Peripheral transmission slot and the source Peripheral for a Peripheral-to-Central transmission slot	
TYPE	Type code, specifies which packet type is used	
FLOW	Flow control, used for flow control of packets over the ACL logical transport. When the RX buffer in the recipient is full, a STOP indication must be returned. When the RX buffer can accept data, a "Go" indication must be returned.	All packets, except ID
ARQN	Automatic repeat request number, acknowledgement indication, used to inform the source of a successful transfer of payload data with CRC can be positive acknowledged ACK or negative acknowledged NAK,	
SEQN	Sequential numbering scheme to order the data packet stream	
HEC	Header-error-check to check the header integrity	

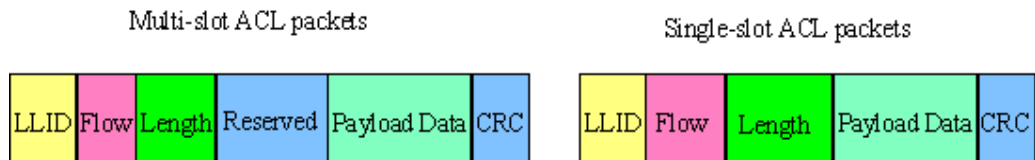
2.4.3.3 Payload format

The payload structure depends on the type of the data field and the data rate. Two fields are defined in the payload: the synchronous data field and the asynchronous data field. The ACL packets only have the asynchronous data field and the SCO and eSCO packets only have the synchronous data field. The exception is DV of SCO transport mode which has both data fields, synchronous and asynchronous.

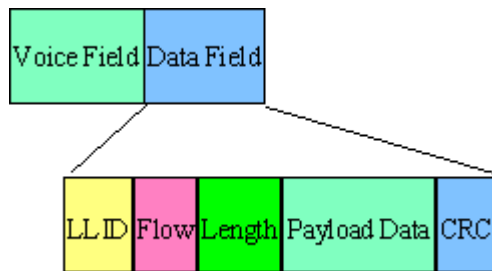
Synchronous data fields



Asynchronous data fields



Synchronous and asynchronous data fields



The meaning of some payload fields is given in the table below.

Table 2-24: The payload fields

Field	Description
CRC	The cyclic redundancy error check
Guard, sync	The guard time and synchronization sequence, used for physical layer change of modulation scheme
LLID	The logical link identifier, specifies the logical link
Flow	Field which controls the flow on the logical channels

The payload format and content of the FHS packet are different from other packets. The fields of the FHS packet are shown in the figure below and their meaning is explained in the table below.

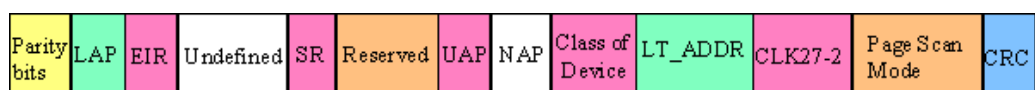


Table 2-25: The payload fields for the FHS packet

Field	Description
Parity bits	Form the first part of the sync word of the access code of the device that sends the FHS packet
LAP	Contains the lower address part of the device that sends the FHS packet
EIR	An extended inquiry response, provides miscellaneous information during the inquiry response procedure
Undefined	Reserved for future use and must be set to zero
SR	The scan repetition field, indicates the interval between two consecutive page scan windows
Reserved	Must be set to 10
UAP	Contains the upper address part of the device that sends the FHS packet
NAP	Contains the non-significant address part of the device that sends the FHS packet
Class of device	Contains the class of device of the device that sends the FHS packet. This field is defined in Bluetooth assigned numbers.
LT_ADDR	Contains the logical transport address
CLK27-2	Contains the value of the native clock of the device that sends the FHS packet, sampled at the beginning of the transmission of the access code of this FHS packet
Page scan mode	Indicates which scan mode is used by default by the sender of the FHS packet

2.4.4 Bluetooth modulation schemes

The modulation used for the basic data rate packets is GFSK (Gaussian Frequency Shift Keying) with a bandwidth bit period product $BT = 0.5$. The modulation index is between 0.28 and 0.35.

The modulation scheme used for enhanced data rate packets changes within the packet. The access code and packet header have a GFSK modulation scheme and are transmitted with the basic rate 1 Mbps. The subsequent synchronization sequence, payload and trailer sequence have a PSK type of modulation and are transmitted with a data rate of 2 Mbps or optionally 3 Mbps.

The PSK modulation, namely $\pi/4$ rotated differential encoded quaternary phase shift keying ($\pi/4$ -DQPSK) is defined for the 2 Mbps transmission.

The PSK modulation, namely differential encoded 8-ary phase shift keying (8DPSK), is defined for the 3 Mbps transmission.

The modulation types and corresponding packet types are given in the table below.

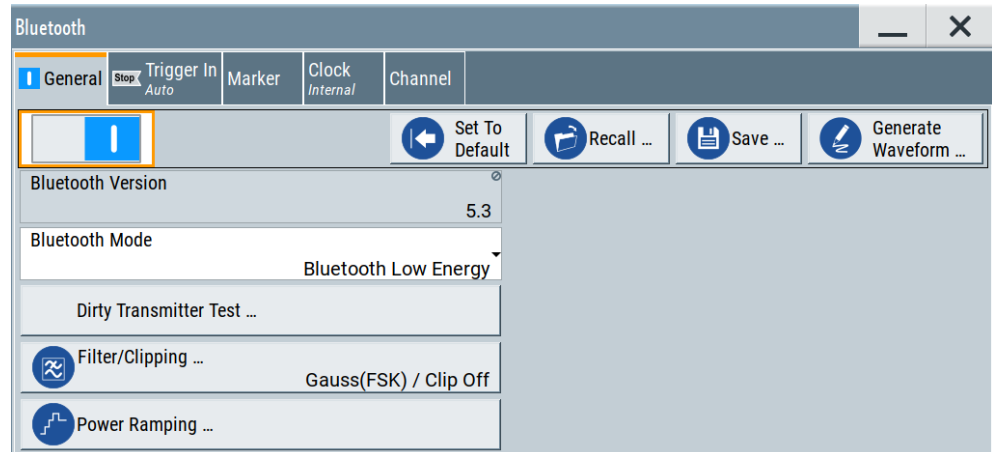
Table 2-26: The modulation types and corresponding packet types

Modulation type	Packet types
GFSK	ID, NULL, POLL, FHS, DM1, DH1, DM3, DH3, DM5, DH5, AUX1, HV1, HV2, HV3, DV, EV3, EV4, EV5
GFSK + $\pi/4$ -DQPSK	2-DH1, 2-DH3, 2-DH5, 2-EV3, 2-EV5
GFSK + 8DPSK	3-DH1, 3-DH3, 3-DH5, 3-EV3, 3-EV5

3 Bluetooth general settings

Access:

- ▶ Select "Baseband" > "Bluetooth".



The tab provides general settings to call default settings and the "Save"/"Recall" settings. Also, it provides Bluetooth version information, Bluetooth mode settings and access to further settings.

Settings:

State.....	35
Set To Default.....	35
Save/Recall.....	36
Generate Waveform.....	36
Bluetooth Version.....	37
Bluetooth Mode.....	37
Transport Mode.....	37
Dirty Transmitter Test.....	37
Filter/Clipping.....	37
Power Ramping.....	38

State

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

Remote command:

[:SOURce<hw>] :BB:BT0oth:STATe on page 165

Set To Default

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

Parameter	Value
State	Not affected by "Set To default"
Bluetooth version	R&S SMM-K60: 4.2 R&S SMM-K117: 5.4 R&S SMM-K178: 5.4 + Channel Sounding
Bluetooth mode	Basic Rate + EDR
Transport mode	ACL(Asynchronous)+EDR
Packet type	DH1
Sequence length	1 Frame
Slot timing	Tx Test Mode
Data whitening	Off
Dirty transmitter test	Off
Filter	Gauss(FSK)
Clipping state	Off
Power ramping function	Cosine
Trigger mode	Auto
Marker mode	Restart
Clock source	Internal

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:PRESet](#) on page 163

Save/Recall

Accesses the "Save/Recall" dialog, that is the standard instrument function for saving and recalling the complete dialog-related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The settings are saved in a file with predefined extension. You can define the filename and the directory, in that you want to save the file.

See also, chapter "File and Data Management" in the R&S SMM100A user manual.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:SETTing:CATalog](#) on page 164

[\[:SOURce<hw>\]:BB:BT0oth:SETTing:LOAD](#) on page 164

[\[:SOURce<hw>\]:BB:BT0oth:SETTing:STORe](#) on page 164

[\[:SOURce<hw>\]:BB:BT0oth:SETTing:DELeTe](#) on page 164

Generate Waveform

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.

Remote command:

[:SOURCE<hw>] :BB:BT00th:WAVEform:CREate on page 166

Bluetooth Version

Displays the version of the standard that the firmware supports.

The displayed version for Bluetooth wireless technology depends on installed options. For example, "Bluetooth Version" > "5.4" requires R&S SMM-K117.

Remote command:

[:SOURCE<hw>] :BB:BT00th:VERSion? on page 165

Bluetooth Mode

Selects the Bluetooth mode.

"Basic Rate + EDR"

Selects basic rate (BR) or enhanced data rate (EDR) Bluetooth mode. For related settings, see [Chapter 6, "Bluetooth BR/EDR configuration and settings"](#), on page 133.

"Bluetooth Low Energy"

Selects low energy (LE) Bluetooth mode. For related settings, see [Chapter 5, "Bluetooth LE configuration and settings"](#), on page 44.

Remote command:

[:SOURCE<hw>] :BB:BT00th:BMODE on page 163

Transport Mode

Requires "Bluetooth Mode" > "Basic Rate + EDR".

Selects the transport mode.

"ACL(Asynchronous)+EDR"

The transport mode selected is used for a point-to-multipoint link establishment between the Central and all the Peripheral devices participating on the piconet.

"SCO(Synchronous)"

The transport mode selected is used for a point-to-point link establishment between a Central and a single Peripheral in the piconet.

"eSCO(Extended SCO)+EDR"

The transport mode selected is used for a symmetric or asymmetric point-to-point link establishment between a Central and a specific Peripheral.

Remote command:

[:SOURCE<hw>] :BB:BT00th:TMODE on page 165

Dirty Transmitter Test

Opens a dialog to configure dirty transmitter tests.

See [Chapter 4, "Dirty transmitter test settings"](#), on page 39.

Filter/Clipping

Opens a dialog to configure the baseband filtering, the modulation settings and clipping.

The button also displays configured filters and the clipping state.

See [Chapter 7.1, "Filter/clipping settings"](#), on page 143.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:FILTerS?` on page 282

`[:SOURce<hw>] :BB:BT0oth:CLIPping:STATe` on page 282

Power Ramping

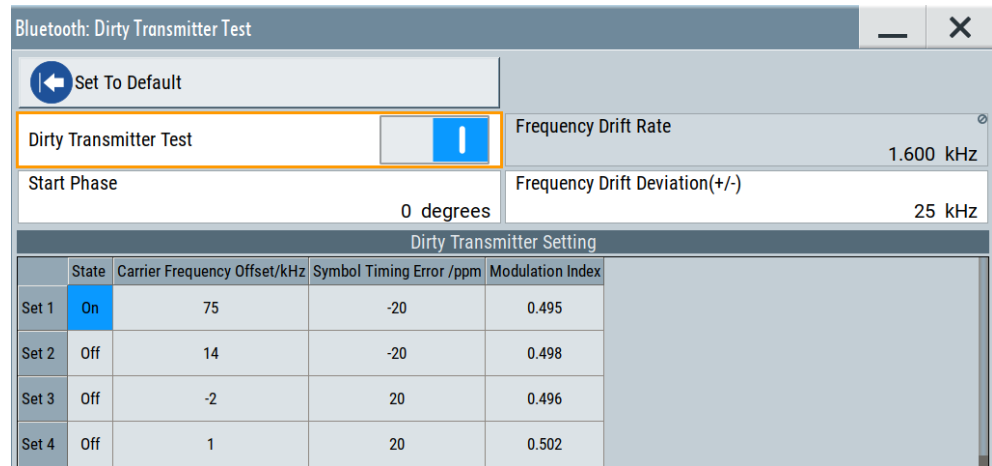
Opens a dialog to configure the power ramping.

See [Chapter 7.2, "Power ramping settings"](#), on page 149.

4 Dirty transmitter test settings

Access:

1. Select "Bluetooth" > "General".
2. Select "Dirty Transmitter Test".



The dialog provides settings to configure dirty transmitter test settings. These settings contain parameters that you can change for the central device signal. It is used to test the connection under 'dirty transmitter' conditions, and to define the influence on the receiver quality (bit error rate tests).

The following tables list dirty transmitter parameters according to the Bluetooth test specification. f_{offset} is the frequency offset, Δt_{error} is the symbol timing error and h is the modulation index.

Table 4-1: Dirty transmitter test parameters for BR

Set	f_{offset}	$\Delta t_{\text{error}}/\text{ppm}$	h
1	75	-20	0.28
2	14	-20	0.30
3	-2	20	0.29
4	1	20	0.32
5	39	20	0.33
6	0	-20	0.34
7	-42	-20	0.29
8	74	-20	0.31
9	-19	-20	0.28
10	-75	20	0.35

Table 4-2: Dirty transmitter test parameters for EDR

Set	f _{offset}	Δt _{error} /ppm
1	0	0
2	65	20
3	-65	-20

Table 4-3: Dirty transmitter test parameters for LE

Set	f _{offset}	Δt _{error} /ppm	h _{standard}	h _{stable} *)
1	100	-50	0.45	0.495
2	19	-50	0.48	0.498
3	-3	50	0.46	0.496
4	1	50	0.52	0.502
5	52	50	0.53	0.503
6	0	-50	0.54	0.504
7	-56	-50	0.47	0.497
8	97	-50	0.50	0.500
9	-25	-50	0.45	0.495
10	-100	50	0.55	0.505

*) h_{stable} requires R&S SMM-K117.

Settings:

Set To Default.....	40
Dirty Transmitter Test.....	41
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Modulation Index Mode.....	41
Frequency Drift Rate.....	41
Frequency Drift Deviation(+/-).....	41
Number Of Packets Per Set/Number Of Steps Per Set.....	42
Dirty Transmitter Setting.....	42
L State.....	42
L Carrier Frequency Offset (kHz).....	42
L Symbol Timing Error (ppm).....	43
L Modulation Index.....	43

Set To Default

Calls the default settings for the dirty transmitter test. Default settings are according to the specification for Bluetooth wireless technology. The setting corresponds to the selected Bluetooth mode.

Remote command:

[:SOURce<hw>] :BB:BT0oth:DTTest:STDefault on page 169

Dirty Transmitter Test

Enables the dirty transmitter test.

The setting is available for the following packet types:

- **BR:** DH1, DH3, DH5
For basic rate packets, each enabled set of parameters in the "Dirty Transmitter Setting" is used for a duration of 20 ms. After 20 ms, the following enabled set is used, continuing with the first enabled set after the sequence is completed.
- **EDR:** 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5, 2-EV3, 2-EV5, 3-EV3, 3-EV5
For EDR packets, the parameter sets apply for 20 packets each.
- **LE:** See the tables [Table 5-1](#) and [Table 5-2](#).
For LE packets, each enabled set of parameters in the "Dirty Transmitter Setting" is used. After transmitting a configured number of packets or steps, the enabled set is used. After the sequence is completed, the transmission continues with the first enabled set.
You can set up to 50 packets or steps, see "[Number Of Packets Per Set/Number Of Steps Per Set](#)" on page 42.

For more information, refer to the Bluetooth Core Specification [1].

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:DTTState](#) on page 167

Start Phase

Enters a start phase.

The start phase of the sine wave used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset is set here.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:SPHase](#) on page 169

Modulation Index Mode

Requires option R&S SMM-K117 and "Bluetooth Mode" > "Bluetooth Low Energy".

Specifies the mode of the modulation index h that is standard or stable.

"Standard" Standard modulation index h_{standard} with a range from 0.450 to 0.550.

"Stable" Stable modulation index h_{stable} with a range from 0.495 to 0.505.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:MIMode](#) on page 168

Frequency Drift Rate

Sets the frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset with the set frequency drift rate.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:FDRate](#) on page 168

Frequency Drift Deviation(+/-)

Sets the frequency drift deviation.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset. The maximum deviation reached during the drift equals the set frequency drift deviation.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:FDDeviation` on page 167

Number Of Packets Per Set/Number Of Steps Per Set

Setting the parameter requires "Bluetooth Mode" > "Bluetooth Low Energy" and one of the following:

"Number Of Packets Per Set"

Requires "Channel Type" > "Advertising" or "Data".

Sets the number of transmitted packets per enabled dirty transmitter set.

"Number Of Steps Per Set"

Requires "Channel Type" > "Advertising" or "Data".

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:NPPSet` on page 168

Dirty Transmitter Setting

Indicates the dirty transmitter parameters according to the Bluetooth test specification.

State ← Dirty Transmitter Setting

Enables the corresponding parameter set.

If deactivated, the parameters are skipped in the sequence, and the next active set is used.

Remote commands `...:LONG:SET<ch>:...` are used for BR and LE packets. The instrument provides a configuration of up to 10 sets (SET1 to SET10).

Remote commands `...:SHORT:SET<ch>:...` are used for EDR packets. The instrument provides a configuration of up to 3 sets (SET1 to SET3).

For basic rate packets, each enabled set applies to 20ms of signal. For EDR packets, each enabled set applies to 20 packets.

For LE, each enabled set applies to 50 test packets.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:STATE`
on page 171

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:STATE`
on page 172

Carrier Frequency Offset (kHz) ← Dirty Transmitter Setting

Determines a carrier frequency offset.

The center frequency of the modulated RF carrier is offset by the specified value.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:CFOffset`
on page 170

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:CFOffset`
on page 172

Symbol Timing Error (ppm) ← Dirty Transmitter Setting

Sets the symbol timing error in ppm.

The symbol timing error modifies the symbol clock frequency by the specified value.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:STError`
on page 171

`[:SOURce<hw>] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:STError`
on page 173

Modulation Index ← Dirty Transmitter Setting

Sets the modulation index.

The modulation index **h** specifies the frequency deviation, defined as:

$$h = \frac{2\Delta f}{f_{symbol}}$$

f_{symbol} is the symbol rate and Δf is the frequency deviation.

The modulation index can vary between 0.28 and 0.35.

For more information, refer to the Bluetooth Core Specification [1].

Remote command:

`[:SOURce<hw>] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:MINdex`
on page 170

5 Bluetooth LE configuration and settings

Access:

1. Select "Baseband" > "Bluetooth".
2. Select "Bluetooth Mode" > "Bluetooth Low Energy".

The remote commands required to define these settings are described in [Chapter 8](#), "Remote control commands", on page 160.

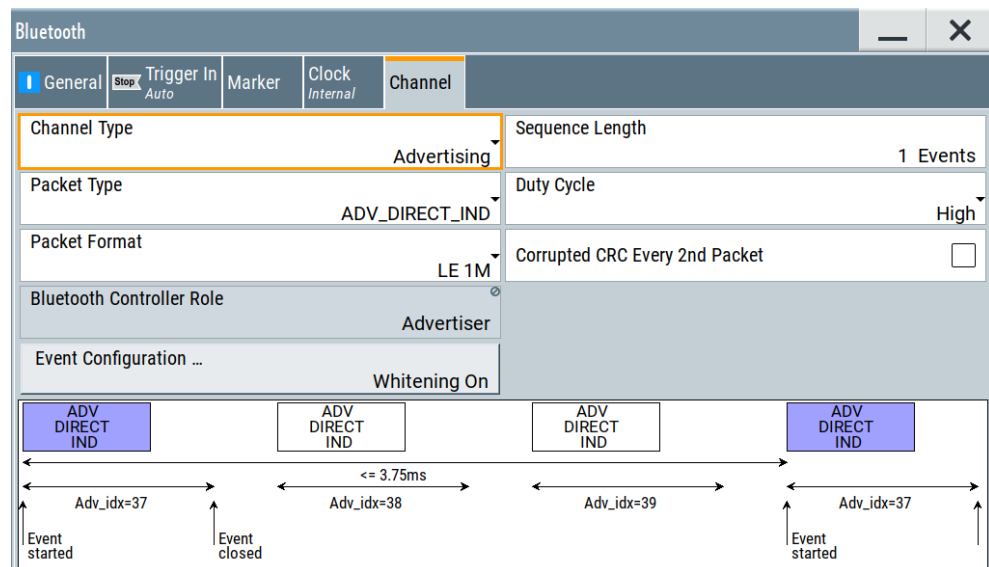
Settings:

- [Channel settings](#)..... 44
- [Advertising event and frame configuration](#).....51
- [Advertising and data packet configuration](#)..... 58
- [CS subevent configuration](#).....91
- [CS control data payload settings](#).....112
- [Test packet configuration](#)..... 129

5.1 Channel settings

Access:

1. Select "Bluetooth" > "General".
2. Select "Bluetooth Mode" > "Bluetooth Low Energy".
3. Select "Channel".



The tab provides settings to configure channel settings and general packet settings.

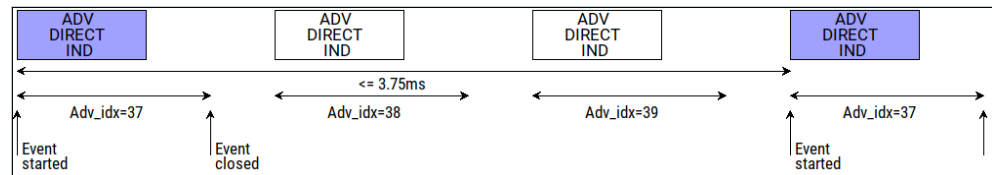
To display Bluetooth LE event or frame sequences

Depending on the channel type packet type and packet format, the "Channel" tab displays a chart at the bottom that illustrates sequences of the corresponding events or frames. The following steps provide examples to illustrate default sequences for different channel types.

- To display the sequence for an advertising channel, select the following:

- Select "Channel Type" > "Advertising".
- Select, for example, "Packet Type" > "ADV_DIRECT_IND".

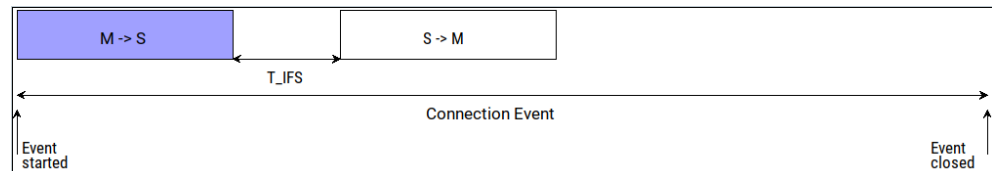
The chart displays one sequence of ADV_DIRECT_IND packets including markers for event start and event stop.



- To display the sequence for a data channel, select the following:

- Select "Channel Type" > "Data".
- Select, for example, "Packet Type" > "DATA".

The chart displays one sequence of data PDUs including markers for event start and event stop.



- To display the sequence for a Channel Sounding channel, select the following:

- Select "Channel Type" > "Channel Sounding".
- Select, for example, "Packet Type" > "CS SEQUENCE".

The chart displays one sequence of CS events including event offset, CS subevents and subevent lengths.



Settings:

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Packet Type.....	46
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Duty Cycle.....	48
Sequence Length.....	48
Bluetooth Controller Role.....	48
Bluetooth Controller State.....	49
Corrupted CRC Every 2nd Packet.....	49
Payload Type.....	49
Duration.....	49
Modulation Format.....	49
Event Configuration/Frame Configuration.....	50
CS Subevent Configuration.....	50
Test Packet Configuration.....	50
Event Intervals/Event_Interval.....	50
Connection Interval.....	50
Event Offset.....	50
Role.....	50

Channel Type

Determines the channel type.

- "Advertising" Selects channel type advertising.
- "Data" Selects the data channel type.
Devices in a connected state transmit the data channel packets in connection events with a start point and an interval.
- "Channel Sounding"
 Requires R&S SMM-K178.
 Selects channel type Channel Sounding.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CTYPE on page 175

Packet Type

Selects the packet type that is the PDU type.

Available packet types depend on the channel type and installed options, see the following tables:

- For non-control data PDUs, see [Table 5-1](#).
- For LE CONTROL_DATA PDUs, see [Table 5-2](#).
- For LE Channel Sounding CS_CONTROL_DATA PDUs, see [Table 5-3](#).

Table 5-1: Channel types and packet/PDU types

Channel type	Packet/PDU type	Option
Advertising	ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_SCAN_IND, SCAN_REQ, SCAN_RSP, CONNECT_IND	R&S SMM-K60
Advertising	ADV_EXT_IND *), AUX_ADV_IND, AUX_CHAIN_IND, AUX_SYNC_IND, AUX_SCAN_REQ, AUX_SCAN_RSP, AUX_CONNECT_REQ, AUX_CONNECT_RSP	R&S SMM-K117

Channel type	Packet/PDU type	Option
Advertising	TEST PACKET	R&S SMM-K60
Advertising	CONTINUOUS	R&S SMM-K60
Data	DATA	R&S SMM-K60
Data	CONTROL_DATA, see Table 5-2 .	See Table 5-2 .
Data	TEST PACKET	R&S SMM-K60
Data	CONTINUOUS	R&S SMM-K60
Channel Sounding	TEST PACKET	R&S SMM-K178
Channel Sounding	CS SEQUENCE	R&S SMM-K178
Channel Sounding	CS_CONTROL_DATA, see Table 5-3 .	R&S SMM-K178

*) PDU type ADV_EXT_IND is available for LE 1M PHY and LE coded PHY.

CONTROL_DATA packets/PDUs depend on the controller role and installed options.

Table 5-2: CONTROL_DATA PDU and controller role

CONTROL_DATA PDU	Controller role	Option
LL_CONNECTION_UPDATE_IND, LL_CHANNEL_MAP_IND, LL_ENC_REQ, LL_FEATURE_REQ, LL_PAUSE_ENC_REQ	Central	R&S SMM-K60
LL_ENC_RSP, LL_UNKNOWN_RSP, LL_FEATURE_RSP, LL_PAUSE_ENC_RSP	Peripheral	R&S SMM-K60
LL_TERMINATE_IND, LL_START_ENC_REQ, LL_START_ENC_RSP, LL_VERSION_IND, LL_REJECT_IND	Central or Peripheral	R&S SMM-K60
LL_PHY_UPDATE_IND	Central	R&S SMM-K117
LL_PERIPHERAL_FEAT_REQ, LL_CONNECTION_PARAM_RSP, LL_PHY_RSP, LL_MIN_USED_CHANNELS_IND	Peripheral	R&S SMM-K117
LL_CONNECTION_PARAM_REQ, LL_REJECT_EXT_IND, LL_PING_REQ, LL_PING_RSP, LL_LENGTH_REQ, LL_LENGTH_RSP, LL_PHY_REQ, LL_CTE_REQ, LL_CTE_RSP, LL_PERIODIC_SYNC_IND, LL_CLOCK_ACCURACY_REQ, LL_CLOCK_ACCURACY_RSP	Central or Peripheral	R&S SMM-K117

CS_CONTROL_DATA packets/PDUs are available for initiator and reflector Channel Sounding devices.

Table 5-3: CS_CONTROL_DATA PDU

CS_CONTROL_DATA PDU	Option
LL_CS_SEC_REQ, LL_CS_SEC_RSP, LL_CS_CAPABILITIES_REQ, LL_CS_CAPABILITIES_RSP, LL_CS_CONFIG_REQ, LL_CS_CONFIG_RSP, LL_CS_REQ, LL_CS_RSP, LL_CS_IND, LL_CS_TERMINATE_IND, LL_CS_FAE_REQ, LL_CS_FAE_RSP, LL_CS_CHANNEL_MAP_IND	R&S SMM-K178

How to: ["To display Bluetooth LE event or frame sequences"](#) on page 45

For more information, refer to the specifications document.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:UPTYPE](#) on page 176

Packet Format

Selects the packet format that is the format according to the physical layer (PHY) that supports the packet type or PDU type.

"LE 1M"	LE uncoded PHY with 1 Msymbol/s modulation.
"LE 2M"	Requires R&S SMM-K117. LE uncoded PHY with 2 Msymbol/s modulation and bandwidth time product $BT = 0.5$.
"LE Coded"	Requires R&S SMM-K117. LE coded PHY with 1 Msymbol/s modulation.
"LE 2M 2BT"	Requires R&S SMM-K178. LE uncoded PHY with 2 Msymbol/s modulation and bandwidth time product $BT = 2$. The BT value in the GFSK filter settings is fixed to a value "B*T" = "2.00". See also "B*T" on page 144.

See also [Table 2-9](#).

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PFORmat](#) on page 175

Duty Cycle

Requires R&S SMM-K117 and "Packet Type" > "ADV_DIRECT_IND".

Specifies the duty cycle for directed advertising.

"High"	Transmits the "ADV_DIRECT_IND" packet expecting an advertising event interval.
"Low"	Transmits the "ADV_DIRECT_IND" packet expecting an advertising event interval and advertising event delay.

See also ["Advertising Event Interval"](#) on page 52.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:DCYCLE](#) on page 175

Sequence Length

Selects the number of frames or events depending on the packet type. The signal repeats after this number.

The packet types SCAN_REQ, CONNECT_IND, AUX_SCAN_REQ and AUX_CONNECT_REQ define the sequence length in frames. All other packets use events.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:USLength](#) on page 178

Bluetooth Controller Role

Requires "Channel Type" > "Advertising"/"Data".

Sets or displays the Bluetooth LE controller role depending on the channel type.

Bluetooth controller role	Channel type	PDU type
Advertiser (read-only)	Advertising	ADV_IND, ADV_DIRECT_IND, ADV_NON-CONN_IND, ADV_SCAN_IND, SCAN_RSP, ADV_EXT_IND, AUX_ADV_IND, AUX_CHAIN_IND, AUX_SYNC_IND, AUX_SCAN_RSP, AUX_CONNECT_RSP, TEST PACKET
Scanner (read-only)	Advertising	SCAN_REQ, AUX_SCAN_REQ
Initiator (read-only)	Advertising	CONNECT_IND, AUX_CONNECT_IND
Central	Data	DATA, CONTROL_DATA
Peripheral	Data	DATA, CONTROL_DATA

See also "[Payload](#)" on page 19 and [Table 5-2](#).

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:BCRole](#) on page 174

Bluetooth Controller State

Requires "Packet Type" > "Data"/"CONTROL_DATA".

Displays the state of the Bluetooth controller.

"Connected" The controller is connected and uses a data channel.

"Disconnected" The controller is disconnected.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:BCText?](#) on page 162

Corrupted CRC Every 2nd Packet

If enabled, sets the ratio of packets with CRC faults to 50%. 50% of packets are generated with correct CRC. This setting is appropriate for packet error rate (PER) report integrity tests.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CCRC:STATE](#) on page 174

Payload Type

Requires "Packet Type" > "CONTINUOUS".

Sets the pattern for continuous packets. The transmitted packets do not contain packet header information.

For supported payload types, refer to "[Payload Type](#)" on page 131.

Duration

Requires "Packet Type" > "CONTINUOUS".

Sets the duration of the continuous packet transmission.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:DURation](#) on page 179

Modulation Format

Requires "Packet Type" > "CONTINUOUS".

Specifies the physical layer.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:MFORmat` on page 178

Event Configuration/Frame Configuration

Opens the "Event Configuration" dialog, if the sequence length of the packet type is expressed in events or opens the "Frame Configuration" dialog, if it is expressed in frames, see [Chapter 5.2, "Advertising event and frame configuration"](#), on page 51.

Also, the button displays the data whitening state, see ["Data Whitening"](#) on page 59.

CS Subevent Configuration

Requires "Channel Type" > "Channel Sounding".

Opens the "CS Subevent Configuration" dialog, see [Chapter 5.4, "CS subevent configuration"](#), on page 91.

Test Packet Configuration

Requires "Packet Type" > "TEST PACKET".

Opens the "Test Packet Configuration" dialog, see [Chapter 5.6, "Test packet configuration"](#), on page 129.

For Channel Sounding test packet settings, see ["User Payload Pattern"](#) on page 104 and ["Select Data List"](#) on page 104 for mode-1 subevents or mode-3 subevents. All other settings are the same as for a CS subevent, see [Chapter 5.4, "CS subevent configuration"](#), on page 91.

Event Intervals/Event Interval

Requires R&S SMM-K178 and "Channel Type" > "Channel Sounding".

Sets the number of LE connection event intervals.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:EINterval` on page 190

Connection Interval

Requires R&S SMM-K178 and "Channel Type" > "Channel Sounding".

Sets the time of the LE connection interval. The anchor points of two consecutive CS events define the length of this interval.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:CINterval` on page 190

Event Offset

Requires R&S SMM-K178 and "Channel Type" > "Channel Sounding".

Sets the time between the anchor point of the LE connection event and the beginning of the CS event.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:EOFFset` on page 191

Role

Requires R&S SMM-K178 and "Channel Type" > "Channel Sounding".

Sets the role of the Channel Sounding device.

"Initiator" Channel Sounding device initiates a CS procedure.

"Reflector" Channel Sounding device responds to a CS procedure.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:ROLE on page 191

5.2 Advertising event and frame configuration

Access:

1. Select "Bluetooth" > "General".
2. Select "Bluetooth Mode" > "Bluetooth Low Energy".
3. In the "Channel" tab, select "Event Configuration" for event-type packets or "Frame Configuration" for frame-type packets.

The "Event Configuration" or "Frame Configuration" dialog provides settings to configure advertising channel events or frames or data channel events. Also it provides access to the packet configuration.

At the bottom of the dialog, the graphics show the distribution of the packets, the physical channel mapping and the channel indices. The channel table gives an overview of the used channels and their assignments.

Settings:

- [Advertising event and frame settings](#).....51
- [Connection settings](#).....54
- [Channel table settings](#).....56

5.2.1 Advertising event and frame settings

Access:

1. Select "Channel" > "Channel Type" > "Advertising".

2. Select "Event Configuration" for event-type packets or "Frame Configuration" for frame-type packets.

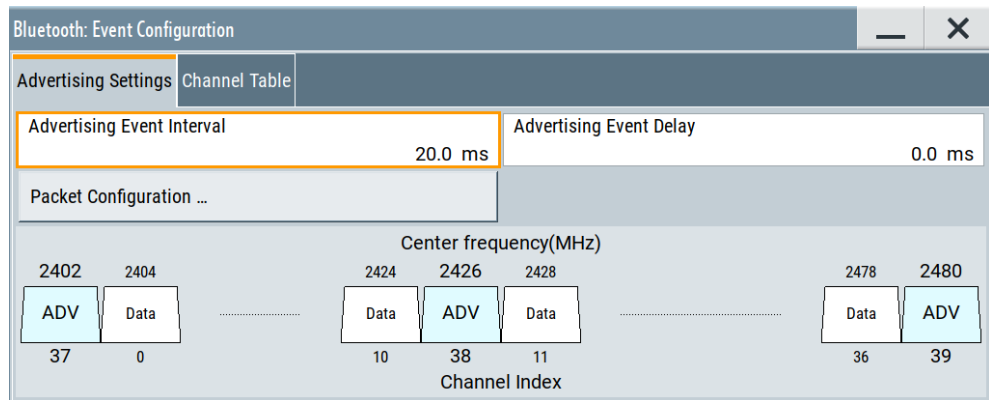


Figure 5-1: Event configuration for an advertising channel (advertiser)

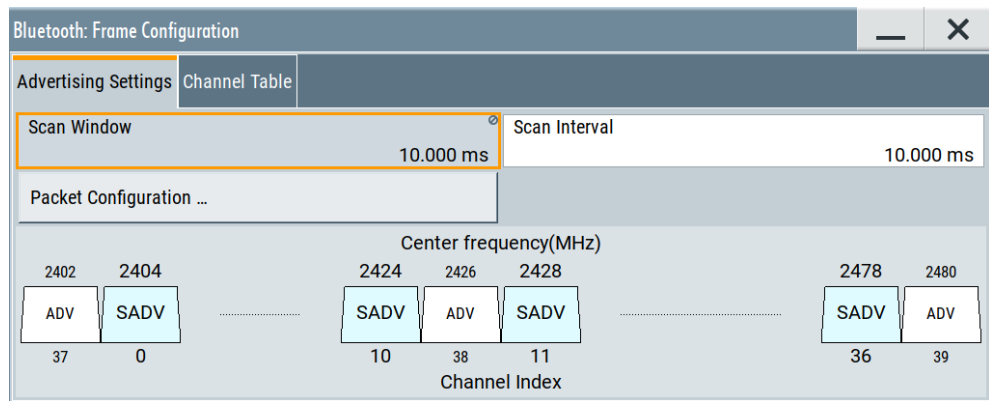


Figure 5-2: Frame configuration for an advertising channel (scanner)

The "Advertising Settings" tab provides general settings to configure advertising channel events or frames or data channel frames. Also it provides access to the packet configuration.

Settings:

- Advertising Event Interval..... 52
- Advertising Event Delay..... 53
- Periodic Advertising Interval..... 53
- Scan Window..... 53
- Scan Interval..... 53
- Advertising Packet Interval..... 53
- Transmit Window Offset..... 54
- Transmit Window Size..... 54
- Packet Configuration..... 54

Advertising Event Interval

Requires a legacy or an extended advertising PDU, see [Table 2-10](#).

Sets the time interval between two consecutive advertising events, regarding the starting points.

Remote command:

For packet type ADV_DIRECT_IND and duty cycle high:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:ADINterval` on page 182

For all others:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:AEINterval` on page 182

Advertising Event Delay

Requires a legacy or an extended advertising PDU, see [Table 2-10](#).

Sets a time delay between the start times of two consecutive advertising events. The advertising event interval extends by this value.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:AEDelay` on page 181

Periodic Advertising Interval

Requires option R&S SMM-K117 and packet type AUX_SYNC_IND.

Sets the time interval between the start of two PDUs from the same advertising set.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PAINterval` on page 186

Scan Window

Requires a scanning PDU with packet type SCAN_REQ or AUX_SCAN_REQ. The PDU AUX_SCAN_REQ also requires option R&S SMM-K117.

Sets the length of the window during which the scanner is operating in the advertising channel.

Note that the scan window is less or equal to the value of the scan interval.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:SWINdow` on page 188

Scan Interval

Requires a scanning PDU with packet type SCAN_REQ or AUX_SCAN_REQ. The PDU AUX_SCAN_REQ also requires option R&S SMM-K117.

Sets the time interval between the starting points of two consecutive windows during which the scanner is operating in an advertising channel.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:SIINterval` on page 187

Advertising Packet Interval

Requires a scanning PDU with packet type SCAN_RSP or AUX_SCAN_RSP. The PDU AUX_SCAN_REQ also requires option R&S SMM-K117.

Sets the time interval between packets starting points of two consecutive packets in the advertising channel.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:APIINterval` on page 183

Transmit Window Offset

Requires packet type CONNECT_IND, AUX_CONNECT_REQ or AUX_CONNECT_RSP.

Displays the start point of the transmit window. For related settings, see "[Transmit Window Offset](#)" on page 77.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:WOffset`
on page 246

Transmit Window Size

Requires packet type CONNECT_IND, AUX_CONNECT_REQ or AUX_CONNECT_RSP.

Displays the start point of the transmit window for configuring advertising frames. For related settings, see "[Transmit Window Size](#)" on page 77.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:WSINfo?` on page 189

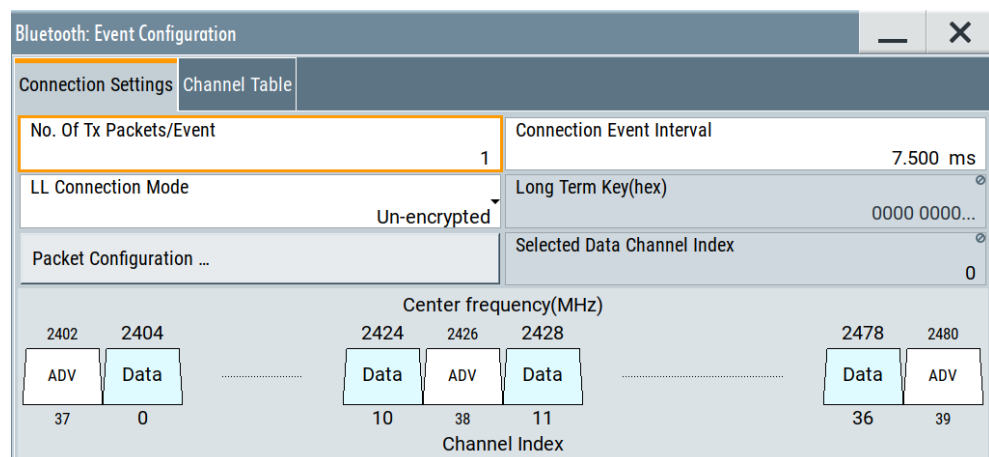
Packet Configuration

Opens the dialog to configure packets. See [Chapter 5.3, "Advertising and data packet configuration"](#), on page 58.

5.2.2 Connection settings

Access:

1. Select "Channel" > "Channel Type" > "Data".
2. Select "Event Configuration".



The "Connection Settings" tab provides general settings to configure data channel events. Also it provides access to the packet configuration.

Settings:

No. Of Tx Packets/Event.....	55
Connection Event Interval.....	55
LL Connection Mode.....	55
Long Term Key(hex).....	56
Selected Data Channel Index.....	56

No. Of Tx Packets/Event

Sets the number of TX packets per event.

Each connection contains at least one data channel packet. The maximum number of packets per event is determined by the duration of the connection event interval.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PNUMber` on page 187

Connection Event Interval

Requires packet type CONNECT_IND, AUX_CONNECT_REQ or DATA.

Set the time interval between the start points of two consecutive connection events. Subsequent transmissions within an event are separated by this parameter to separate connecting event starting points in time.

See also "[Connection Event Interval](#)" on page 78.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CINterval` on page 229

LL Connection Mode

Select the link layer connection mode.

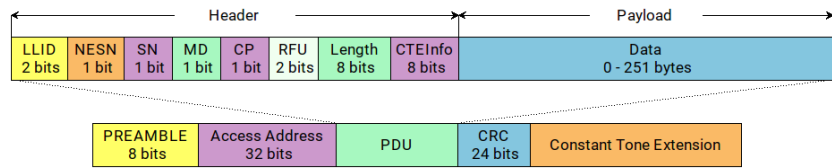
To provide safe transmission of payload data, you can encrypt the data in the packet. If encrypted, the payload data follows a 32-bit message integrity check (MIC field).

The following table shows data packets with limited encrypting or unencrypting. All other data packets allow encrypting and unencrypting the data packet.

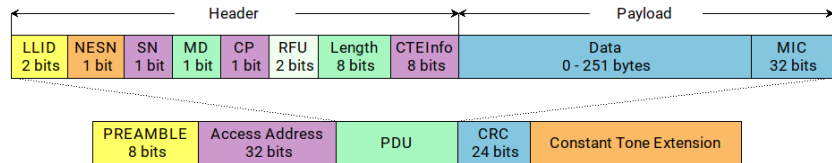
Table 5-4: Limited data packet encryption (R&S SMM-K60)

Packet type	Encrypted	Unencrypted
LL_ENC_REQ	No	Yes
LL_ENC_RSP	No	Yes
LL_START_ENC_REQ	No	Yes
LL_START_ENC_RSP	Yes	No
LL_PAUSE_ENC_REQ	No	Yes
LL_PAUSE_ENC_RSP	Yes	No

"Un-encrypted" Payload data is transmitted without encoding. Example of packet type data:



"Encrypted" The link layer connection runs in encrypted mode. Example of packet type data:



Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:LCMode` on page 183

Long Term Key(hex)

For "LL Connection Mode" > "Un-encrypted", indicates the long-term key.

For "LL Connection Mode" > "Encrypted", sets the long-term key.

This key is the time that the controller needs to receive the long-term key from the host. After this time, the controller is ready to enter into the last phase of encryption mode setup.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:LTKey` on page 184

Selected Data Channel Index

Displays the number of the first active data channel.

The data channel is selected for each connection event. The Central device and Peripheral device determine the used data channel by selecting from the list of used channels, see "Channel Table" on page 57.

Displays the data channel index currently selected.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:SDCI?` on page 187

5.2.3 Channel table settings

Access:

1. Follow the directions in [Chapter 5.2, "Advertising event and frame configuration"](#), on page 51.

2. Select "Channel Table"

	Center Frequency /MHz	Channel Index	Channel Type	Channel State
Channel 0	2 402	37	Advertising	Used
Channel 1	2 426	38	Advertising	Unused
Channel 2	2 480	39	Advertising	Unused

The channel table displays all possible channels and their characteristics. Also you can select the channel that you want to use for the generated packets.

Settings:**Channel Table**

The channel table displays channel characteristics including the channel state.

Each row lists the configuration for a channel as per the data channel index. LSB represents data channel index 0 and the bit in position 36 represents data channel index 36.

If you use the channel ("Used"), the channel bit is 1. If you do not use the channel ("Unused"), the channel bit is 0. The bits in positions 37, 38 and 39 are zero during transmission and a receiver ignores them.

For a graphical representation

"Center Frequency"

Displays the center frequency of a channel.

"Channel Index"

Displays the channel index.

"Channel Type"

Displays the channel type.

"Channel State"

Sets if you use the channel ("Used") or not ("Unused"). You can only use one channel.

Remote command:

```
[ :SOURCE<hw> ]:BB:BT0oth:ECONfiguration:ACTable:
CHANnel<ch0>:STATE on page 181
```

```
[ :SOURCE<hw> ]:BB:BT0oth:ECONfiguration:DCTable:
CHANnel<ch0>:STATE on page 181
```

```
[ :SOURCE<hw> ]:BB:BT0oth:ECONfiguration:
PCONfiguration:DCMTable:CHANnel<ch0>:STATE
on page 181
```

5.3 Advertising and data packet configuration

Access:

1. Select "Bluetooth" > "General".
2. "Bluetooth Mode" > "Bluetooth LE".
3. In the "Channel" tab, select the channel type, for example, "Channel Type" > "Advertising".
4. Select "Event Configuration" event-type packets or "Frame Configuration" for frame-type packets.

The "Event Configuration" or "Frame Configuration" dialog opens.

5. Select "Packet Configuration"

The dialog provides settings to configure the parameters of the selected packet type.

Settings:

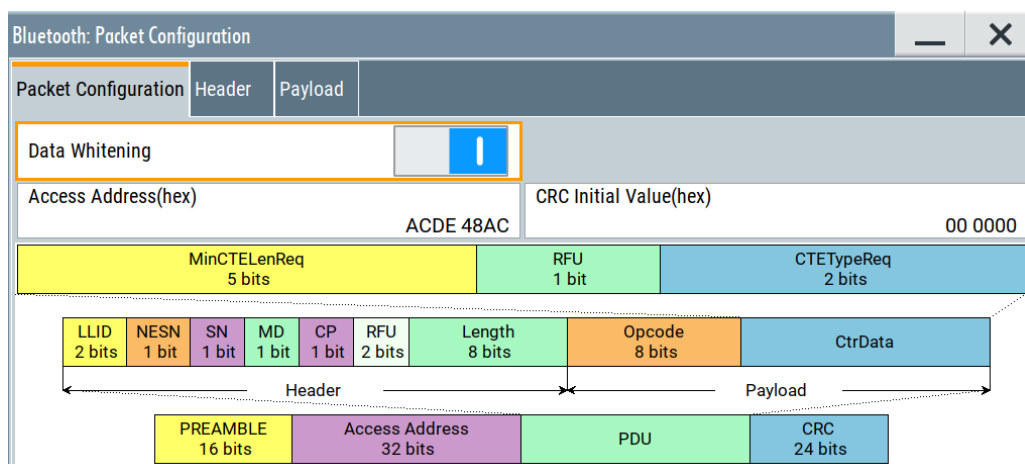
● Packet configuration settings	58
● Header settings	60
● CTEInfo settings	62
● Legacy advertising PDU payload settings	63
● Extended advertising PDU payload settings	66
● Scanning PDU payload settings	74
● Initiating PDU payload settings	76
● Data channel PDU payload settings	79
● FeatureSet configuration settings	89

5.3.1 Packet configuration settings

Access:

- ▶ Select "Packet Configuration".

The "Packet Configuration" tab provides settings to configure the general packet parameters. Also, it displays the main fields and field lengths of the selected packet type.

**Settings:**

Data Whitening.....	59
Access Address.....	59
CRC Initial Value(hex).....	60

Data Whitening

Enables data whitening.

Evenly distributed white noise is ideal for the transmission and real data can be forced to look similar to white noise with different methods called "Data Whitening". Applied to the PDU and CRC fields of all packet types, whitening is used to avoid long equal sequences in the data bitstream.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DWHitening`
on page 216

Access Address

Sets the access address of the link layer connection.

Bluetooth LE transmissions are based on an interface packet format that consists of a preamble (8 bits) the access address (32 bits), the PDU and CRC (24 bits).

Access address is used to identify communications on a physical channel, and to exclude or ignore packets on different physical channels. The channels are using the same PHY channels in physical proximity.

The structure of the access address depends on the packet type:

- Data channel packets
The access address is a pseudo-random LL connection address, generated by the initiator of the LL connection. The address has to follow some specific rules, which are described in the Bluetooth LE technology.
- Advertising channel packets
The address is fixed to 01101011011111011001000101110001 with the leftmost bit sent first and being the LSB.

This parameter is relevant for packet types in event or frame configurations of a data channel or an advertising channel. See also [Table 5-1](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:AADress`
on page 217

CRC Initial Value(hex)

Requires data channel PDU or an advertising channel PDU. For an advertising channel, also requires packet type CONNECT_IND or AUX_CONNECT_REQ.

Sets the initialization value for the 24-bit cyclic redundancy check (CRC) calculation. A receiver receives a packet correctly after it passes the CRC.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CIValue`
on page 217

5.3.2 Header settings

Access:

1. Select "Packet Configuration".
2. Select "Header".

Packet Configuration	Header	Payload
NESN Start Value		0
SN Start Value		0
CTEInfo Present		<input type="checkbox"/>
		CTEInfo Configuration ...

The tab provides settings to configure the packet header settings.

Settings:

NESN Start Value.....	60
SN Start Value.....	61
Channel Selection.....	61
CTEInfo Present.....	61
CTEInfo Configuration.....	61
Tx Address Type/Rx Address Type.....	61

NESN Start Value

Requires a data channel packet that is not a test packet.

Sets the next expected sequence number (NESN). This number is the start value of the next expected packet from the same device in the LL connection. You can set this parameter for the first event. From the second event and later events, the field is empty.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NSValue`
on page 218

SN Start Value

Requires a data channel packet that is not a test packet.

Sets the sequence number of the packet. You can set this parameter for the first event. From the second event and later events, the field is empty.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SSValue`
on page 218

Channel Selection

Requires option R&S SMM-K117.

Sets the algorithm of channel selection for advertising channel packets, see [Table 2-10](#).

"Algorithm #1" Channel selection only for connection events.

"Algorithm #2" Channel selection for connection events and periodic advertising packets.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CSElection`

CTEInfo Present

Requires a data channel packet or a test packet.

Enables the CTEInfo field in the header of Bluetooth LE data packets in the LE un-coded PHY.

See also "[Constant tone extension](#)" on page 23.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CPresent`
on page 218

CTEInfo Configuration

Requires "CTEInfo Present" > "On".

Opens the "CTEInfo Configuration" dialog to configure CTE length and the CTE method. See [Chapter 5.3.3, "CTEInfo settings"](#), on page 62.

Tx Address Type/Rx Address Type

Requires an advertising channel packet, see [Table 2-10](#).

Selects the address type of a Bluetooth LE device. Depending on the Bluetooth controller role, either the Tx or Rx or both address types are assigned.

The format of the device address differs depending on the selected address type. The address type and corresponding packet types are as follows:

- "Tx" for the packet types ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_SCAN_IND, SCAN_REQ, SCAN_RSP and CONNECT_IND
Within R&S SMM-K117 also with the packet types ADV_EXT_IND, AUX_ADV_IND, AUX_CHAIN_IND, AUX_SYNC_IND, AUX_SCAN_REQ, AUX_SCAN_RSP and AUX_CONNECT_REQ
- "Rx" for the packet types ADV_DIRECT_IND, SCAN_REQ and CONNECT_IND

- "Public" Allocates a unique 48-bit address to each Bluetooth LE device. Public addresses use an organizational unique identifier (OUI) obtained from the IEEE registration authority.
- "Random" Allocates a 48-bit random static device address to each Bluetooth LE device. A random address is optional. It can be directly generated by the beacon.

Remote command:

[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:TAType
on page 241

5.3.3 CTEInfo settings

Access:

1. Select "Packet Configuration".
2. Select "Header".
3. Select "CTEInfo Present" > "On".
4. Select "CTEInfo Configuration".

CTEInfo Configuration	
CTETime 0.016 ms	CTEType AOD(1us)
Antenna Number 4	
Antenna0 Gain 0.00 dB	Antenna1 Gain 0.00 dB
Antenna2 Gain 0.00 dB	Antenna3 Gain 0.00 dB

The dialog provides constant tone extension (CTE) settings for direction finding including the CTE length and the CTE method. The settings are relevant for data event configuration and all data channel packet types including test packets. See also "Constant tone extension" on page 23.

Settings:

CTETime.....	62
CTEType.....	63
Antenna Number.....	63
AntennaX Gain.....	63

CTETime

Sets the CTETime that is the length of the constant tone extension field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CTIME`
on page 219

CTEType

Sets the type of constant tone extension. The type specifies the CTE AoA/AoD method and for AoD the length of the switching and I/Q sampling slots.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CTYPE`
on page 219

Antenna Number

Requires "CTEType" > "AoD(1us)"/"AoD(2us)".

Sets the number of antennas for the angle of departure (AoD) direction finding method. You can select up to four antennas for direction finding.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfig:PCOnfig:ANTNumber` on page 220

AntennaX Gain

Requires "CTEType" > "AoD(1us)"/"AoD(2us)".

Sets the gain of the antenna "AntennaX", where X is 0 to 3 depending on the number of antennas. You can set the antenna gain information of up for four individual antennas for direction finding.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfig:PCOnfig:ANTGain<ch0>` on page 220

5.3.4 Legacy advertising PDU payload settings

Access:

1. Select a legacy advertising PDU:
 - a) In the "Channel" tab, select "Channel Type" > "Advertising".
 - b) Select a legacy advertising PDU, for example "Packet Type" > "ADV_IND".
2. Select "Event Configuration"/"Frame Configuration" > "Packet Configuration".
3. Select "Payload".

Packet Configuration	Header	Payload
Advertiser's Device Addr	AC DE48	00 0080
	NAP(16), UAP(8)	LAP(24)
Data Source	PN 9	
Data Length	31 bytes	

The tab provides settings to configure the payload of the legacy advertising PDUs.

For an overview of supported legacy advertising PDUs, see [Table 2-10](#).

Settings:

Advertiser's Device Addr	64
Target's Device Addr	65
Data Source	65
Data Length	65

Advertiser's Device Addr

Sets the 48-bit device address of the advertiser.

This device address identifies the Bluetooth device. Devices use a public device address or a random device address, see ["Tx Address Type/Rx Address Type"](#) on page 61. For more information, see [\[1\]](#).

With Bluetooth wireless technology up to the version 4.2, the following address formats are defined:

- "Public Address Type" is the unique 48-bit identity address of each Bluetooth LE device.
The registration authority IEEE provides the address that consists of the following:
 - LSB: 24 bits = company_assigned
 - MSB: 24 bits = company_id
- "Random Address Type" is an optional 48-bit random static device address.
- "Private Address Type" is a resolvable 48-bit optional address.
A private address consists of the:
 - LSB: 24 bits = hash
 - MSB: 24 bits = random

Since version 5.0, the device address format is in accordance with BD_ADDR for BR/EDR with the exception that LAP values does not apply. Unless the public device address is also used for a BR/EDR controller.

- **NAP**: Selects the non-significant address part. The length of NAP is 16 bits or 4 hexadecimal figures.
- **UAP**: Selects the upper address part. The length of UAP is 8 bits or two hexadecimal figures.
- **LAP**: Selects the lower address part. The length of LAP is 24 bits or 6 hexadecimal figures.

The NAP+UAP can take any values except the 64 reserved LAP values: #H9E8B00 – #H9E8B3F.

For the address formats of Bluetooth version 5.0 and later, install option R&S SMM-K117.

For advertising channel PDU types, see ["Payload"](#) on page 19.

Remote command:

Company_Assigned and Company_Id in the device address of an advertiser:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ACID
```

on page 224

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ACASsigned
```

on page 224

NAP+UAP and LAP in the device address of an advertiser:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ANUap](#)
on page 226

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ALAP](#)
on page 225

Target's Device Addr

TargetA field of the device address that is a scanner's device address or an initiator's device address.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:TNUap](#)
on page 226

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:TLAP](#)
on page 225

Data Source

Selects the data source for data in the corresponding data subfield of the Payload field.

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 set the bit pattern.
- "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog. The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA](#)
on page 229

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DPATtern](#) on page 230

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DSElection](#) on page 230

Data Length

Selects the length of the corresponding data subfield of the Payload field.

Remote command:

[:SOURce<hw>] :BB:BT00th:ECONfiguration:PCONfiguration:DLEngth
on page 231

5.3.5 Extended advertising PDU payload settings

Option: R&S SMM-K117

Access:

1. Select an extended advertising PDU:
 - a) In the "Channel" tab, select "Channel Type" > "Advertising".
 - b) Select an extended advertising PDU, for example "Packet Type" > "ADV_EXT_IND".
2. Select "Event Configuration"/"Frame Configuration" > "Packet Configuration".
3. Select "Payload".

The tab provides settings to configure the payload of the extended advertising PDUs.

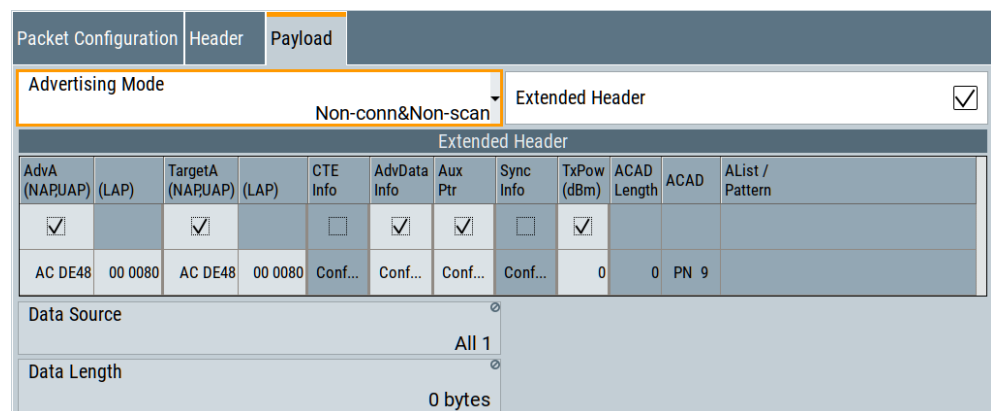
For an overview of supported extended advertising PDUs, see [Table 2-10](#).

- [General settings](#).....66
- [Extended header settings](#)..... 67
- [AdvDataInfo configuration settings](#)..... 71
- [AuxPtr configuration settings](#)..... 71
- [SyncInfo configuration settings](#)..... 73

5.3.5.1 General settings

Access:

- ▶ Select "Payload".



Packet Configuration											
Header											Payload
Advertising Mode											Extended Header <input checked="" type="checkbox"/>
Non-conn&Non-scan											
Extended Header											
AdvA (NAPUAP)	(LAP)	TargetA (NAPUAP)	(LAP)	CTE Info	AdvData Info	Aux Ptr	Sync Info	TxPow (dBm)	ACAD Length	ACAD	AList / Pattern
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
AC DE48	00 0080	AC DE48	00 0080	Conf...	Conf...	Conf...	Conf...	0	0	PN 9	
Data Source						All 1					
Data Length						0 bytes					

The tab provides general settings to configure the payload of the extended advertising PDUs.

Advertising Mode.....	67
Extended Header.....	67
Data Source.....	67
Data Length.....	67

Advertising Mode

Selects the mode of the advertisement in the AdvMode field.

"Non-conn&Non-scan"

Non-connectable and non-scannable

"Conn&Non-scan"

Connectable and non-scannable

"Non-conn&Scan"

Non-connectable and scannable

"Chained data" Fixed value for an AUX_CHAIN_IND PDU.

"Scan response"

Fixed value for an AUX_SCAN_RSP PDU.

"Connection response"

Fixed value for an AUX_CONNECT_RSP PDU.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:AMODE`
on page 226

Extended Header

Enables the extended header of an extended advertising PDU.

If enabled, displays a table with extended header settings, see [Chapter 5.3.5.2, "Extended header settings"](#), on page 67.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHHeader:STATE` on page 232

Data Source

See ["Data Source"](#) on page 65.

Data Length

See ["Data Length"](#) on page 65.

5.3.5.2 Extended header settings

Access:

- ▶ Select "Payload" > "Extended Header" > "On".

If enabled, the R&S SMM100A signals the extended header for extended advertising PDUs.

Extended Header											
AdvA (NAPUAP)	(LAP)	TargetA (NAPUAP)	(LAP)	CTE Info	AdvData Info	Aux Ptr	Sync Info	TxPow (dBm)	ACAD Length	ACAD	AList / Pattern
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
AC DE48	00 0080	AC DE48	00 0080	Conf...	Conf...	Conf...	Conf...	0	26	PN 9	

The "Extended Header" table provides general settings to configure the extended header. It also provides access to further settings of fields within the extended header.

Settings:

AdvA.....	68
TargetA.....	68
CTEInfo.....	68
AdvDataInfo.....	69
AuxPtr.....	69
SyncInfo/SyncInfo Configuration.....	69
TxPow(dBm).....	69
ACAD Length.....	70
ACAD.....	70
AList / Pattern.....	70

AdvA

Enables the flag of the advertiser's device address (AdvA) subfield. If enabled, this subfield is present in the Extended Header field.

For related settings, see "[Advertiser's Device Addr](#)" on page 64.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
AADDRESS:STATE on page 232
```

TargetA

Requires an advertising channel PDU that contains the TargetA field, see [Table 2-11](#).

Enables the flag of the target's device address (TargetA) subfield. If enabled, this subfield is present in the Extended Header field.

For related settings, see "[Advertiser's Device Addr](#)" on page 64.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
TADDRESS:STATE on page 234
```

CTEInfo

Requires a data channel packet including a test packet. See also "[Constant tone extension](#)" on page 23.

Enables the flag of the CTEInfo subfield. If enabled, this subfield is present in the Extended Header field.

Selecting "Conf" opens the CTEInfo configuration dialog to define the CTE length and the CTE method for direction finding. See [Chapter 5.3.3, "CTEInfo settings"](#), on page 62.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
CINfo:STATe on page 233
```

AdvDataInfo

Enables the flag of the advertising data information (AdvDataInfo) subfield. If enabled, this subfield is present in the Extended Header field.

Select "Conf" to open further AdvDataInfo settings, see [Chapter 5.3.5.3, "AdvDataInfo configuration settings"](#), on page 71.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
ADINfo:STATe on page 233
```

AuxPtr

Enables the flag of the AuxPtr subfield. If enabled, this subfield is present in the Extended Header field.

The presence of the AuxPtr subfield indicates that some or all advertisement data is in a following auxiliary packet. The contents of the AuxPtr subfield describe this auxiliary packet.

Select "Conf" to open further AuxPtr settings, see [Chapter 5.3.5.4, "AuxPtr configuration settings"](#), on page 71.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
APTR:STATe on page 233
```

SyncInfo/SyncInfo Configuration

Requires packet type AUX_ADV_IND or LL_PERIODIC_SYNC_IND.

Enables the flag of the SyncInfo subfield. If enabled, this subfield is present in the Extended Header field. The presence of the SyncInfo field indicates the presence of a periodic advertisement.

Select "Conf" to open further SyncInfo settings, see [Chapter 5.3.5.5, "SyncInfo configuration settings"](#), on page 73.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
SINfo:STATe on page 234
```

TxPow(dBm)

Enables signaling and sets the required transmit power.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EHFLags:
TPOWer:STATe on page 234
```

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:TPOWer
on page 245
```

ACAD Length

Specifies the length of an additional controller advertising data (ACAD) field.

Remote command:

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ALENgtH`
on page 225

ACAD

Sets the pattern for additional controller advertising data (ACAD).

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 set the bit pattern.
- "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog. The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD`
on page 222

AList / Pattern

Sets one of the following:

- For "ACAD" > "Data List", selects the data list source file and directory.
- For "ACAD" > "Pattern", sets the pattern.

See also "[ACAD](#)" on page 70.

Remote command:

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:`
`APATtern` on page 223

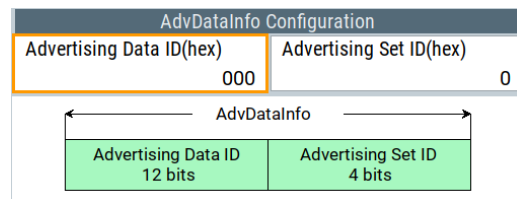
`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:`
`ASElection` on page 223

5.3.5.3 AdvDataInfo configuration settings

Access:

1. Select "Payload" > "Extended Header".
2. Select "AdvDataInfo" > "On".
3. Select "AdvDataInfo" > "Conf".

The "AdvDataInfo Configuration" section opens.



The section provides AdvDataInfo field settings and displays the structure of the field graphically.

Settings:

Advertising Data ID(hex)

Sets the "Advertising Data ID" in the AdvDataInfo field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ADID`
on page 224

Advertising Set ID(hex)

Sets the "Advertising Set ID" in the AdvDataInfo field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ASID`
on page 228

5.3.5.4 AuxPtr configuration settings

Access:

1. Select "Payload" > "Extended Header".
2. Select "AuxPtr" > "On".
3. Select "AuxPtr" > "Conf".

The "AuxPtr Configuration" dialog opens.

AuxPtr Configuration		Secondary Advertising Channel Table	
Clock Accuracy	51 ppm to 500 ppm	Offset Units	30 us
AUX Offset	245.70 ms	AUX PHY	LE 1M

The "AuxPtr Configuration" tab provides AuxPtr field settings and displays the structure of the field graphically.

The "Secondary Advertising Channel Table" tab lists the configuration of all 37 LE channels and allows you to enable the channel that you want to use for secondary advertising. For related settings, see [Chapter 5.2.3, "Channel table settings"](#), on page 56.

Settings:

Clock Accuracy	72
Offset Units	72
AUX Offset	72
AUX PHY	72

Clock Accuracy

Sets the clock accuracy of the advertiser used between the packet containing this data and the auxiliary packet.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CACCuracy`
on page 228

Offset Units

Sets the units used by the AUX offset, see "[AUX Offset](#)" on page 72.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:AOUNits`
on page 227

AUX Offset

Sets the time from the start of the packet containing the AuxPtr field to the approximate start of the auxiliary packet.

The parameter "Offset Units" affects the length of the AUX offset. Set the value at least to the length of the packet plus 300 μ s.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:AOFFset`
on page 227

AUX PHY

Specifies the physical layer used to transmit the auxiliary packet.

Remote command:

[:SOURCE<hw>] :BB:BT00th:ECONfiguration:PCONfiguration:APHY

on page 227

5.3.5.5 SyncInfo configuration settings

Access:

1. Select "Payload" > "Extended Header".
2. Select "SyncInfo" > "On".
3. Select "SyncInfo" > "Conf".

The "SyncInfo Configuration" dialog opens.

SyncInfo Configuration		Secondary Advertising Channel Map Table							
Sync Packet Offset	245.70 ms	Offset Units	30 us						
Offset Adjust	<input type="checkbox"/>	Periodic Adv Interval	20.00 ms						
Sleep Clock Accuracy	251 ppm - 500 ppm	Access Address(hex)	ACDE 48AC						
CRC Initial Value(hex)	00 0000	Event Counter	0 Events						
← SyncInfo →									
Sync Packet Offset	Offset Units	Offset Adjust	RFU	Interval	ChM	SCA	AA	CRCInit	Event Counter
13 bits	1 bit	1 bit	1 bit	16 bits	37 bits	3 bits	32 bits	24 bits	16 bits

The "SyncInfo Configuration" tab provides SyncInfo field settings and displays the structure of the field graphically.

The "Secondary Advertising Channel Table" tab lists the configuration of all 37 LE channels and allows you to enable the channel that you want to use for secondary advertising. For related settings, see [Chapter 5.2.3, "Channel table settings"](#), on page 56.

Sync Packet Offset	73
Offset Units	74
Offset Adjust	74
Periodic Adv Interval	74
Sleep Clock Accuracy	74
Access Address	74
CRC Initial Value(hex)	74
Event Counter	74

Sync Packet Offset

Specifies the time from the start of the AUX_ADV_IND packet containing the SyncInfo field to the start of the AUX_SYNC_IND packet.

The sync packet offset consists of multiples of the offset units, see ["Offset Units"](#) on page 74.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SPOffset  
on page 244
```

Offset Units

Sets the offset units of the sync packet offset, see "[Sync Packet Offset](#)" on page 73.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SOUNits  
on page 244
```

Offset Adjust

Adjusts the "Sync Packet Offset" automatically to the next value, which is a multiple of the "Offset Units".

If "Offset Adjust" > "On", the "Sync Packet Offset" is 2.4567 s and "Offset Units" > "300 us".

If "Offset Units" > "30 us", disables the offset adjust.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:OADJust  
on page 240
```

Periodic Adv Interval

See "[Periodic Advertising Interval](#)" on page 53.

Sleep Clock Accuracy

See "[Sleep Clock Accuracy](#)" on page 79.

Access Address

See "[Access Address](#)" on page 59.

CRC Initial Value(hex)

See "[CRC Initial Value\(hex\)](#)" on page 60.

Event Counter

Counts the AUX_SYNC_IND packets that the SyncInfo field describes.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ECOUNTER  
on page 231
```

5.3.6 Scanning PDU payload settings

Access:

1. Select a scanning PDU:
 - a) In the "Channel" tab, select "Channel Type" > "Advertising".
 - b) Select a scanning PDU, for example "Packet Type" > "ADV_SCAN_REQ".

2. Select "Event Configuration"/"Frame Configuration" > "Packet Configuration".
3. Select "Payload".

Packet Configuration	Header	Payload	
Scanner's Device Addr	AC DE48		00 0080
	NAP(16), UAP(8)		LAP(24)
Advertiser's Device Addr	AC DE48		00 0080
	NAP(16), UAP(8)		LAP(24)

The tab provides settings to configure the payload of the scanning PDUs.

For an overview of supported scanning PDUs, see [Table 2-10](#).

Settings:

Scanner's Device Addr	75
Advertiser's Device Addr	75
Data Source	75
Data Length	75
Extended Header	76

Scanner's Device Addr

Requires a SCAN_REQ PDU or an AUX_SCAN_REQ PDU.

Sets the 48-bit device address of the scanner.

For more information, see ["Advertiser's Device Addr"](#) on page 64.

Remote command:

Company_Assigned and Company_Id in the device address of a scanner:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCASsigned`
on page 224

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCID`
on page 224

NAP+UAP and LAP in the device address of a scanner:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SNUap`
on page 226

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SLAP`
on page 225

Advertiser's Device Addr

See ["Advertiser's Device Addr"](#) on page 64.

Data Source

Requires a SCAN_RSP PDU or an AUX_SCAN_RSP PDU.

For related settings, see ["Data Source"](#) on page 65.

Data Length

Requires a SCAN_RSP PDU or an AUX_SCAN_RSP PDU.

For related settings, see ["Data Length"](#) on page 65.

Extended Header

Requires an AUX_SCAN_RSP PDU.

For related settings, see ["Extended Header"](#) on page 67 and [Chapter 5.3.5.2, "Extended header settings"](#), on page 67.

5.3.7 Initiating PDU payload settings

Access:

1. Select a scanning PDU:
 - a) In the "Channel" tab, select "Channel Type" > "Advertising".
 - b) Select a scanning PDU, for example "Packet Type" > "CONNECT_IND".
2. Select "Event Configuration"/"Frame Configuration" > "Packet Configuration".
3. Select "Payload".

Packet Configuration	Header	Payload	
Initiator's Device Addr	AC DE48	00 0080	
	NAP(16), UAP(8)	LAP(24)	
Advertiser's Device Addr	AC DE48	00 0080	
	NAP(16), UAP(8)	LAP(24)	
Access Address(hex)	ACDE 48AC	CRC Initial Value(hex)	0000 0000
Transmit Window Size	1.25 ms	Transmit Window Offset	0.00 ms
Connection Event Interval	7.500 ms	Slave Latency	0 Events
LL Connection Timeout	100 ms	Show Data Channel Map Table »	
Hop Length	5	Sleep Clock Accuracy	251 ppm - 500 ppm

The tab provides settings to configure the payload of the initiating PDUs.

For an overview of supported initiating PDUs, see [Table 2-10](#).

Settings:

Initiator's Device Addr	77
Advertiser's Device Addr	77
Transmit Window Size	77
Transmit Window Offset	77
Connection Event Interval	78
Peripheral Latency	78
LL Connection Timeout	78
Show Data Channel Map Table/Hide Data Channel Map Table	79
Hop Length	79
Sleep Clock Accuracy	79

Data Source.....	79
Data Length.....	79
Extended Header.....	79

Initiator's Device Addr

Sets the 48-bit device address of the initiator.

For more information, see "[Advertiser's Device Addr](#)" on page 64.

Remote command:

Company_Assigned and Company_Id in the device address of an initiator:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ICASsigned`
on page 224

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ICID`
on page 224

NAP+UAP and LAP in the device address of an initiator:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:INUap`
on page 226

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ILAP`
on page 225

Advertiser's Device Addr

See "[Advertiser's Device Addr](#)" on page 64.

Transmit Window Size

Requires packet type CONNECT_IND, AUX_CONNECT_REQ, LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs AUX_CONNECT_REQ, LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

Sets the size of the transmit window for configuring advertising frames. The "Frame Configuration" dialog also displays this setting.

The scan window size is less or equal to the value of the connection interval, see "[Connection Event Interval](#)" on page 78.

Remote command:

For advertising channels:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:WSIZE`
on page 246

For data channels:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NWSize`
on page 240

Transmit Window Offset

Requires packet type CONNECT_IND, AUX_CONNECT_REQ, LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs AUX_CONNECT_REQ, LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

Sets the start point of the transmit window for configuring advertising frames. The "Frame Configuration" dialog also displays this setting.

Remote command:

For advertising channels:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:WOffset`
on page 246

For data channels:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NWOffset`
on page 240

Connection Event Interval

Requires packet type CONNECT_IND, AUX_CONNECT_REQ, LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_REQ. The PDUs AUX_CONNECT_REQ, LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_REQ also require option R&S SMM-K117.

Set the time interval between the start points of two consecutive connection events. Also, this setting separates subsequent transmissions within an event to separate connecting event starting points in time.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NCInterval`
on page 239

Peripheral Latency

Requires packet type CONNECT_IND, AUX_CONNECT_REQ, LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_REQ. The PDUs AUX_CONNECT_REQ, LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_REQ also require option R&S SMM-K117.

Sets the number of consecutive connection events that the Peripheral can ignore for asymmetric link layer connections.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SLATency`
on page 243

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NSLatency`
on page 239

LL Connection Timeout

Requires packet type CONNECT_IND, AUX_CONNECT_REQ, LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_REQ. The PDUs AUX_CONNECT_REQ, LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_REQ also require option R&S SMM-K117.

Defines the maximum time between two correctly received Bluetooth LE packets in the LL connection before the connection is considered lost.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:LCTimeout`
on page 236

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NLCTimeout`
on page 239

Show Data Channel Map Table/Hide Data Channel Map Table

Requires packet type CONNECT_IND or LL_CHANNEL_MAP_IND.

Shows or hides the data channel map table. For related settings, see [Chapter 5.2.3, "Channel table settings"](#), on page 56.

Remote command:

n.a.

Hop Length

Requires packet type CONNECT_IND.

Sets the difference from the current channel to the next channel.

The Central and the Peripherals determine the data channel in use for every connection event from the channel map. Hop_length is set for the LL connection and communicated in the CONNECT_IND packets.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:HLength`
on page 235

Sleep Clock Accuracy

Requires packet type CONNECT_IND or LL_PERIODIC_SYNC_IND.

Sets the clock accuracy of the Central device with a specified encoding. The Peripheral device uses this parameter to determine the required listening windows in the LL connection. It is a controller design parameter known by the controller.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCACcuracy`
on page 243

Data Source

Requires an AUX_CONNECT_RSP PDU.

For related settings, see ["Data Source"](#) on page 65.

Data Length

Requires an AUX_CONNECT_RSP PDU.

For related settings, see ["Data Length"](#) on page 65.

Extended Header

Requires an AUX_CONNECT_RSP PDU.

For related settings, see ["Extended Header"](#) on page 67 and [Chapter 5.3.5.2, "Extended header settings"](#), on page 67.

5.3.8 Data channel PDU payload settings

Access:

1. Select "Channel Type" > "Data".

2. Select "Event Configuration" for event-type packets or "Frame Configuration" for frame-type packets.

The "Event Configuration" or "Frame Configuration" dialog opens.

3. Select "Packet Configuration"

Packet Configuration	Header	Payload
Advertiser's Device Addr	AC DE48	00 0080
	NAP(16), UAP(8)	LAP(24)
Data Source	PN 9	
Data Length	31 bytes	

The dialog provides settings to configure the payload of advertising PDUs.

For an overview of supported advertising PDUs, see [Table 2-10](#).

Settings:

Transmit Window Size.....	81
Transmit Window Offset.....	81
Connection Event Interval.....	81
Peripheral Latency.....	81
LL Connection Timeout.....	81
Connection Instant.....	82
Show Data Channel Map Table/Hide Data Channel Map Table.....	82
Error Code(hex).....	82
Random Vector(hex).....	82
Encrypted DIversifier(hex).....	82
Session Key iD(hex).....	83
Initialization Vector(hex).....	83
Unknown Type(hex).....	83
FeatureSet Length.....	83
FeatureSet Configuration.....	83
Version Number(hex).....	83
SubVersion Number(hex).....	84
Company Id(hex).....	84
Min. Interval.....	84
Max. Interval.....	84
Preferred Periodicity.....	84
Ref. Connection Event Count.....	85
Show Offset Setting Table/Hide Offset Setting Table.....	85
Offset Setting Table.....	85
Reject Opcode.....	85
MaxRxOctets/MaxTxOctets.....	85
MaxRxTime/MaxTxTime.....	86
TX PHYS/RX PHYS.....	86
M_TO_S_PHYS/S_TO_M_PHY.....	86
PHYs.....	87

Min Used Channels.....	87
ID(hex).....	87
SyncInfo Configuration.....	87
Connection Event Count.....	87
Last Pa Event Counter.....	88
SID(hex).....	88
Address Type.....	88
Sleep Clock Accuracy.....	88
PHY.....	88
Advertiser's Device Addr.....	89
Sync Connection Event Counter.....	89
MinCTELenReq.....	89
CTETypeReq.....	89

Transmit Window Size

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

For related settings, see "[Transmit Window Size](#)" on page 77.

Transmit Window Offset

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

For related settings, see "[Transmit Window Offset](#)" on page 77.

Connection Event Interval

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

For related settings, see "[Connection Event Interval](#)" on page 78.

Peripheral Latency

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

For related settings, see "[Peripheral Latency](#)" on page 78.

LL Connection Timeout

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP. The PDUs LL_CONNECTION_PARAM_REQ and LL_CONNECTION_PARAM_RSP also require option R&S SMM-K117.

For related settings, see "[LL Connection Timeout](#)" on page 78.

Connection Instant

Requires packet type LL_CONNECTION_UPDATE_IND, LL_CHANNEL_MAP_IND or LL_PHY_UPDATE_IND. The PDU LL_PHY_UPDATE_IND also requires option R&S SMM-K117.

Sets a connection instant for indicating the connection event at which the new connection parameters are taken in use.

Both the Central and the Peripheral have a 32-bit connection event counter per LL connection. For the first event of the LL connection, the instant is zero and increments by one on every elapsed connection event interval of the LL connection.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CINstant`
on page 229

Show Data Channel Map Table/Hide Data Channel Map Table

Requires packet type LL_CHANNEL_MAP_IND.

Shows or hides the data channel map table. For related settings, see [Chapter 5.2.3, "Channel table settings"](#), on page 56.

Remote command:

n.a.

Error Code(hex)

Requires packet type LL_TERMINATE_IND, LL_REJECT_IND or LL_REJECT_EXT_IND.

Sets an 8-bit error code. For an LL_TERMINATE_IND packet, informs the remote device about the termination of the connection. For an LL_REJECT_IND packet, indicates a rejected request.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ECODE`
on page 231

Random Vector(hex)

Requires the packet type LL_ENC_REQ and a Central Bluetooth controller.

Sets the random vector of the Central device for device identification.

The parameter is an initialization vector provided by the host in the HCI_ULP_Start_Encryption command.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RVEctor`
on page 242

Encrypted Diversifier(hex)

Requires the packet type LL_ENC_REQ and a Central Bluetooth controller.

Sets the encrypted diversifier of the Central device for device identification. The parameter is an initialization vector provided by the host in the HCI_ULP_Start_Encryption command.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:EDIVersifier` on page 232

Session Key ID(hex)

Requires the packet type LL_ENC_REQ and a Central Bluetooth controller or LL_ENC_RSP and a Peripheral Bluetooth controller.

Sets the portion of the Central or the portion of the Peripheral of the session key diversifier (SKDm/SKDs).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MSKD` on page 237

Initialization Vector(hex)

Requires the packet type LL_ENC_REQ and a Central Bluetooth controller or LL_ENC_RSP and a Peripheral Bluetooth controller.

Sets the portion of the Central or the portion of the Peripheral of the initialization vector (IVm/IVs).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MIVector` on page 236

Unknown Type(hex)

Requires the packet type LL_UNKNOWN_RSP and a Peripheral Bluetooth controller.

Enables indication of an invalid control packet. The "CtrType" field indicates the value of the LL control packet that caused the transmission of this packet.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:UTYPE` on page 245

FeatureSet Length

Requires the packet type LL_FEATURE_REQ, LL_FEATURE_RSP or LL_PERIPHERAL_FEATURE_REQ.

Displays the length of the feature set.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:FSLength` on page 235

FeatureSet Configuration

Requires the packet type LL_FEATURE_REQ, LL_FEATURE_RSP or LL_PERIPHERAL_FEATURE_REQ.

Opens a dialog to enable or disable features within the link layer control PDU. See "[FeatureSet configuration table](#)" on page 90.

Version Number(hex)

Requires packet type LL_VERSION_IND.

Sets the version of the Bluetooth controller. It is an 8-bit value in hexadecimal representation.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:VNUmber`
on page 246

SubVersion Number(hex)

Requires packet type LL_VERSION_IND.

Sets a unique 16-bit value for each implementation or revision of an implementation of the Bluetooth controller.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SVNumber`
on page 244

Company Id(hex)

Requires packet type LL_VERSION_IND.

Sets the 16-bit company identifier of the manufacturer of the Bluetooth controller.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CID`
on page 228

Min. Interval

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Displays the minimum allowed connection interval.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MNINterval`
on page 184

Max. Interval

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Sets the maximum allowed connection interval.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MXINterval`
on page 184

Preferred Periodicity

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Sets the preferred periodicity. This value is typically a multiple of the value of the connection interval.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PPERiodicity`
on page 186

Ref. Connection Event Count

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Sets connection event counter relative to the calculation of all valid offset fields Offset0 to Offset5.

See also "[Offset Setting Table](#)" on page 85.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RCECount`
on page 186

Show Offset Setting Table/Hide Offset Setting Table

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Shows or hides the offset setting table, see "[Offset Setting Table](#)" on page 85.

Remote command:

n.a.

Offset Setting Table

Requires option R&S SMM-K117 and packet types LL_CONNECTION_PARAM_REQ or LL_CONNECTION_PARAM_RSP.

Sets the possible positions of the offset points of the LE connection. At these points, you can update connection parameters relative to the reference connection event count, see "[Ref. Connection Event Count](#)" on page 85.

"State" Enables the offset point state.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:OFFSet<ch0>:STATe` on page 185

"Offset(ms)" Sets the offset value.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:OFFSet<ch0>:VALue` on page 185

Reject Opcode

Requires option R&S SMM-K117 and packet type LL_REJECT_EXT_IND.

Sets the Opcode of a rejected control data PDU. For Opcode settings, see [Table 2-7](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ROPCode`
on page 242

MaxRxOctets/MaxTxOctets

Requires option R&S SMM-K117 and packet types LL_LENGTH_REQ or LL_LENGTH_RSP.

Sets the maximum allowed payload length of a received packet (RX) or a transmitted packet (TX).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MR0ctets`
on page 236

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MT0ctets`
on page 236

MaxRxTime/MaxTxTime

Requires option R&S SMM-K117 and packet types LL_LENGTH_REQ or LL_LENGTH_RSP.

Sets the maximum allowed time to receive (RX) a packet or to transmit (TX) a packet.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MRTime`
on page 237

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MTTime`
on page 237

TX PHYS/RX PHYS

Requires option R&S SMM-K117 and packet types LL_PHY_REQ or LL_PHY_RSP.

Sets preferred physical layers in receive direction (Rx) and transmit direction (Tx). For permitted PHYs, see [Table 2-9](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RPHYs:L1M:STATE` on page 242

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RPHYs:L2M:STATE` on page 242

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RPHYs:LCOD:STATE` on page 242

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:TPHYs:L1M:STATE` on page 242

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:TPHYs:L2M:STATE` on page 242

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:TPHYs:LCOD:STATE` on page 242

M_TO_S_PHY/S_TO_M_PHY

Requires option R&S SMM-K117 and packet type LL_PHY_UPDATE_IND.

Sets the physical layers of the Central-to-Peripheral (C_TO_P) direction and Peripheral-to-Central (P_TO_C) direction.

For available PHYs, see [Table 2-9](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MTSPhy:L1M:STATE` on page 238

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MTSPhy:L2M:STATE` on page 238

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MTSPhy:LCOD:STATE` on page 238

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:STMPHy:L1M:STATe` on page 238

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:STMPHy:L2M:STATe` on page 238

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:STMPHy:LCOD:STATe` on page 238

PHYs

Requires option R&S SMM-K117 and packet type LL_MIN_USED_CHANNELS_IND.

Sets the physical layers for which the Peripheral device has a minimum used channels requirement. See also "[Min Used Channels](#)" on page 87.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHYS:L1M:STATe` on page 241

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHYS:L2M:STATe` on page 241

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHYS:LCOD:STATe` on page 241

Min Used Channels

Requires option R&S SMM-K117 and packet type LL_MIN_USED_CHANNELS_IND.

Sets the minimum number of channels to be used on the specified "[PHYs](#)" on page 87.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MUChannels` on page 238

ID(hex)

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the ID of the identifier specified by the Host in the CtrData field. The value is in hexadecimal representation.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ID` on page 247

SyncInfo Configuration

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

For related settings, see "[SyncInfo/SyncInfo Configuration](#)" on page 69 and [Chapter 5.3.5.5, "SyncInfo configuration settings"](#), on page 73.

Connection Event Count

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Specifies the connEventCount field in the CtrData field.

The count value is specified within the following range:

$\text{currEvent} - 2^{14} < \text{connEventCount} < \text{currEvent} + 2^{14}$

CurrEvent is the counter value for the connection event during transmission or retransmission of the PDU.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CECount`
on page 247

Last Pa Event Counter

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the lastPaEventCounter field in the CtrData field.

The lastPaEventCounter value is typically equal to the PaEventCounter value in the AUX_SYNC_IND PDU.

The values for lastPaEventCounter and EventCounter are as follows:

- Equal values
- Values with a difference of 1 (modulo 65536)
- Values representing LL_PERIODIC_SYNC_IND and AUX_SYNC_IND timing of less than 5 seconds

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:LPECounter`
on page 248

SID(hex)

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the SID field in the CtrData field. The value is in hexadecimal representation.

The SID is typically equal to the Advertising SID subfield of the advertising set pointing to periodic advertising.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SID`
on page 249

Address Type

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the address type in the CtrData field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ATYPE`
on page 247

Sleep Clock Accuracy

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

For related settings, see "[Sleep Clock Accuracy](#)" on page 79.

PHY

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the PHY field in the CtrData field. The value is set in a hexadecimal representation.

The PHY information indicates the PHY type during periodic advertising. The selection is exclusive; enabling one PHY disables the other enabled PHY.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHY:L1M:STATe` on page 248

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHY:L2M:STATe` on page 248

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:PHY:LCOD:STATe` on page 249

Advertiser's Device Addr

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

For related settings, see "[Advertiser's Device Addr](#)" on page 64.

Sync Connection Event Counter

Requires option R&S SMM-K117 and packet type LL_PERIODIC_SYNC_IND.

Sets the event counter for the sync connection.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCECounter` on page 249

MinCTELenReq

Requires option R&S SMM-K117 and packet type LL_CTE_REQ.

Sets the minimum CTE length in the CtrData field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MCLReq` on page 248

CTETypeReq

Requires option R&S SMM-K117 and packet type LL_CTE_REQ.

Sets the 2-bit constant tone extension type in the CtrData field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CTReq` on page 219

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MCLReq` on page 248

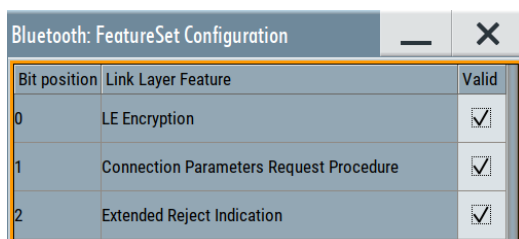
5.3.9 FeatureSet configuration settings

Option: R&S SMM-K117

Access:

1. In the "Channel" tab, select "Channel Type" > "Data".
2. Select a link layer control PDU that contains feature set information. These PDUs are available for central or peripheral controllers.
3. For a central controller, proceed as follows:

- a) Select "Bluetooth Controller Role" > "Central".
 - b) Select "Packet Type" > "LL_FEATURE_REQ" or "LL_PERIPHERAL_FEATURE_REQ".
4. For a peripheral controller, proceed as follows:
 - a) Select "Bluetooth Controller Role" > "Peripheral".
 - b) Select "Packet Type" > "LL_FEATURE_RSP" or "LL_PERIPHERAL_FEATURE_REQ".
 5. Select "Event Configuration" > "Packet Configuration".
 6. Select "Payload" > "FeatureSet Configuration".



Opens a dialog to enable or disable features within the link layer control PDU. A table lists all features that are available within the feature set of the PDU.

Settings:

FeatureSet configuration table

Displays available features within the link layer control PDU.

For configurable features, see the table [Table 5-5](#). To enable the feature, select "Valid" > "On" to the right of the feature.

Table 5-5: Link layer features: Bit number and feature

Bit	Link layer feature	Bit	Link layer feature
0	LE encryption	14	Channel selection algorithm #2
1	Connection parameter request procedure	15	LE power class 1
2	Extended reject indication	16	Minimum Number of Used Channels procedure
3	Peripheral-initiated feature exchange	17	Connection CTE request
4	LE ping	18	Connectionless CTE response
5	LE data packet length extension	19	Connectionless CTE transmitter
6	LL privacy	20	Connectionless CTE receiver
7	Extended scanner filter policies	21	Antenna switching during CTE transmission (AoD)
8	LE 2M PHY	22	Antenna switching during CTE reception (AoD)
9	Stable modulation index - transmitter	23	Receiving constant tone extensions
10	Stable modulation index - receiver	24	Periodic advertising Sync transfer - sender
11	LE coded PHY	25	Periodic advertising Sync transfer - recipient

Bit	Link layer feature	Bit	Link layer feature
12	LE extended advertising	26	Sleep clock accuracy updates
13	LE periodic advertising	27	Remote public key validation

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:FSBit<ch0>:STATe` on page 234

5.4 CS subevent configuration

Option: R&S SMM-K178

Access:

1. Select "Bluetooth" > "General".
2. Select "Bluetooth Mode" > "Bluetooth Low Energy".
3. Select "Channel".
4. Select "Channel Type" > "Channel Sounding".
5. Select "Cs Subevent Configuration".

The dialog provides settings to configure Channel Sounding subevents.

For more information, refer to the Bluetooth Channel Sounding specification [2].

Settings:

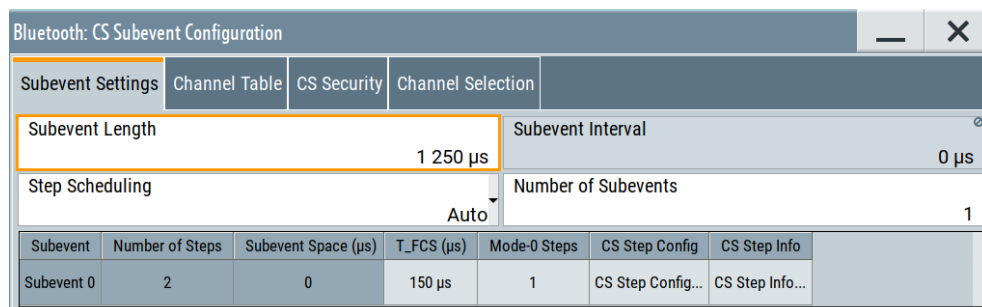
- [Subevent settings](#).....91
- [Channel table](#).....95
- [CS security settings](#).....96
- [Channel selection settings](#).....98
- [CS step configuration](#).....99
- [CS step info](#).....108

5.4.1 Subevent settings

Access:

1. Select "Cs Subevent Configuration".

2. Select "Subevent Settings".



The tab provides settings to configure subevent settings.

Settings:

Subevent Length.....	92
Subevent Interval.....	92
Step Scheduling.....	93
Number of Subevents.....	93
Subevent table.....	93
Subevent.....	94
Number of Steps.....	94
Subevent Space (µs).....	94
T_FCS (µs).....	94
Mode-0 Steps.....	94
CS Step Config.....	94
CS Step Info.....	94

Subevent Length

Sets the subevent length that is the duration of a CS subevent.

You can set values in multiples of 625 µs. Settable subevent lengths depend on the number of event intervals, the connection interval, the event offset and the subevent interval.

For more information, refer to the Bluetooth Channel Sounding specification [2].

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:SLENgth on page 192

Subevent Interval

Sets the subevent interval. This interval is the time in multiples of 625 µs between the beginning of a CS subevent and the beginning of the next CS subevent within the same CS event.

For "Number of Subevents" = "1", the subevent interval is 0µs. For "Number of Subevents" higher than "1", settable subevent intervals depend on the number of event intervals, the connection interval, the event offset and the subevent length.

For more information, refer to the Bluetooth Channel Sounding specification [2].

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:SINTerval on page 192

Step Scheduling

Sets the CS step scheduling mode.

"Auto" Automatic CS step scheduling. The subevent length, the subevent interval and the number of subevents are configurable.

The number of CS steps is 2.

"Manual" Manual CS step scheduling. The table [Table 5-6](#) lists fixed CS parameters.

Table 5-6: CS parameters for manual step scheduling

Parameter	Value
"Subevent Length"	1250 μ s
"Subevent Interval"	0 μ s
"Number of Subevents"	1
"Event Intervals"	2
"Connection Interval"	7.5 ms
"Event Offset"	500 μ s

The number of CS steps is configurable.

For more information, refer to the Bluetooth Channel Sounding specification [\[2\]](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:SSCHeduling` on page 193

Number of Subevents

Sets number of subevents. Settable values depend on the subevent interval.

For more information, refer to the Bluetooth Channel Sounding specification [\[2\]](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:SNUMber` on page 193

Subevent table

Lists properties and settings of all configured subevents in a table. The number of rows equals the number of subevents.

Subevent	Number of Steps	Subevent Space (μ s)	T_FCS (μ s)	Mode-0 Steps	CS Step Config	CS Step Info
Subevent 0	2	935	150 μ s	1	CS Step Config...	CS Step Info...
Subevent 1	2	935	150 μ s	1	CS Step Config...	CS Step Info...
Subevent 2	2	935	150 μ s	1	CS Step Config...	CS Step Info...

The table allows you to check or configure the following parameters for each subevent individually:

- ["Subevent"](#) on page 94
- ["Number of Steps"](#) on page 94
- ["Subevent Space \(\$\mu\$ s\)"](#) on page 94
- ["T_FCS \(\$\mu\$ s\)"](#) on page 94
- ["Mode-0 Steps"](#) on page 94
- ["CS Step Config"](#) on page 94
- ["CS Step Info"](#) on page 94

Subevent

Displays the subevent number "Subevent x" within a subevent interval. "x" ranges from 0 to 31 depending on the number of subevents, see ["Number of Subevents"](#) on page 93.

Remote command:

Via suffix `SUBevent<ch>`

Number of Steps

Sets or display the number of CS steps. Setting requires "Step Scheduling" > "Manual". Settable minimum values are 1 or equal to the number of non-zero Mode-0 steps, see ["Mode-0 Steps"](#) on page 94.

For more information, refer to the Bluetooth Channel Sounding specification [2].

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :NOSTep` on page 193

Subevent Space (µs)

Displays the subevent space in microseconds.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :SSpace?` on page 194

T_FCS (µs)

Sets the frequency change period (T_FCS) between consecutive CS steps. The period ranges from 15 µs to 150 µs.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :TFCS` on page 194

Mode-0 Steps

Sets the number of Mode-0 CS steps.

For "Step Scheduling" > "Auto", the range is 1 to 3. For "Step Scheduling" > "Manual", the range is 0 to 3. For non-zero Mode-0 CS steps ("Mode-0 Steps" ≠ "0"), the minimum number of CS steps equals the configured Mode-0 CS steps.

For more information, refer to the Bluetooth Channel Sounding specification [2].

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MZSteps` on page 194

CS Step Config

Opens a dialog to configure CS steps, see [Chapter 5.4.5, "CS step configuration"](#), on page 99.

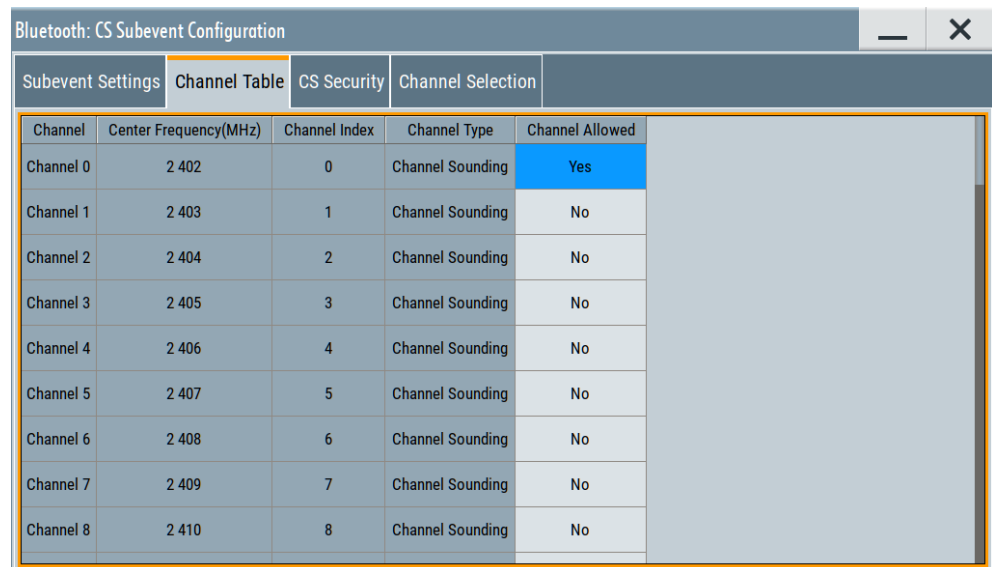
CS Step Info

Opens a dialog that provides information on configured CS steps per subevent in a table, see [Chapter 5.4.6, "CS step info"](#), on page 108.

5.4.2 Channel table

Access:

1. Select "CS Subevent Configuration".
2. Select "Channel Table".



Channel	Center Frequency(MHz)	Channel Index	Channel Type	Channel Allowed
Channel 0	2 402	0	Channel Sounding	Yes
Channel 1	2 403	1	Channel Sounding	No
Channel 2	2 404	2	Channel Sounding	No
Channel 3	2 405	3	Channel Sounding	No
Channel 4	2 406	4	Channel Sounding	No
Channel 5	2 407	5	Channel Sounding	No
Channel 6	2 408	6	Channel Sounding	No
Channel 7	2 409	7	Channel Sounding	No
Channel 8	2 410	8	Channel Sounding	No

The tab lists general settings for all 78 Bluetooth LE channels in a table.

Settings:

Channel.....	95
Center Frequency (MHz).....	95
Channel Index.....	96
Channel Type.....	96
Channel Allowed.....	96

Channel

Displays the channel number that consists of "Channel" and the channel index.

For example, for "Channel 0" the channel index is 0 and the center frequency is 2402 MHz. See also [Table 2-13](#).

Remote command:

Via suffix CHNNL<ch>

Center Frequency (MHz)

Displays the center frequency of the channel.

See also [Table 2-13](#).

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CTABLE [:CHANnel<ch0>] :CFrequency?

on page 204

Channel Index

Displays the channel index of the channel.

See also [Table 2-13](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CTABLE [:CHANnel<ch0>] :CINDEX?`
on page 205

Channel Type

Displays the channel type that is Channel Sounding for all channels.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CTABLE [:CHANnel<ch0>] :CTYPE?`
on page 205

Channel Allowed

Enables transmission of the subevent via the selected channel.

See also [Table 2-13](#).

"Yes" Enables transmission of the subevent for the selected channel.

"No" Disables transmission of the subevent for the selected channel.

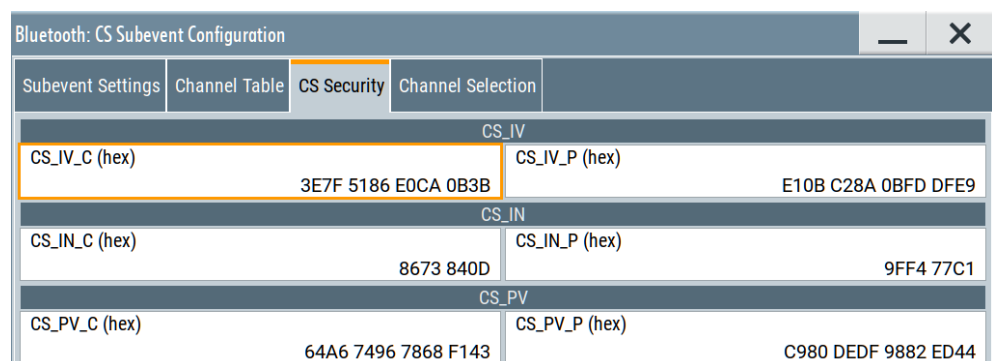
Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CTABLE [:CHANnel<ch0>] :CALLOWed`
on page 205

5.4.3 CS security settings

Access:

1. Select "CS Subevent Configuration".
2. Select "CS Security".



The tab provides settings to configure CS security settings.

Settings:

CS_IV_C(hex)	97
CS_IV_P(hex)	97
CS_IN_C(hex)	97
CS_IN_P(hex)	97
CS_PV_C(hex)	97
CS_PV_P(hex)	97

CS_IV_C(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IV_C parameter. The parameter is 64-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CIVC](#) on page 206

CS_IV_P(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_RSP.

Sets the CS_IV_P parameter. The parameter is 64-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CIVP](#) on page 206

CS_IN_C(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IN_C parameter. The parameter is a 32-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CINC](#) on page 207

CS_IN_P(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_RSP.

Sets the CS_IN_P parameter. The parameter is a 32-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CINP](#) on page 207

CS_PV_C(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_PV_C parameter. The parameter is 64-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CSPVc](#) on page 208

CS_PV_P(hex)

Requires packet type CS SEQUENCE or LL_CS_SEC_RSP.

Sets the CS_PV_P parameter. The parameter is 64-bit in hexadecimal representation.

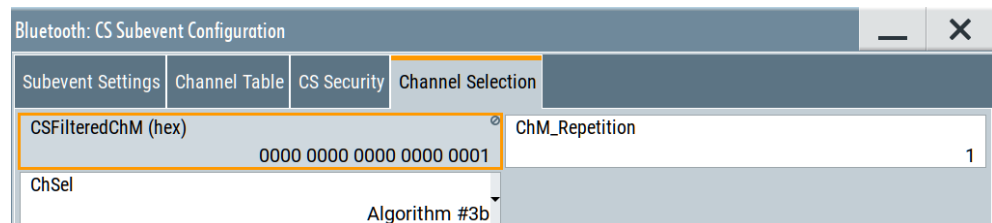
Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CPVP](#) on page 208

5.4.4 Channel selection settings

Access:

1. Select "CS Subevent Configuration".
2. Select "Channel Selection".



The tab provides settings to configure channel selection.

Settings:

CSFilteredChM(hex)	98
ChM_Repetition	98
ChSel	98
Ch3cShape	99
Ch3cJump	99

CSFilteredChM(hex)

Displays the value of the field CSFilteredChM.

This value determines the bit map for the Channel Sounding channel map update procedure. The parameter is 64-bit in hexadecimal representation.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CFCHm?](#) on page 208

ChM_Repetition

Sets the 3-bit ChM_Repetition field.

The value equals the number of cycles of the ChM field for non-Mode-0 CS steps within a CS procedure.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CMRepetition](#) on page 209

ChSel

Sets the algorithm to select the channels.

"Algorithm #3b"

Sets for Algorithm #3b channel selection algorithm.

"Algorithm #3c"

Sets for Algorithm #3c channel selection algorithm.

Table 5-7: Algorithm #3c parameters

CSChannelJump	seq1StartCh	seq2StartCh	maxRepsAllowed	saltRate
2	1	76	1	2
3	77	0	1	2
4	78	0	2	2
5	78	0	2	2
6	76	1	3	2
7	74	1	3	2
8	76	0	3	2

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CSEL](#) on page 209

Ch3cShape

Requires "ChSel" > "Algorithm #3c".

Sets the bits of the Ch3cShape field. The field has a length of 4 bits and sets the shaping method of the rising and falling ramps of the channels.

The resulting shapes are incorporated into a shuffled channel map so that they appear random, preserving equal channel distribution qualities.

"Hat Shape" Channel with a rising ramp and a falling ramp.

"X Shape" Channel with interleaved rising and falling ramps.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CTCShape](#) on page 210

Ch3cJump

Requires "ChSel" > "Algorithm #3c".

Determines the number of skipped channels when rendering the channel shapes. The Ch3cJump field has a length of 1 octet and relates to the channel index values. See also [Table 5-7](#).

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CTCJump](#) on page 209

5.4.5 CS step configuration

Access:

1. Select "CS Subevent Configuration".
2. Select "Subevent Settings" > "Subevent 0" > "CS Step Config..."

The "CS Step Config" tab of the "Structure for Subevent x" dialog opens.

The tab provides CS step settings for the first subevent "Subevent 0". If configured, all following subevents share CS step configuration as subevent 0.

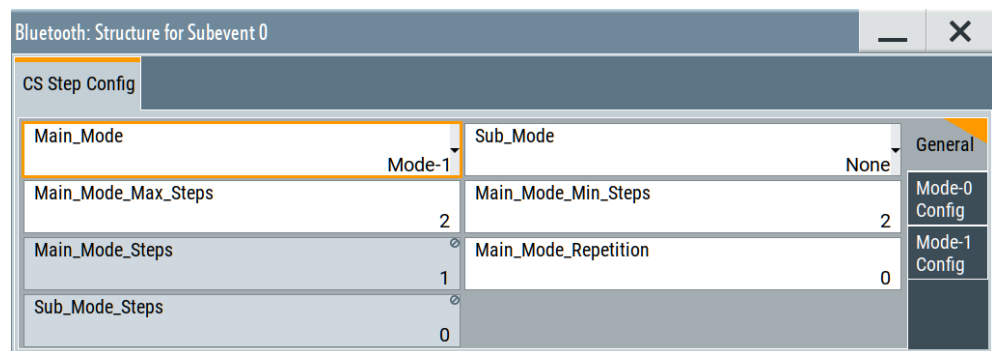
Settings:

- [General settings](#)..... 100
- [Mode-0 config settings](#)..... 102
- [Mode-1 config settings](#)..... 102
- [Mode-2 config settings](#)..... 104
- [Mode-3 config settings](#)..... 106

5.4.5.1 General settings

Access:

- ▶ Select "CS Step Config" > "General".



The tab provides CS step general settings for each subevent.

Settings:

- [Main_Mode](#)..... 100
- [Sub_Mode](#)..... 101
- [Main_Mode_Max_Steps](#)..... 101
- [Main_Mode_Min_Steps](#)..... 101
- [Main_Mode_Steps](#)..... 101
- [Main_Mode_Repetition](#)..... 101
- [Sub_Mode_Steps](#)..... 101

Main_Mode

Sets the main mode of the CS step.

- "Mode-1" Mode-1 mode with no submode available.
- "Mode-2" Mode-2 mode with submodes "Mode-1" and "Mode-3" available.
- "Mode-3" Mode-3 mode with submode "Mode-2" available.

The table [Table 5-8](#) provides an overview on available submodes per main mode.

Table 5-8: CS step main modes and submodes

"Main_Mode"	"Sub_Mode"
"Mode-1"	"None"
"Mode-2"	"None", "Mode-1", "Mode-3"
"Mode-3"	"None", "Mode-2"

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMODE](#) on page 195

Sub_Mode

Sets the submode of the main mode.

The table [Table 5-8](#) provides an overview on available submodes per main mode.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:SMODE](#) on page 196

Main_Mode_Max_Steps

Sets the maximum number of main mode steps.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMASteps](#) on page 196

Main_Mode_Min_Steps

Sets the minimum number of main mode steps.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMISteps](#) on page 196

Main_Mode_Steps

Displays the number of main mode CS steps.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMSteps?](#) on page 197

Main_Mode_Repetition

Sets the main mode repetition.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMRepetition](#) on page 197

Sub_Mode_Steps

Sets the number of submode CS steps.

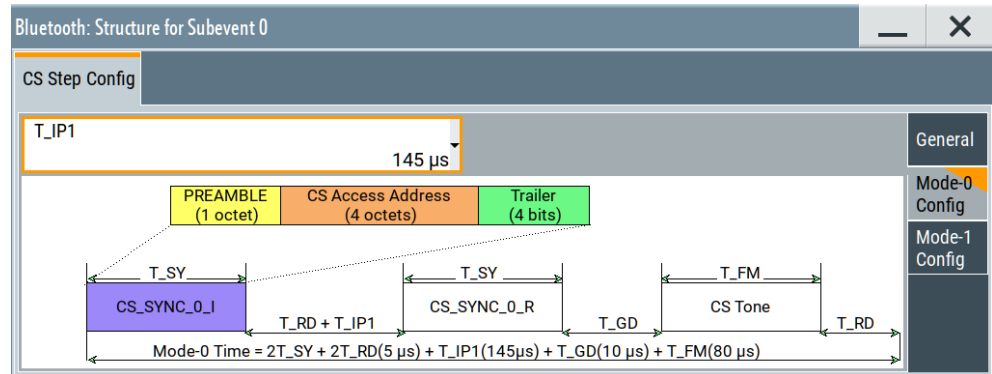
Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:SMSTep?](#) on page 197

5.4.5.2 Mode-0 config settings

Access:

- ▶ Select "CS Step Config" > "Mode-0 Config".



The tab provides Mode-0 CS step settings.

Settings:

T_IP1

Sets the time "T_IP1" for Mode-0 CS steps.

Remote command:

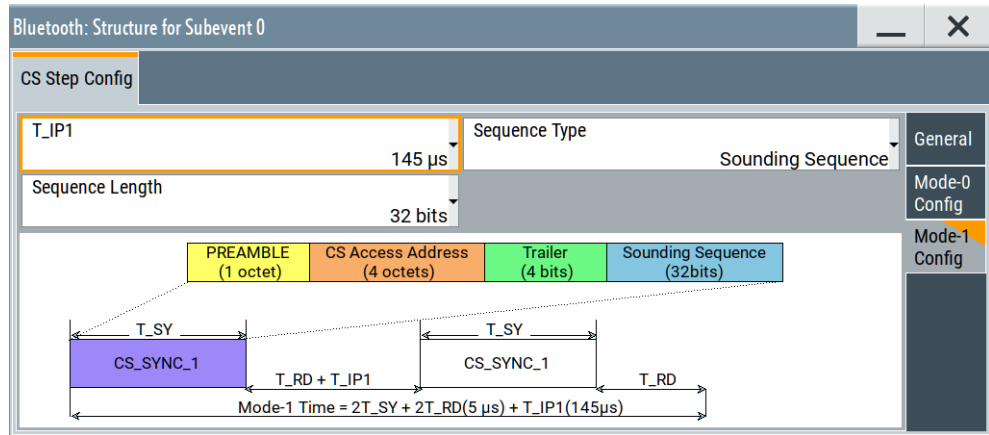
[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MZERo:TIPO on page 197

5.4.5.3 Mode-1 config settings

Access:

1. Select "CS Step Config" > "General".
2. Select Mode-1 in the CS step main mode or submode:
 - Select "Main_Mode" > "Mode-1".

- Select "Main_Mode" > "Mode-2" and "Sub_Mode" > "Mode-1".



The tab provides Mode-1 CS step settings.

Settings:

T_IP1.....103
 Sequence Length.....103
 Sequence Type.....103
 User Payload Pattern.....104
 Select Data List.....104

T_IP1

Sets the time "T_IP1" for Mode-1.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] :MONE:TIPO on page 197
```

Sequence Length

Sets the sequence length. The length is discrete and depends on the sequence type.

Sequence type	Sequence length
Sounding sequence	32 bits, 96 bits
Random sequence	32 bits, 64 bits, 96 bits and 128 bits

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] :SEQLength on page 199
```

Sequence Type

Sets the sequence type.

"Sounding Sequence"
 Sounding sequence

"Random Sequence"
 Random sequence

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] :STYPe on page 199
```

User Payload Pattern

Displaying the parameter "User Payload Pattern" requires the following:

- "Packet Type" > "TEST PACKET".
- "Main_Mode" > "Mode-1" or "Mode-3".
"Sub_Mode" > "Mode-1" or "Mode-3".
- In the "Mode-1 Config" or "Mode-3 Config", select "Sequence Type" > "Random Sequence".

Sets a predefined pattern or user-defined data list as the data source for the user payload.

"PRBS 9 sequence"/"PRBS 15 sequence"

Pseudo random bit sequences of the length 9 or 15 - transmission of identical packet series.

Predefined pattern

"Repeated 11110000 sequence", "Repeated 10101010 sequence",
"Repeated 11111111 sequence", "Repeated 00000000 sequence",
"Repeated 00001111 sequence" or "Repeated 01010101 sequence"

"Use CS_SYNC_User_Payload"

Selects binary data from a user-defined data list file, see ["Select Data List"](#) on page 104.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :UPPattern` on page 200

Select Data List

Requires "User Payload Pattern" > "Use CS_SYNC_User_Payload".

See ["Data Source"](#) on page 65.

Remote command:

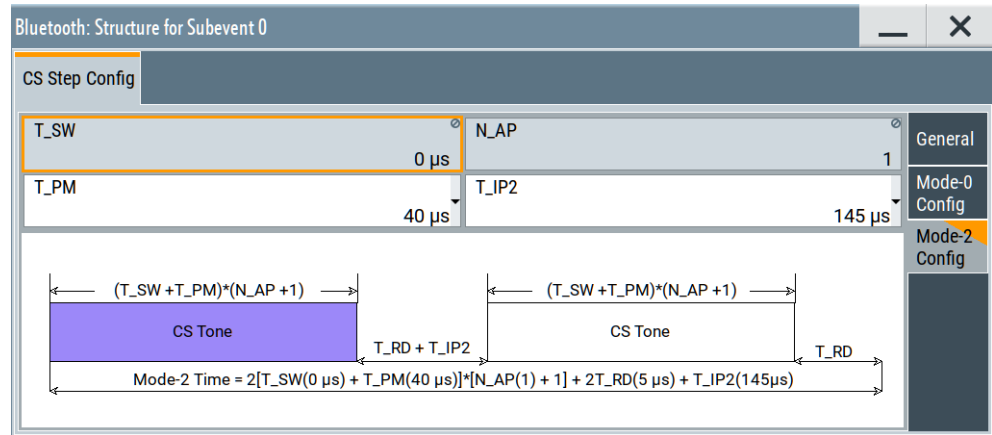
`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :UPAYload` on page 199

5.4.5.4 Mode-2 config settings

Access:

1. Select "CS Step Config" > "General".
2. Select Mode-2 in the CS step main mode or submode:
 - Select "Main_Mode" > "Mode-2".

- Select "Main_Mode" > "Mode-3" and "Sub_Mode" > "Mode-2".



The tab provides Mode-2 CS step settings.

Settings:

T_SW	105
N_AP	105
T_PM	105
T_IP2	105

T_SW

Sets the time "T_SW" for Mode-2.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTWO:TSW?` on page 198

N_AP

Sets the number of antenna path in the N_AP field.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTWO:NAP?` on page 198

T_PM

Sets the time "T_PM" for Mode-2.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTWO:TPM` on page 198

T_IP2

Sets the time "T_IP2" for Mode-2 CS steps.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTWO:TIPT` on page 199

5.4.5.5 Mode-3 config settings

Access:

1. Select "CS Step Config" > "General".
2. Select Mode-3 in the CS step main mode or submode:
 - Select "Main_Mode" > "Mode-3".
 - Select "Main_Mode" > "Mode-2" and "Sub_Mode" > "Mode-3".

The tab provides Mode-3 CS step settings.

Settings:

T_SW	106
N_AP	106
T_PM	107
T_IP2	107
Sequence Length	107
Sequence Type	107
User Payload Pattern	107
Select Data List	108

T_SW

Sets the time "T_SW" for Mode-3.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTHRee:TSW? on page 198

N_AP

Sets the "N_AP".

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTHRee:NAP? on page 198

T_PM

Sets the time "T_PM" for Mode-3.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTHRee:TPM on page 198

T_IP2

Sets the time "T_IP2" for Mode-3.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :MTHRee:TIPT on page 199

Sequence Length

Sets the sequence length. The length is discrete and depends on the sequence type.

Sequence type	Sequence length
Sounding sequence	32 bits, 96 bits
Random sequence	32 bits, 64 bits, 96 bits and 128 bits

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :SEQLength on page 199

Sequence Type

Sets the sequence type.

"Sounding Sequence"

Sounding sequence

"Random Sequence"

Random sequence

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :STYPe on page 199

User Payload Pattern

Displaying the parameter "User Payload Pattern" requires the following:

- "Packet Type" > "TEST PACKET".
- "Main_Mode" > "Mode-1" or "Mode-3".
"Sub_Mode" > "Mode-1" or "Mode-3".
- In the "Mode-1 Config" or "Mode-3 Config", select "Sequence Type" > "Random Sequence".

Sets a predefined pattern or user-defined data list as the data source for the user payload.

"PRBS 9 sequence"/"PRBS 15 sequence"

Pseudo random bit sequences of the length 9 or 15 - transmission of identical packet series.

Predefined pattern

"Repeated 11110000 sequence", "Repeated 10101010 sequence",
"Repeated 11111111 sequence", "Repeated 00000000 sequence",
"Repeated 00001111 sequence" or "Repeated 01010101 sequence"

"Use CS_SYNC_User_Payload"

Selects binary data from a user-defined data list file, see ["Select Data List"](#) on page 104.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEvent<ch0>] :UPPattern` on page 200

Select Data List

Requires "User Payload Pattern" > "Use CS_SYNC_User_Payload".

See ["Data Source"](#) on page 65.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS [:SEvent<ch0>] :UPAYload` on page 199

5.4.6 CS step info

Access:

1. Select "CS Subevent Configuration".
2. Select "Subevent settings" > "CS Step Config".
The "CS Step Config" dialog opens.
The dialog provides CS step settings for each subevent.

Settings:

5.4.6.1 Step table

Access:

- ▶ Select "CS Step Info" > "Step Table".

Step	Mode Type	Channel Index	CS Access Address	Sounding Sequence Content	Companion Signal	CS Tone Ext.
Step 0	Mode-0	0	1D56 EC36	0000 0000	None	Off
Step 1	Mode-2	0	0000 0000	0000 0000	-4 and 4	Off

The tab provides the step table that lists the properties and settings for individual CS steps per subevent. The number of rows equals the number of CS steps per subevent. The table allows you to check or configure the following settings for each CS step.

Settings:

Step..... 109
 Mode Type..... 109
 Channel Index..... 110
 CS Access Address..... 110
 Sounding Sequence Content/Random Sequence Content..... 110
 Companion Signal..... 110
 CS Tone Ext..... 112

Step

Displays the number of the CS step "Step x". "x" depends on the number of main mode steps, see "Main_Mode_Steps" on page 101.

Remote command:

Via suffix STEP<st0>

Mode Type

Displays the mode type for individual CS steps.

The displayed mode type depends on the number of Mode-0 CS steps and the configured main mode in the CS step configuration. See "Mode-0 Steps" on page 94 and "Main_Mode" on page 100.

Example:

This example assumes manual step scheduling for one subevent with three CS steps and one mode-0 step. The CS step main mode is mode-3. Set as follows:

"Step Scheduling" > "Manual", "Number of Subevents" = "1", "Number of Steps" = "3", "Mode-0 Steps" = "1" and "Main_Mode" > "Mode-3".

Step Scheduling				Number of Subevents			
Manual				1			
Subevent	Number of Steps	Subevent Space (µs)	T_FCS (µs)	Mode-0 Steps	CS Step Config	CS Step Info	
Subevent 0	3	0	50 µs	1	CS Step Config...	CS Step Info...	

Select "CS Step Info..." to open the CS step table. The table displays the information for three CS steps. The first step "Step 0" has the "Mode Type" > "Mode-0". The second step "Step 1" and the third step "Step 2" have the "Mode Type" > "Mode-3"

Step	Mode Type	Channel Index	CS Access Address	Sounding Sequence Content	Companion Signal	CS Tone Ext.	
Step 0	Mode-0	0	1D56 EC36	0000 0000	None		
Step 1	Mode-3	0	1D56 EC36	0000 0000	None	Off	
Step 2	Mode-3	0	1D56 EC36	0000 0000	None	Off	

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] [:STEP<st0>] :MType?
 on page 201

Channel Index

Sets or displays the channel index for individual CS steps.

Setting the index requires "Step Scheduling" > "Manual"

See also [Table 2-13](#).

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] [ :STEP<st0> ] :CINdex  
on page 202
```

CS Access Address

Sets or displays the 32-bit CS access address for individual CS steps.

Setting the address requires "Step Scheduling" > "Manual"

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] [ :STEP<st0> ] :CAAddress  
on page 202
```

Sounding Sequence Content/Random Sequence Content

Displays the 128-bit content of a sounding sequence or a random sequence. The content depends on the subevent mode.

For CS test packets, you can set the content for a sounding sequence and random sequence, see "[Sequence Type](#)" on page 103.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] [ :STEP<st0> ] :SCONTent  
on page 202
```

Companion Signal

Sets the companion signal and the data source.

"Companion Signal"

Enables or disables the companion signal. This signal consists of one or two signals that deviate symmetrically from the carrier frequency of the wanted signal.

The carrier frequency is the center frequency of the channel that relates to the channel index, see ["Channel Index"](#) on page 110.

You can select between the following values:

- "None":
Disables the companion signal.
- "-2"/"2"/"-2 and 2":
Requires "Packet Format" > "LE 1M".
Enables the companion signal with a deviation of -2 MHz or 2 MHz from the carrier frequency of the wanted signal. "-2 and 2" enables two companion signals that deviate symmetrically from the carrier by 2 MHz.
- "-4"/"4"/"-4 and 4":
Requires "Packet Format" > "LE 2M" or "LE 2M 2BT".
Enables the companion signal with a deviation of -4 MHz or 4 MHz from the carrier frequency of the wanted signal. "-4 and 4" enables two companion signals that deviate symmetrically from the carrier by 4 MHz.

Remote command:

```
[ :SOURce<hw> ] :BB:BT0oth:CS [ :SEVent<ch0> ] [ :STEP<st0> ] :CSIGNAL on page 203
```

- "Data Source" Requires "Companion Signal" ≠ "None".
Selects the 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 set the bit pattern.
 - "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog.
The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :DATA`

on page 203

`[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :PATTern`

on page 204

`[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] :DLISt`

on page 203

CS Tone Ext.

Displaying the CS tone extension requires the following:

- "Step Scheduling" > "Manual".
- "Number of Steps" higher than "Mode-0 Steps"
For example, "Number of Steps" = "2", "Mode-0 Steps" = "1".
- "Main_Mode" > "Mode-2" or "Mode-3"

Enables CS tone extension for mode-2 and mode-3 CS steps.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS [:SEVent<ch0>] [:STEP<st0>] :CTEXtension`

on page 204

5.5 CS control data payload settings

Option: R&S SMM-K178

Access:

1. Select "Packet Configuration".
2. Select "Payload".

Packet Configuration	Header	Payload	
Mode_Types	Mode-3	RTT_Capability	0 CpbData 1
RTT_AA_Only	150ns	RTT_Sounding_N	0ns CpbData 2
RTT_Random_Sequence_N	0ns	NADM_Sounding_Capability	No-NADM CpbData 3
NADM_Random_Sequence_Capability	No-NADM	CS_SYNC_PHY_Capability	LE 2M
Num_Ant	1	Max_Ant_Path	1
Role	Initiator	Companion_Signal	<input type="checkbox"/>

The tab provides settings to configure the packet/PDU payload.

- [CS security payload settings](#)..... 113
- [CS capabilities payload settings](#)..... 113
- [CS configuration payload settings](#)..... 119
- [CS payload settings](#)..... 122
- [CS IND payload settings](#)..... 126
- [CS terminate payload settings](#)..... 128
- [CS FAE payload settings](#)..... 128
- [CS channel map payload settings](#)..... 129

5.5.1 CS security payload settings

For packet type LL_CS_SEC_REQ and LL_CS_SEC_RSP, the "Payload" tab provides CS security settings. The table below lists available CS security settings per LL Control PDU.

LL Control PDU	CS security settings
LL_CS_SEC_REQ	"CS_IV_C(hex)", "CS_IN_C(hex)", "CS_PV_C(hex)"
LL_CS_SEC_RSP	"CS_IV_P(hex)", "CS_IN_P(hex)", "CS_PV_P(hex)"

For related settings, see [Chapter 5.4.3, "CS security settings"](#), on page 96.

5.5.2 CS capabilities payload settings

For packet type LL_CS_CAPABILITIES_REQ and LL_CS_CAPABILITIES_RSP, the "Payload" tab provides the following settings.

Settings:

- [CpbData 1 settings](#)..... 114
- [CpbData 2 settings](#)..... 116
- [CpbData 3 settings](#)..... 117

5.5.2.1 CpbData 1 settings

Mode_Types	114
RTT_Capability	114
RTT_AA_Only	114
RTT_Sounding_N	115
RTT_Random_Sequence_N	115
NADM_Sounding_Capability	115
NADM_Random_Sequence_Capability	115
CS_SYNC_PHY_Capability	115
Num_Ant	115
Max_Ant_Path	115
Role	116
Companion_Signal	116

Mode_Types

Displays the LL Control packet mode type that is Mode-3.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:MTYPE?](#) on page 258

RTT_Capability

Sets the bits in the RTT_Capability field.

These bits determine the time values for the RTT_AA_Only_N field, the RTT_Sounding_N field and the RTT_Random_Sequence_N field. See the table [Table 5-9](#) for an overview.

Table 5-9: RTT_Capability bit numbers and RTT fields

"RTT_Capability"	"RTT_AA_Only"	"RTT_Sounding_N"	"RTT_Random_Sequence_N"
0	150ns, 10ns, 0ns	0ns	0ns
1	0ns	150ns, 10ns, 0ns	0ns
2	0ns	0ns	150ns, 10ns, 0ns

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:RCAPability](#) on page 262

RTT_AA_Only

Displays or sets the time values of the RTT_AA_Only_N field.

Setting the value depends on the bits of the RTT_Capability field. See the table [Table 5-9](#) for an overview.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:RAONLY](#) on page 262

RTT_Sounding_N

Displays or sets the time values of the RTT_Sounding_N field.

Setting the value depends on the bits of the RTT_Capability field. See the table [Table 5-9](#) for an overview.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:RSounding](#) on page 265

RTT_Random_Sequence_N

Displays or sets the time values of the RTT_Random_Sequence_N field.

Setting the value depends on the bits of the RTT_Capability field. See the table [Table 5-9](#) for an overview.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:RRSequence](#) on page 265

NADM_Sounding_Capability

Sets the NADM sounding sequence capability.

"No-NADM" NADM disabled

"NADM" NADM enabled

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:NSCapability](#) on page 260

NADM_Random_Sequence_Capability

Sets the NADM random sequence capability.

"No-NADM" NADM disabled

"NADM" NADM enabled

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:NRSCapability](#) on page 260

CS_SYNC_PHY_Capability

Displays the value of the CS_SYNC_PHY_Capability field that is the LE 2M PHY.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:CSPCapability?](#) on page 267

Num_Ant

Sets the bits of the Num_Ant field. This field indicates the number of antenna elements of the Channel Sounding device.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:NANT](#) on page 259

Max_Ant_Path

Sets the maximum Num_Ant paths.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:MAPath](#) on page 256

Role

See "Role" on page 50.

Companion_Signal

Enables the companion signal.

See also "Companion Signal" on page 110.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CSIGnal on page 256

5.5.2.2 CpbData 2 settings

No_FAE.....	116
Channel Selection Algorithm #3c.....	116
Sounding_PCT_Estimate.....	116
RFU.....	117
Num_Configs.....	117
Max_Procedures_Supported.....	117
T_SW.....	117

No_FAE

Sets the No_FAE bit. This bit indicates if the transmitting LE device supports a fractional frequency offset actuation error (FAE) or not.

"On" No_FAE bit is 1. The transmitting LE device only supports an FAE of zero.

"Off" No_FAE bit is 0. The transmitting LE device supports FAE values as listed in an FAE table.

See also "Channel FAE Table" on page 129.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:NFAE on page 259

Channel Selection Algorithm #3c

Enables the channel selection algorithm #3c.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CSAThreec on page 255

Sounding_PCT_Estimate

Sets the Sounding_PCT_Estimate bit. This bit indicates if the device supports phase correction term (PCT) estimates from a sounding sequence or not.

"On" The Sounding_PCT_Estimate bit is 1. The device supports PCT estimates from a sounding sequence.

"Off" The Sounding_PCT_Estimate bit is 0. The device does not support PCT estimates from a sounding sequence.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:SPEstimate on page 266

RFU

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:RFU](#) on page 263

Num_Configs

Sets the Num_Configs field that relates to the number of independent CS configurations.

This number equals the CS configurations supported by the link layer transmitting this PDU for this specific ACL connection.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:NCONfig](#) on page 259

Max_Procedures_Supported

Sets the bits in the Max_Procedures_Supported field.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:MPSupported](#) on page 258

T_SW

Sets the T_SW field values that relate to the duration of the antenna switch period.

The local controller uses this period when switching antennas during active transmissions.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CS:CDATa:TSW](#) on page 264

5.5.2.3 CpbData 3 settings

Show T_IP1 Capability Table/Hide T_IP1 Capability Table	117
T_IP1_Capability Table	117
Show T_IP2 Capability Table/Hide T_IP2 Capability Table	118
T_IP2_Capability Table	118
Show T_FCS Capability Table/Hide T_FCS Capability Table	118
T_FCS_Capability Table	118
Show T_PM Capability Table/Hide T_PM Capability Table	118
T_PM_Capability Table	119

Show T_IP1 Capability Table/Hide T_IP1 Capability Table

Shows or hides the "T_IP1_Capability Table".

The table provides settings to enable T_IP1 capability for bit positions that relate to eight T_IP1 times. See also "T_IP1" on page 102.

T_IP1_Capability Table

The table provides settings to enable the T_IP1 capability including the T_IP1 time per bit position. You can enable T_IP1 capabilities for bit position 0 to bit position 7.

"Bit Position" Displays the bit position.

"T_IP1" Displays the T_IP1 time of the bit position.

"T_IP1 Capability"

Enables the T_IP1 capability per bit position.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CDATa [:BPOSITION<ch0>] :TIPO:CAPability` on page 253

Show T_IP2 Capability Table/Hide T_IP2 Capability Table

Shows or hides the "T_IP2_Capability Table".

The table provides settings to enable T_IP2 capability for bit positions that relate to eight T_IP2 times. See also "T_IP2" on page 105.

T_IP2_Capability Table

The table provides settings to enable the T_IP2 capability including the T_IP2 time per bit position. You can enable T_IP2 capabilities for bit position 0 to bit position 7.

"Bit Position" Displays the bit position.

"T_IP2" Displays the T_IP2 time of the bit position.

"T_IP2 Capability"

Enables the T_IP2 capability per bit position.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CDATa [:BPOSITION<ch0>] :TIPT:CAPability` on page 253

Show T_FCS Capability Table/Hide T_FCS Capability Table

Shows or hides the "T_FCS_Capability Table".

The table provides settings to enable T_FCS capability for bit positions that relate to 10 T_FCS times. See also "T_FCS (µs)" on page 94.

T_FCS_Capability Table

The table provides settings to enable the T_FCS capability including the T_FCS time per bit position. You can enable T_FCS capabilities for bit position 0 to bit position 9.

"Bit Position" Displays the bit position.

"T_FCS" Displays the T_FCS time of the bit position.

"T_FCS Capability"

Enables the T_FCS capability per bit position.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:CS:CDATa [:BPOSITION<ch0>] :TFCapability` on page 253

Show T_PM Capability Table/Hide T_PM Capability Table

Shows or hides the "T_PM_Capability Table".

The table provides settings to enable T_PM capability for bit positions that relate to three T_PM times. See also "T_PM" on page 105.

T_PM_Capability Table

The table provides settings to enable the T_PM capability including the T_PM time per bit position. You can enable T_PM capabilities for bit position 0 to bit position 2.

"Bit Position"	Displays the bit position.
"T_PM"	Displays the T_PM time of the bit position.
"T_PM Capability"	Enables the T_PM capability per bit position.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:CDATa[:BPOsition<ch0>]:TPCapability`
on page 254

5.5.3 CS configuration payload settings

For packet type LL_CS_CONFIG_REQ and LL_CS_CONFIG_RSP, the "Payload" tab provides the following settings.

Settings:

• Cfg Data 1 settings.....	119
• Cfg Data 2 settings.....	121
• Cfg Data 3 settings.....	122

5.5.3.1 Cfg Data 1 settings

Config_ID.....	119
State.....	119
ChM_Repetition.....	120
Main_Mode.....	120
Sub_Mode.....	120
Main_Mode_Min_Steps.....	120
Main_Mode_Max_Steps.....	120
Main_Mode_Repetition.....	120
Mode_0_Steps.....	120
PHY.....	120
RTT_Type.....	121
Role.....	121

Config_ID

Sets the 6-bit Config_ID field that is the CS configuration ID. Settable ID values are 2 bits in decimal representation. All other values are for future use.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CID` on page 255

State

Enables the CS configuration ID, see "Config_ID" on page 119.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CCID:STATE` on page 255

ChM_Repetition

Sets the 3-bit ChM_Repetition field.

The value equals the number of cycles of the ChM field for non-Mode-0 CS steps within a CS procedure.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CMRepetition on page 209

Main_Mode

Sets the main mode of the CS control PDU.

"Mode-1" Mode-1 mode with no submode available.

"Mode-2" Mode-2 mode with submodes "Mode-1" and "Mode-3" available.

"Mode-3" Mode-3 mode with submode "Mode-2" available.

For an overview on available submodes per main mode, see [Table 5-8](#).

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:MMODE on page 257

Sub_Mode

Sets the submode of the main mode.

For an overview on available submodes per main mode, see [Table 5-8](#).

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:SMODE on page 267

Main_Mode_Min_Steps

Sets the minimum number of main mode steps.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:MMISteps on page 257

Main_Mode_Max_Steps

Sets the maximum number of main mode steps.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:MMASSteps on page 257

Main_Mode_Repetition

Sets the main mode repetition.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:MMRepetition on page 257

Mode_0_Steps

Sets the number of Mode-0 steps.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:MZSteps on page 258

PHY

Displays the PHY field value that is also the packet format.

This value indicates the TX PHY of the remote device, to which the Pwr_Delta field in this PDU applies.

See also ["Packet Format"](#) on page 48.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:PHY? on page 261

RTT_Type

Selects the RTT type determined by the 4-bit RTT_Type field. This field indicates the round trip time (RTT) variant within the CS procedure. The table [Table 5-10](#) provides an overview.

Table 5-10: RTT_Type and RTT variant

RTT_Type value	RTT variant	<RttType>
0x00	RTT CS Access Address only timing	RAAOT
0x01	RTT with 32-bit sounding sequence	R32SS
0x02	RTT with 96-bit sounding sequence	R96SS
0x03	RTT with 32-bit random sequence	R32RS
0x04	RTT with 64-bit random sequence	R64RS
0x05	RTT with 96-bit random sequence	R96RS
0x06	RTT with 128-bit random sequence	R128RS
All other	Reserved for future use.	RAAOT

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:RTYPE on page 263

Role

Selects the CS role, see ["Role"](#) on page 50.

5.5.3.2 Cfg Data 2 settings

Companion_Signal.....	121
RFU.....	122
ChSel.....	122
T_IP1.....	122
T_IP2.....	122
T_FCS.....	122
T_PM.....	122

Companion_Signal

Enables the companion signal.

See also ["Companion Signal"](#) on page 110.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CSIGnal on page 256

RFU

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:RFU on page 263

ChSel

See "ChSel" on page 98.

T_IP1

See "T_IP1" on page 102.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:TIONe on page 264

T_IP2

See "T_IP2" on page 105.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:TITWo on page 264

T_FCS

See "T_FCS (μs)" on page 94.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:TFCS on page 263

T_PM

See "T_PM" on page 105.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:TPM on page 264

5.5.3.3 Cfg Data 3 settings

Show Channel Table/Hide Channel Table

Shows or hides the channel table. For related settings, see [Chapter 5.2.3, "Channel table settings"](#), on page 56.

Remote command:

n.a.

5.5.4 CS payload settings

For packet type LL_CS_REQ and LL_CS_RSP, the "Payload" tab provides the following settings.

Settings:

Config_ID.....	123
RFU.....	123
connEventCount.....	123
Offset_Min.....	123
Offset_Max.....	124
Max_Procedure_Len.....	124
Event_Interval.....	124
Subevent_Per_Event.....	124
Subevent_Interval.....	124
Subevent_Len.....	125
Procedure_Interval.....	125
Procedure_Count.....	125
ACI.....	125
PHY.....	125
Preferred_Peer_Ant.....	125
Pwr_Delta.....	126

Config_ID

Sets the 6-bit Config_ID field that is the CS configuration ID. Settable ID values are 2 bits in decimal representation. All other values are for future use.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CID on page 255

RFU

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:RFU on page 263

connEventCount

Sets the 16-bit connEventCount field bits in a hexadecimal representation.

The connEventCount field sets a connection event counter value that meets the following requirement:

$$\text{currEvent} - 2^{14} < \text{connEventCount} < \text{currEvent} + 2^{14} \pmod{65536}$$

The currEvent parameter is the counter value for the connection event for PDUs that transmit or retransmit this field. The connEventCount value is greater than the currEvent value of the event that transmits the LL_CS_REQ PDU first.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CECount on page 255

Offset_Min

Sets the time value of the Offset_Min field. The value has a length of 3 octets or 9 bits.

The field corresponds to the proposed minimum time (μs) from the ACL anchor point of a certain connection event to the start of the first CS subevent. The connEventCount field references this connection event.

The Offset_Min time value is greater than or equal to 500 µs and less than 4 s.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:OMIN on page 260

Offset_Max

Sets the time value of the Offset_Max field. The value has a length of 3 octets or 9 bits.

The field corresponds to the proposed maximum time between the ACL anchor point and the offset of the first CS step of the first CS subevent. The anchor point marks a certain connection event.

The Offset_Max time value is in microseconds. The value is greater than or equal to the Offset_Min value and is less than the LE connection interval.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:OMAX on page 260

Max_Procedure_Len

Sets the time value of the Max_Procedure_Len field. The value has a length of 2 octets or 6 bits.

The Max_Procedure_Len field is the proposed maximum extent of the entire CS procedure in units of 625 µs. This value is equivalent to the time extent from the beginning of the transmission of the first CS step to the end of the transmission of the final CS step.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:MPLength on page 258

Event_Interval

Sets the 16-bit Event_Interval field, see "Event Intervals/Event_Interval" on page 50.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:EINterval on page 190

Subevent_Per_Event

For packet type LL_CS_REQ, displays the number of subevents per event.

For packet type LL_CS_RSP, sets the number of subevents per event.

The Subevents_Per_Event field indicates the number of CS subevents in each CS event.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:SNUMber on page 266

Subevent_Interval

Sets or displays the subevent interval. Setting requires "Subevent_Per_Event" ≠ "1".

For "Subevent_Per_Event" = "1", the subevent interval is 0 µs.

The subevent interval is the time gap, in units of 625 µs, between the start of two consecutive CS subevents. These subevents start from the same LE anchor point.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:SINterval on page 265

Subevent_Len

Sets the subevent length in the Subevent_Len field. The value has a length of 3 octets or 9 bits.

The Subevent_Len field implies the maximum duration of each CS subevent in microseconds. It is greater than or equal to 1250 µs and less than 4 s.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:SLENgth on page 266

Procedure_Interval

Sets the procedure interval in the Procedure_Interval field. The value has a length of 2 octets or 6 bits.

The Procedure_Interval field implies the time in units of connection intervals between the start of consecutive CS procedures.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:PINterval on page 262

Procedure_Count

Sets the bits in the Procedure_Count field. The value has a length of 2 octets.

The Procedure_Count field implies the number of consecutive CS procedures to invoke. A value of 0 indicates that CS procedures continue to be invoked until they terminate.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:PCount on page 261

ACI

Sets the antenna configuration index (ACI) field. The value has a length of 1 octet or 0 to 7 in decimal representation.

The ACI field indicates the preferred ACI to use in the CS procedure.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:ACI on page 254

PHY

See "PHY" on page 120.

Remote command:

[:SOURCE<hw>] :BB:BT0oth:CS:CDATa:PHY? on page 261

Preferred_Peer_Ant

Sets the bits in the Preferred_Peer_Ant field. The value has a length of 1 octet or 3 bits.

The Preferred_Peer_Ant field is a bit-mapped field and indicates the preferred peer-ordered antenna elements. The peer uses these elements for the antenna configuration as in the ACI field.

The table [Table 5-11](#) lists all possible values and their meaning.

Table 5-11: Preferred_Peer_Ant field values

Bit number	Description	<PrePeerAnt>
0	Use the first ordered antenna element	ANT0
1	Use the second ordered antenna element	ANT1
2	Use the third ordered antenna element	ANT2
3	Use the fourth ordered antenna element	ANT3
All other bits	Reserved for future use	-

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:PPANtenna on page 262

Pwr_Delta

Sets the bits in the Pwr_Delta field. The value has a length of 1 octet or 3 bits.

The Pwr_Delta field indicates the difference between the transmit power level of the remote device for the CS tones and RTT packets and the transmit power level for the PHY is in the PHY field.

The value in the Pwr_Delta field is a signed integer in dB. A positive value indicates a higher transmit power level for the CS tones and RTT packets. A negative value indicates a lower transmit power level for the CS tones and RTT packets, compared to the transmit power level for the PHY indicated by the PHY field. A Pwr_Delta value of 0x00 indicates that the two transmit power levels are the same.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:PDELta on page 261

5.5.5 CS IND payload settings

For packet type LL_CS_IND, the "Payload" tab provides the following settings.

Settings:

Config_ID.....	126
RFU.....	127
connEventCount.....	127
Offset.....	127
Event_Interval.....	127
Subevents_Per_Event.....	127
Subevent_Interval.....	127
Subevent_Len.....	127
ACI.....	127
PHY.....	128
Pwr_Delta.....	128

Config_ID

Sets the 6-bit Config_ID field that is the CS configuration ID. Settable ID values are 2 bits in decimal representation. All other values are for future use.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CID on page 255

RFU

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:RFU on page 263

connEventCount

See "connEventCount" on page 123.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CECount on page 255

Offset

Sets the time value of the Offset field. The value has a length of 3 octets or 9 bits.

The field corresponds to the proposed minimum time (μ s) from the ACL anchor point of a certain connection event to the start of the first CS subevent. The connEventCount field references this connection event.

The Offset time value is greater than or equal to 500 μ s and less than 4 s.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:EOFFset on page 256

Event_Interval

Sets the 16-bit Event_Interval field, see "Event Intervals/Event_Interval" on page 50.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:EINTerval on page 190

Subevents_Per_Event

See "Subevent_Per_Event" on page 124.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:SNUMber on page 266

Subevent_Interval

See "Subevent_Interval" on page 124.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:SINTerval on page 265

Subevent_Len

See "Subevent_Len" on page 125.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:SLENgth on page 266

ACI

See "ACI" on page 125.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:ACI on page 254

PHY

Displays the LE physical layer that is the LE uncoded PHY LE1M.

See also "Packet Format" on page 48.

Remote command:

[:SOURce<hw>] :BB:BT0oth:PFORmat on page 175

Pwr_Delta

See "Pwr_Delta" on page 126.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:PDELta on page 261

5.5.6 CS terminate payload settings

For packet type LL_CS_TERMINATE_IND, the "Payload" tab provides the following settings.

Settings:

Config_ID.....	128
RFU.....	128
Error Code(hex).....	128

Config_ID

Sets the 6-bit Config_ID field that is the CS configuration ID. Settable ID values are 2 bits in decimal representation. All other values are for future use.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:CID on page 255

RFU

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:RFU on page 263

Error Code(hex)

Sets an 8-bit error code. For an LL_CS_TERMINATE_IND packet, informs the remote device about the termination of the connection.

Remote command:

[:SOURce<hw>] :BB:BT0oth:CS:CDATa:ECODE on page 256

5.5.7 CS FAE payload settings

For packet type LL_CS_FAE_RSP, the "Payload" tab provides the following settings.

Settings:

Show Channel FAE Table/Hide Channel FAE Table	129
Channel FAE Table	129

Show Channel FAE Table/Hide Channel FAE Table

Shows or hides the fractional frequency offset actuation error (FAE) channel table.

See "[Channel FAE Table](#)" on page 129.

Channel FAE Table

The FAE channel table provides settings to set the fractional frequency offset actuation error (FAE) per channel.

"Channel Index"

See "[Channel Index](#)" on page 96.

"Channel FAE" Sets the FAE of the channel.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:CS:CDATa [:CHANnel<ch0>] :CFAE` on page 254

5.5.8 CS channel map payload settings

For packet type LL_CS_CHANNEL_MAP_IND, the "Payload" tab provides the following settings.

Settings:

Show Channel Mapping Table/Hide Channel Mapping Table	129
Connection Instant	129

Show Channel Mapping Table/Hide Channel Mapping Table

Shows or hides the channel-mapping table to set channel characteristics.

See [Chapter 5.4.2, "Channel table"](#), on page 95.

Connection Instant

See "[Connection Instant](#)" on page 82.

Remote command:

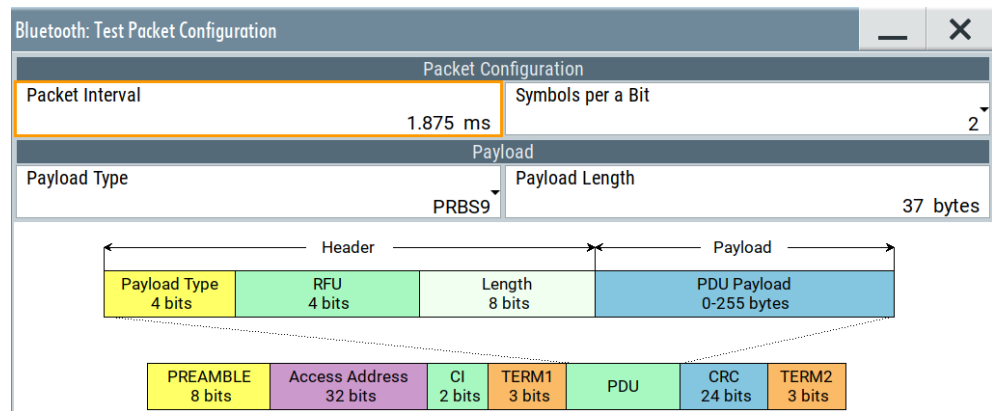
`[:SOURce<hw>] :BB:BT0oth:ECONfiguration:PCONfiguration:CINstant` on page 229

5.6 Test packet configuration

Access:

1. Select "Bluetooth" > "General".
2. "Bluetooth Mode" > "Bluetooth Low Energy".

3. Select "Channel" > "Packet Type" > "TEST PACKET".
4. Select "Test Packet Configuration".



The dialog provides settings to configure test packets. The graphic below the settings shows the test packet structure and fields.

Settings:

Packet Configuration.....	130
Packet Interval.....	130
Symbols per a Bit.....	130
Header.....	131
CTEInfo Present.....	131
CTEInfo Configuration.....	131
Sync Word.....	131
User Pattern(hex).....	131
Payload.....	131
Payload Type.....	131
Payload Length.....	132

Packet Configuration

The "Packet Configuration" section provides settings to configure the packet interval and the number of symbols per bit "S".

Packet Interval

Sets the time interval between two consecutive test packets, regarding the starting points.

Remote command:

```
[ :SOURCE<hw> ] :BB:BT0oth:DTTest:TPConfiguration:TPInterval
```

on page 269

Symbols per a Bit

Requires option R&S SMM-K117 and "Packet Format" > "LE Coded".

Sets the number of symbols per bit "S" for forward error correction (FEC) coding for LE coded packets. See also [Table 2-4](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SPBit`
on page 268

Header

The "Header" section provides settings to configure the header of the test packet.

CTEInfo Present

Requires a data channel packet or a test packet.

Enables the CTEInfo field in the header of Bluetooth LE data packets in the LE uncoded PHY.

See also "[Constant tone extension](#)" on page 23.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CPresent`
on page 218

CTEInfo Configuration

Requires "CTEInfo Present" > "On".

Opens the "CTEInfo Configuration" dialog to configure CTE length and the CTE method. See [Chapter 5.3.3, "CTEInfo settings"](#), on page 62.

Sync Word

Requires an LE uncoded PHY, see "[Packet Format](#)" on page 48.

Sets the 32-bit Sync Word in the packet header field.

"0x94826E8E" Fixed value in hexadecimal representation.

"User Pattern" Allows a user-defined value, see "[User Pattern\(hex\)](#)" on page 131.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SYNCword`
on page 268

User Pattern(hex)

Requires "Sync Word" > "User Pattern".

Sets a user-defined value of the 32-bit Sync Word. This value is an 8-digit hexadecimal input.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:USERpatt`
on page 269

Payload

The "Payload" section provides settings to configure the payload of the test packet.

Payload Type

Selects the data source used for the payload test packets.

"PRBS 9"/"PRBS 15"

Pseudo random bit sequences of the length 9 or 15 - transmission of identical packet series.

Predefined pattern

11110000, 10101010, 11111111, 00000000, 00001111 or 01010101

"Data List" See ["Data Source"](#) on page 65.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TPConfiguration:UPSource`
on page 270

Payload Length

Sets the payload length of the test packet.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TPConfiguration:UPLength`
on page 270

6 Bluetooth BR/EDR configuration and settings

Access:

1. Select "Baseband" > "Bluetooth".
2. Select "Bluetooth Mode" > "Basic Rate + EDR".

The remote commands required to define these settings are described in [Chapter 8, "Remote control commands"](#), on page 160.

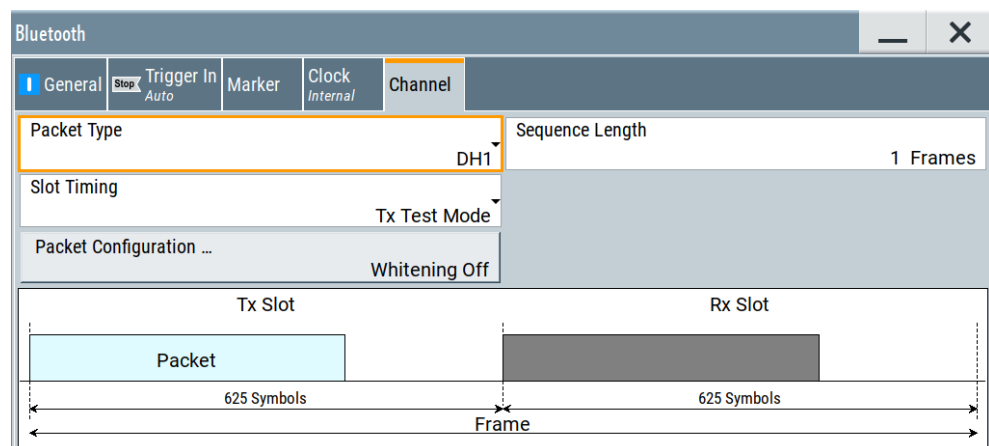
Settings:

- [Channel settings](#)..... 133
- [Packet configuration](#)..... 135

6.1 Channel settings

Access:

1. Select "Bluetooth" > "General".
2. Select "Bluetooth Mode" > "Basic Rate + EDR".
3. Select "Bluetooth" > "Channel".



The tab provides settings to configure Bluetooth BR/EDR channel settings. These settings include the packet type, the sequence length and the slot timing. The graphic at the bottom of the tab shows the frame structure of the selected packet type.

Also, the tab provides further access to the BR/EDR packet configuration, see [Chapter 6.2, "Packet configuration"](#), on page 135.

For Bluetooth LE channel settings, see [Chapter 5.1, "Channel settings"](#), on page 44.

Settings:

Packet Type	134
Sequence Length	134
Slot Timing	134
Packet Configuration	135

Packet Type

Selects the packet type.

The available packets depend on the selected [Transport Mode](#).

All packet types as defined in the Bluetooth specification are supported. For an overview, see [Chapter 2.4.1, "Bluetooth packet types for BR/EDR"](#), on page 27.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PTYPe` on page 271

Sequence Length

Selects the sequence length in frames of the generated signal. The signal repeats after the specified number of frames.

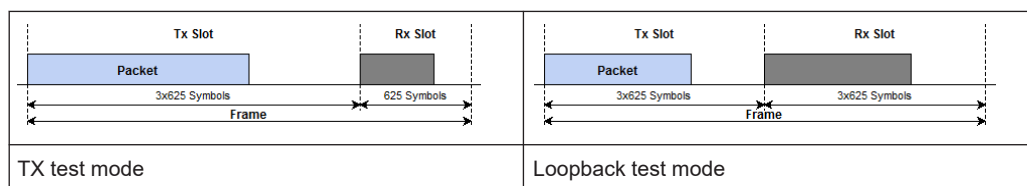
Remote command:

`[:SOURCE<hw>] :BB:BT0oth:SEnGth` on page 271

Slot Timing

Selects the timing mode for the RX slot.

The graphic below shows the frame structure of the selected [Packet Type](#) and slot timing.



A transmitted packet has a duration of $N \times 625 \mu\text{s}$ where "N" is an odd integer larger than 0. N depends on the type of the transmitted packet. In "Tx Test" mode, $N = 1$ for RX slots.

"Tx Test Mode"

The transmitted RX package takes 625 symbols, regardless of the selected packet type.

"Loopback Test Mode"

Extends the RX slot time according to the selected packet type. For example, the RX slot of [Packet Type > DH3](#) takes 3×625 symbols.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:STIMing` on page 271

Packet Configuration

Access the "Packet Configuration" dialog, see [Chapter 6.2, "Packet configuration"](#), on page 135.

The current data source for the packet and the data whitening state are displayed next to the button.

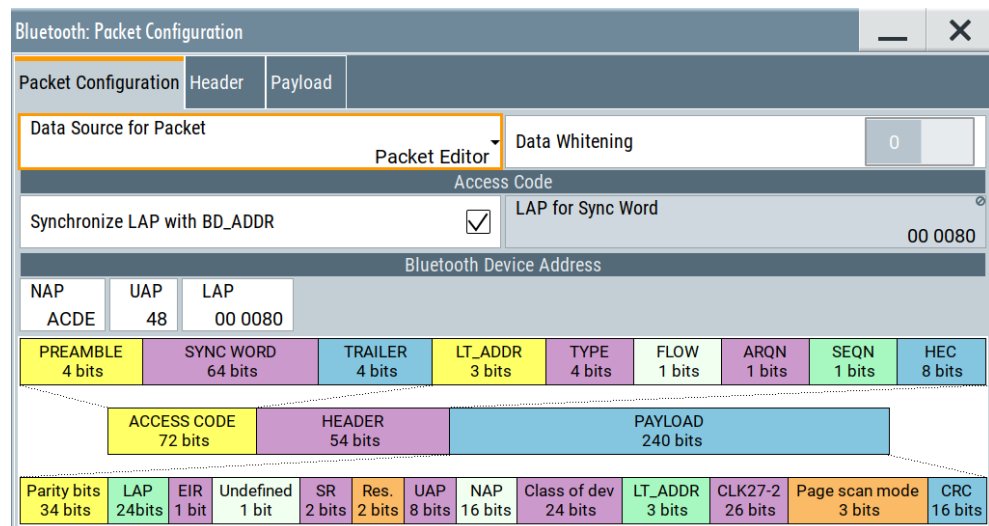
Remote command:

n.a.

6.2 Packet configuration

Access:

1. Select "Bluetooth" > "General".
2. Select "Bluetooth Mode" > "Basic Rate + EDR".
3. Select "Bluetooth" > "Channel" > "Packet Configuration".



The dialog contains the parameters for configuring the packet type.

Available settings vary according to the selected [Packet Type](#) and data source.

Settings:

Packet Configuration.....	136
L Data Source for Packet.....	136
L Data Whitening.....	136
L Synchronize LAP with BD_ADDR.....	136
L LAP for Sync Word.....	136
L Bluetooth Device Address (BD_ADDR).....	137
Header.....	137
L Logical Transport Address.....	137
L Flow Control.....	137

L Acknowledgment.....	138
L SEQN Start Value.....	138
Payload.....	138
L Data Source.....	138
L Data Length.....	139
L EIR packet follows.....	139
L Flow Control.....	139
L Scan Repetition Mode.....	140
L Class of Device.....	140
DV Payload.....	140
L Data Source (Voice Field).....	140
L Data Source.....	141
L Data Length.....	142
L Flow Control.....	142
Data.....	142
L Packet Length.....	142

Packet Configuration

In this section, specify general Bluetooth BR/EDR packet properties.

Data Source for Packet ← Packet Configuration

The data sent for each packet can be comfortably edited with the packet editor, or filled with a predefined "ALL" data sequence.

"Packet Editor" Enables the editing mode to configure the packet fields individually.

"All Data" Fills the generated packets with the selected data source. This mode is useful if you need to load predefined data contents from a data list file or the data contents of the packet are not of interest.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:DSFPacket` on page 276

Data Whitening ← Packet Configuration

Activates the data whitening.

Evenly distributed white noise is ideal for the transmission, and real data can be forced to look similar to white noise with different methods called "Data Whitening".

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:DWhitening` on page 277

Synchronize LAP with BD_ADDR ← Packet Configuration

Requires "Packet Type" > "FHS".

Activates synchronization of the [LAP for Sync Word](#) and the [Bluetooth Device Address > LAP](#).

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:SLAP` on page 279

LAP for Sync Word ← Packet Configuration

Requires "Packet Type" > "FHS".

Sets the 24-bit lower address part (LAP) in the 64-bit sync word separately, if "Synchronize LAP with BD_ADDR > OFF".

The LAP is obtained automatically from the Bluetooth device address "BD_ADDR > LAP", if "Synchronize LAP with BD_ADDR > ON".

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:LFSWord](#) on page 278

Bluetooth Device Address (BD_ADDR) ← Packet Configuration

Enters the Bluetooth device address. Each Bluetooth device has allocated a unique 48-bit Bluetooth device address (BD_ADDR).

The BD_ADDR can take any values except the 64 reserved LAP values: 0x9E8B00 – 0x9E8B3F.

"NAP"	Selects non-significant address part. The length of NAP is 16 bits or 4 hexadecimal figures.
"UAP"	Selects the upper address part. The length of UAP is 8 bits or two hexadecimal figures.
"LAP"	Selects the lower address part. The length of LAP is 24 bits or 6 hexadecimal figures.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDANap](#) on page 273

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDAUap](#) on page 273

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDALap](#) on page 273

Header

Access:

Select "Bluetooth > General > Bluetooth Mode > Basic Rate + EDR > Packet Configuration > Header".

Packet Configuration	Header	Payload
LT Address	0	Flow Control
Acknowledgment	ACK	SEQN Start Value
		GO
		1

Provides header settings.

Logical Transport Address ← Header

Available for all packet types except ID packet.

Enters the logical transport address for the header.

Each Peripheral that is active in a piconet is assigned a primary logical transport address (LT_ADDR). The all-zero LT_ADDR is reserved for broadcast messages.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:LTAddress](#) on page 278

Flow Control ← Header

Available for all packet types except ID packet.

Sets the FLOW bit in the header. This bit indicates the start or stop of transmission of packets over the ACL logical transport.

"Go" Allows the other devices to transmit new data.

"Stop" Stops the other devices from transmitting data temporarily.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:HFControl](#) on page 277

Acknowledgment ← Header

Available for all packet types except ID packet.

Sets the ARQN bit of the packet header.

"NAK" Request to retransmit the previous payload.

"ACK" Previous payload has been received successfully.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:ACKnowledgement](#) on page 272

SEQN Start Value ← Header

Available for all packet types except ID packet.

Sets the start value of the header SEQN bit.

The SEQN bit is present in the header to filter out retransmissions in the destination.

The signal generator is altering this bit automatically on consecutive frames, if a sequence length of at least two frames is set.

"0" The SEQN bit starts with 0.

"1" The SEQN bit starts with 1.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:SNValue](#) on page 280

Payload

Access:

Select "Bluetooth > General > Bluetooth Mode > Basic Rate + EDR > Packet Configuration > Payload".

Packet Configuration	Header	Payload	
Data Source		PN 9	
Data Length		17 bytes	Flow Control GO

Provides payload settings.

Data Source ← Payload

(Available for all packet types except ID, POLL, NULL and FHS packets)

Selects the data source used for the payload.

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 set the bit pattern.
- "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog. The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA](#) on page 274

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DPATtern](#) on page 274

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DSElection](#) on page 275

Data Length ← Payload

(Available for all packet types except ID, POLL, NULL and FHS packets)

Enters the payload data length in bytes.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DLENgth](#) on page 276

EIR packet follows ← Payload

Available for FHS packets.

Indicates that an extended inquiry response packet can follow.

"Yes" Indicates that an EIR packet follows.

"No" Indicates that EIR does not follow.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:EIRPacketfollows](#)
on page 277

Flow Control ← Payload

(Available for all packets types except ID, POLL, NULL, FHS, HV1, HV2, HV3, EV3, EV4, EV5, 2-EV3, 2-EV5, 3-EV3, 3-EV5 packets.)

Sets the FLOW bit in the payload (flow control per logical link)

"Go" Indicates start of transmission of ACL packets after a new connection has been established.

"Stop" Indicates stop of transmission of ACL packets before an additional amount of payload data is sent.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:PFControl](#) on page 279

Scan Repetition Mode ← Payload

Available for FHS packets.

The 2-bit scan repetition field indicates the interval between two consecutive page scan windows, determines the behavior of the paging device.

"R0" The scan interval is equal to the scan window $T_{w_page_scan}$ (continuous scan) and maximal 1.28s.

"R1" The scan interval is maximal 1.28s.

"R2" The scan interval is maximal 2.56s.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:SRMode](#) on page 280

Class of Device ← Payload

Available for FHS packets.

A parameter received during the device discovery procedure, indicates the type of device and which types of service that are supported.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:CODevice](#) on page 274

DV Payload

Access:

Select "Bluetooth > Transport Mode = SCO > Channel > Packet Type = DV > Packet Configuration > Data Source for Packet = Packet Editor > DV Payload".

Packet Configuration	Header	DV Payload
Voice Field		
Data Source		PN 9
Data Field		
Data Source	Data List	Select Data List ... BR_Data_Test
Data Length	9 bytes	Flow Control GO

Provides DV payload settings.

Data Source (Voice Field) ← DV Payload

(Available for DV packets)

Selects the data source for the voice field.

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 set the bit pattern.
- "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog. The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:VDATA](#) on page 281

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:VDPattern](#) on page 275

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:VDSElection](#)
on page 276

Data Source ← DV Payload

(Available for all packet types except ID, POLL, NULL and FHS packets)

Selects the data source used for the payload.

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 set the bit pattern.
- "Data List"/"Select Data List"
Binary data from a list file, internally or externally generated.
Select "Select Data List" to open the standard "Select List" dialog. The dialog lists file with file extension *.dm_iqd if existing.
 - Navigate to the list file and tap "Select" to select the file.
 - Use the "New" and "Edit" functions to create a data list internally or to edit an existing one.
 - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "About data signals" in the R&S SMM100A user manual.
- Section "File and data management" in the R&S SMM100A user manual.
- Section "Data list editor" in the R&S SMM100A user manual.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA](#) on page 274

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DPATtern](#) on page 274

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DSElection](#) on page 275

Data Length ← DV Payload

(Available for all packet types except ID, POLL, NULL and FHS packets)

Enters the payload data length in bytes.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:DLENgth` on page 276

Flow Control ← DV Payload

(Available for all packets types except ID, POLL, NULL, FHS, HV1, HV2, HV3, EV3, EV4, EV5, 2-EV3, 2-EV5, 3-EV3, 3-EV5 packets.)

Sets the FLOW bit in the payload (flow control per logical link)

"Go" Indicates start of transmission of ACL packets after a new connection has been established.

"Stop" Indicates stop of transmission of ACL packets before an additional amount of payload data is sent.

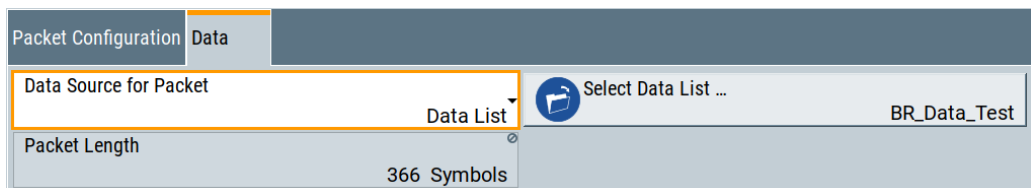
Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:PFControl` on page 279

Data

Access:

Select "Packet Configuration > Data Source for Packet = All Data > Data".



Provides data settings.

Packet Length ← Data

(Available in "All Data" mode and for all packet types except ID packet.)

Enters the packet length in symbols.

Remote command:

`[:SOURCE<hw>] :BB:BT0oth:PCONfiguration:PLENgth` on page 279

7 Signal control and signal characteristics

This section lists settings provided for configuring the baseband filter and configuring power ramping of bluetooth bursts. Also settings are listed for defining the signal generation start and for generating signals necessary for synchronization with other instruments.

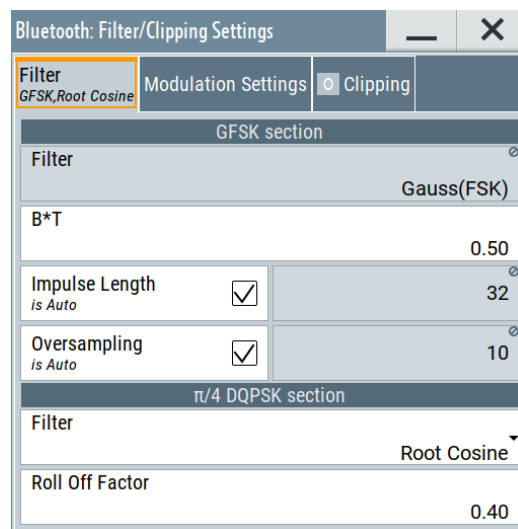
It covers the following topics:

- [Filter/clipping settings](#).....143
- [Power ramping settings](#).....149
- [Trigger settings](#).....151
- [Marker settings](#).....156
- [Clock settings](#).....158
- [Local and global connectors settings](#).....159

7.1 Filter/clipping settings

Access:

1. Select "Baseband" > "Bluetooth".
2. Select "General" > "Filter"/"Clipping".



The dialog provides settings to configure the baseband filter, the modulation settings and to enable clipping.

Settings:

7.1.1	Common filter settings.....	144
7.1.2	DPSK filter settings.....	145
7.1.3	Modulation settings.....	146
7.1.4	Clipping settings.....	148

7.1.1 Common filter settings

Access:

1. Select "General" > "Filter"/"Clipping".
2. Select "Filter" > "GFSK section".

GFSK section	
Filter	Gauss(FSK)
B*T	0.50
Impulse Length <i>is Auto</i>	<input checked="" type="checkbox"/> 32
Oversampling <i>is Auto</i>	<input checked="" type="checkbox"/> 10

The section provides settings to configure the common baseband GFSK filter.

Settings:

Filter.....	144
B*T.....	144
Impulse Length.....	145
Oversampling.....	145

Filter

Displays the filter type that is GFSK. This type is common to the Bluetooth baseband signal.

Remote command:

n.a.

B*T

Sets the rolloff factor or bandwidth time product ("B*T") for the filter type that supports this parameter.

For supporting predefined filters, this parameter can have a different default value for each of the predefined filters.

Remote command:

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:APCO25 on page 285

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:COsine on page 285

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:FGauss on page 286

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:GAUSS on page 286
 [:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:LPASS on page 286
 [:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:PGAuss on page 287
 [:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:RCOSine on page 287
 [:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:SPHase on page 287

Impulse Length

Displays the number of filter tabs.

If enabled, the most sensible parameter values are selected. The value depends on the coherence check.

Disable it to set the values manually.

Remote command:

[:SOURce<hw>] :BB:BT0oth:FILTer:ILENgtH:AUTO [:STATe] on page 284
 [:SOURce<hw>] :BB:BT0oth:FILTer:ILENgtH on page 283

Oversampling

Sets the upsampling factor.

If enabled, the most sensible parameter values are selected. The value depends on the coherence check.

Disable it to change the value manually.

Remote command:

[:SOURce<hw>] :BB:BT0oth:FILTer:OSAMpling:AUTO [:STATe] on page 284
 [:SOURce<hw>] :BB:BT0oth:FILTer:OSAMpling on page 284

7.1.2 DPSK filter settings

Access:

1. Select a Bluetooth EDR packet that supports a $\pi/4$ DQPSK filter or 8DPSK filter:
See [Table 7-1](#).
2. Select "General" > "Filter"/"Clipping".
3. Select "Filter" > " $\pi/4$ DQPSK section" or "8DPSK section".

$\pi/4$ DQPSK section	
Filter	Root Raised Cosine (RRC)
Roll Off Factor	0.40

The section provides settings to configure the $\pi/4$ DQPSK filter or 8DPSK filter.

Table 7-1: DPSK filter for Bluetooth EDR packets

Transport mode	Packet type	DPSK filter type
ACL+EDR	2-DH1, 2-DH3, 2-DH5	$\pi/4$ DQPSK
	3-DH1, 3-DH3, 3-DH5	8DPSK
eSCO+EDR	2-EV3, 2-EV5	$\pi/4$ DQPSK
	3-EV3, 3-EV5	8DPSK

Settings:

Filter.....	146
Roll Off Factor/B*T.....	146
Cut Off Frequency Factor.....	146

Filter

Selects the filter type for DQPSK sections or 8DPSK sections in EDR packets.

Remote command:

[:SOURce<hw>] :BB:BT0oth:FILTer:TYPE on page 283

Roll Off Factor/B*T

Sets the rolloff factor or bandwidth time product ("B*T") for the filter type that supports this parameter.

For supporting predefined filters, this parameter can have a different default value for each of the predefined filters.

Remote command:

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:APCO25 on page 285

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:COSine on page 285

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:FGAuss on page 286

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:GAUSSs on page 286

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:LPASSs on page 286

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:PGAuss on page 287

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:RCOSine on page 287

[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:SPHase on page 287

Cut Off Frequency Factor

Requires a lowpass filter.

Sets the value for the cutoff frequency factor. The cutoff frequency of the filter can be adjusted to reach spectrum mask requirements.

Remote command:

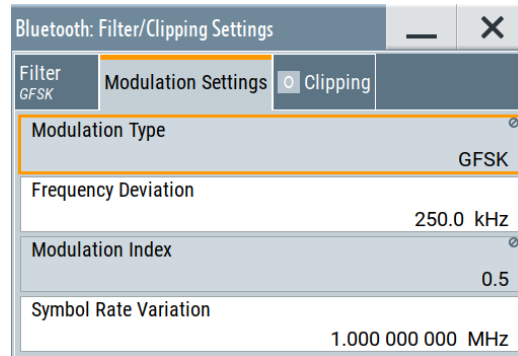
[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:LPASSs on page 286

7.1.3 Modulation settings

Access:

1. Select "General" > "Filter"/"Clipping".

2. Select "Modulation Settings".



The tab provides settings to configure modulation settings.

Settings:

Modulation Type.....	147
Frequency Deviation.....	147
Modulation Index.....	147
Symbol Rate Variation.....	148

Modulation Type

Displays the modulation format used for the current packet selection.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:FILTer:MTYPE](#) on page 285

Frequency Deviation

Enter the frequency deviation of the frequency modulated part.

The frequency deviation can be varied in a range from 100.0 kHz to 200.0 kHz according to the Bluetooth specification.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:MSEttings:FDEVIation](#) on page 285

Modulation Index

Displays the modulation index resulting from the entered frequency deviation value.

Modulation index is calculated from the given frequency deviation and symbol rate values.

The modulation index **h** is defined as:

$$h = \frac{2\Delta f}{f_{symbol}}$$

Where f_{symbol} is the "symbol rate" and Δf is the "frequency deviation".

According to the Bluetooth specification, the modulation index is allowed to vary between 0.28 and 0.35.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:FILTer:MINDEX](#) on page 284

Symbol Rate Variation

Enter the symbol rate.

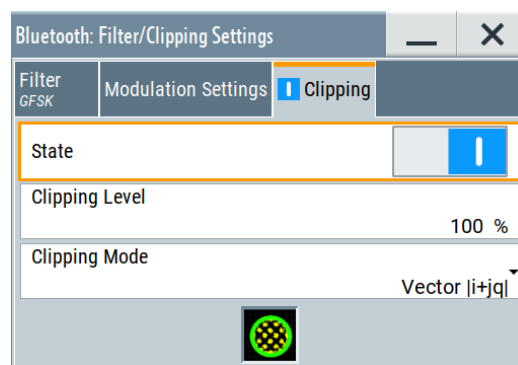
Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:SRATe:VARiAtion](#) on page 288

7.1.4 Clipping settings

Access:

1. Select "General" > "Filter"/"Clipping".
2. Select "Clipping".



The tab provides settings to configure clipping.

Settings:

State	148
Clipping Level	148
Clipping Mode	149

State

Switches baseband clipping on and off.

Baseband clipping is a simple and effective way of reducing the crest factor of the signal. Since clipping is done before to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLIPping:STATe](#) on page 282

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:BT0oth:CLIPping:LEVel](#) on page 281

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.

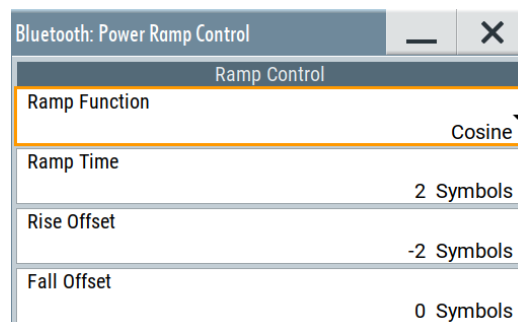
Remote command:

`[:SOURce<hw>] :BB:BT0oth:CLIPping:MODE` on page 282

7.2 Power ramping settings

Access:

- ▶ Select "Bluetooth" > "General" > "Power Ramping".



The dialog provides settings to configure power ramping.

To monitor power ramping for LE Channel Sounding

1. Select "Bluetooth" > "General" > "Bluetooth Mode" > "Bluetooth Low Energy".
2. Select "Bluetooth" > "Channel" > "Channel Type" > "Channel Sounding".
3. Select "Bluetooth" > "General" > "Power Ramping".

LE Channel Sounding uses fixed power ramping parameter as in the table below.

Parameter	Value
"Ramp Function"	"Cosine"
"Ramp Time"	"5 Symbols"
"Rise Offset"	"0 Symbols"
"Fall Offset"	"0 Symbols"

Settings:

Ramp Function.....	150
Ramp Time.....	150
Rise Offset.....	150
Fall Offset.....	150

Ramp Function

Selects the form of the transmitted power, i.e. the shape of the rising and falling edges during power ramp control.

- "Linear" The transmitted power rises and falls with linear fashion.
- "Cosine" The transmitted power rises and falls with a cosine-shaped edge. This setting causes a more favorable spectrum than the "Linear" setting.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:PRAMping:RFUNction](#) on page 289

Ramp Time

Sets the ramp time, which extends the burst by a corresponding number of 0 padding symbols at the beginning and the end of a burst. During this period of time, power ramping is based on the specified ramp function.

Do not switch the transmitted power abruptly at the end or the start of a burst, since the switching operation generates excessively strong non-harmonics. The switching operation is therefore stretched over several symbol clocks.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:PRAMping:RTIME](#) on page 289

Rise Offset

Sets the offset of the rising edge of a burst. The offset is specified by the selected number of symbols.

Negative values shift the rising edge to earlier positions, which results in a corresponding number of added 0 padding symbols before the burst.

Positive values shift the rising edge to later positions, which results in a corresponding number of skipped symbols at the beginning of the burst.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:PRAMping:ROFFset](#) on page 289

Fall Offset

Sets the offset of the falling edge of a burst. The offset is specified by the selected number of symbols.

Negative values shift the falling edge to earlier positions, which results in a corresponding number of skipped symbols at the end of the burst.

Positive values shift the falling edge to later positions, which results in a corresponding number of added 0 padding symbols following the burst.

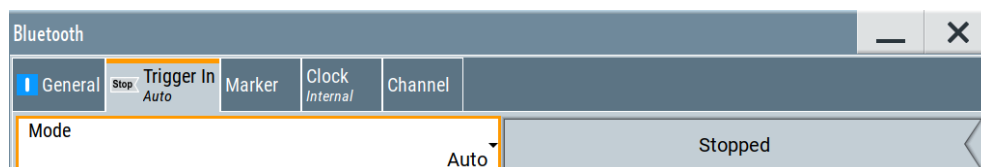
Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:PRAMping:FOFFset](#) on page 288

7.3 Trigger settings

Access:

- ▶ Select "Baseband" > "Bluetooth" > "Trigger In".



This tab provides settings to select and configure the trigger, like trigger source, trigger mode and trigger delays, 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 7.6, "Local and global connectors settings"](#), on page 159.

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 SMM100A starts baseband signal generation after the configured trigger event.

About baseband trigger signals

This section focuses on the available settings.

For detailed information on baseband trigger signals, see section "About trigger signals" in the R&S SMM100A user manual.

Settings:

Mode.....	152
Signal Duration Unit.....	152
Signal Duration.....	152
Running/Stopped.....	153
Time Based Trigger.....	153
Trigger Time.....	153
Arm.....	153

Execute Trigger.....	153
Source.....	154
Sync. Output to Ext. Trigger/Sync. Output to Trigger.....	154
External Inhibit/Trigger Inhibit.....	155
External Delay/Trigger Delay.....	155

Mode

Selects the trigger mode. The mode determines the effect of a trigger event on the signal generation.

For more information, see chapter "About trigger signals" in the R&S SMM100A 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:BT0oth [:TRIGger] :SEQuence` on page 291

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:BT0oth:TRIGger:SLUNit` on page 294

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:BT0oth:TRIGger:SLENgth` on page 293

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:BT0oth:TRIGger:RMODE](#) on page 292

Time Based Trigger

Requires trigger "Mode" > "Armed Auto"/"Single".

Activates time-based triggering with a fixed time reference.

The R&S SMM100A 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 SMM100A user manual.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:TRIGger:TIME\[:STATe\]](#) on page 293

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 SMM100A. 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 SMM100A user manual.

"Date" Sets the date of the time-based trigger in format YYYY-MM-DD.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:TRIGger:TIME:DATE](#) on page 292

"Time" Sets the time of the time-based trigger in format hh:mm:ss.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:TRIGger:TIME:TIME](#) on page 292

Arm

Stops the signal generation until subsequent trigger event occurs.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:TRIGger:ARM:EXECute](#) on page 294

Execute Trigger

For internal trigger source, executes trigger manually.

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:TRIGger:EXECute](#) on page 294

Source

The following sources of the trigger signal are available:

- "Internal"
The trigger event is internal. Tap "Execute Trigger" to trigger signal generation manually.
- "External Global Trigger"
The trigger event is the active edge of an external trigger signal provided and configured at the User x connectors.
- "Baseband Sync In"
Requires "Multi Instrument Trigger" > "Secondary" for primary-secondary instrument mode.
Triggers signal generation at the secondary instrument by the active edge of the baseband synchronization signal of the primary instrument.

How to: ["Routing and activating a trigger signal"](#) on page 151

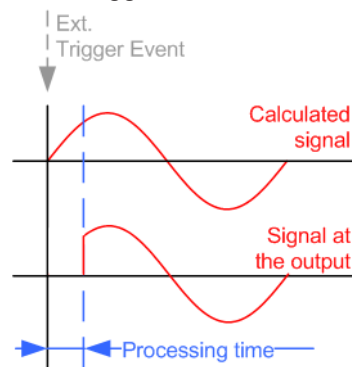
Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger:SOURce` on page 291

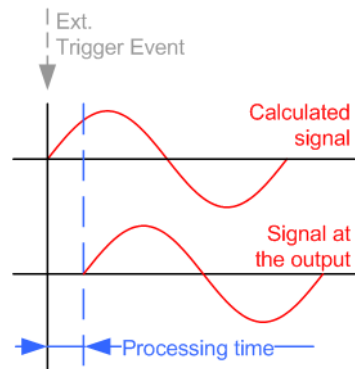
Sync. Output to Ext. Trigger/Sync. Output to Trigger

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.



Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal] :SYNChronize:OUTPut`
on page 294

External Inhibit/Trigger Inhibit

Applies for an external trigger signal.

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 on signals, modulation formats and filters" in the user manual.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal] :INHibit` on page 295

External Delay/Trigger Delay

Delays the trigger event of the signal from:

- The external trigger source

Use this setting to:

- Synchronize the instrument with the device under test (DUT) or other external devices

For more information, see chapter "Basics on ..." in the R&S SMM100A user manual.

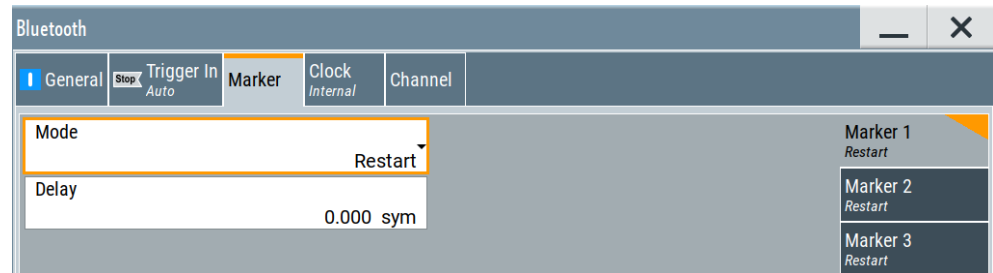
Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal] :DELay` on page 295

7.4 Marker settings

Access:

- ▶ Select "Baseband" > "Bluetooth" > "Marker".



This tab provides settings to select and configure the marker output signal including marker mode and marker delay.

Routing and activating a marker signal

1. To define the signal shape of an individual marker signal "x", select "Marker" > "Marker x" > "Mode".
2. Optionally, define the connector for signal output. See [Chapter 7.6, "Local and global connectors settings"](#), on page 159.
You can map marker signals to one or more User x or T/M connectors.
3. Enable baseband signal generation. In the block diagram, set "Baseband" > "On".
The R&S SMM100A adds the marker signal to the baseband signal. Also, R&S SMM100A outputs this signal at the configured User x connector.

About marker output signals

This section focuses on the available settings.

For detailed information on baseband trigger signals, see section "About trigger signals" in the R&S SMM100A user manual.

Settings:

Mode	156
Delay	158

Mode

Sets the marker mode that defines the shape and periodicity of the marker signals.

You can configure marker modes for up to 3 markers. The marker configuration changes with the selected marker mode.

How to: "[Routing and activating a marker signal](#)" on page 156

"Restart" A marker signal is generated at the start of each signal sequence.

"Event/Frame Start"

A marker signal is generated at the start of each event/frame. The term event corresponds to a Bluetooth LE event, the term frame corresponds to a Bluetooth BR/EDR frame.

"Event/Frame Active Part"/"Event/Frame Inactive Part"

The marker masks the active/inactive part of the event/frame. At the start of each burst, the marker signal changes to high/low. It changes back to low/high after the end of each burst.

Shift the marker signal at the start/end of each burst with the parameters "Rising/Falling Edge Shift".

Also, for Bluetooth LE data packets higher than one, configure the "Packet Index". The index corresponds to the transmitted Tx event during the connection interval.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:FESHift`
on page 296

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:RESHift`
on page 299

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:PINdex`
on page 298

"Pulse"

A regular marker signal is generated. The pulse frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below it.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:`
`DIVider` on page 298

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:`
`FREQuency?` on page 299

"Pattern"

A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when pattern is selected.

Remote command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OUTPut<ch>:PATTern`
on page 298

"On/Off Ratio"

A regular marker signal that is defined by an On/Off ratio is generated. A period lasts one On and Off cycle.

If "Marker Mode > On/Off Ratio", specify the "On Time" and "Off Time", which are expressed as number of samples.



Remote command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:ONTime
```

on page 298

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime
```

on page 298

Remote command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:MODE on page 297
```

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.

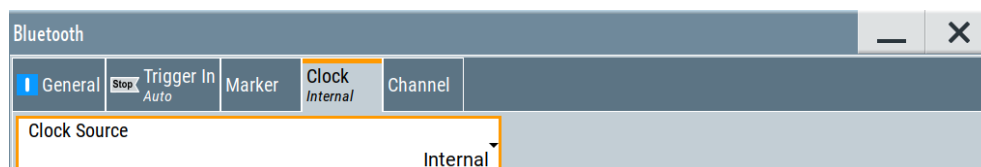
Remote command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:DELay on page 296
```

7.5 Clock settings

Access:

- ▶ Select "Baseband" > "Bluetooth" > "Clock".



This tab provides settings to select and configure the clock signal, like the clock source and clock mode.

Defining the clock

1. Select "Clock" > "Source" to define the source of the clock signal.
2. For external clock signals, define the connector for the signal input. See [Chapter 7.6, "Local and global connectors settings"](#), on page 159.
You can map clock 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 SMM100A starts baseband signal generation with a symbol rate that equals the clock rate.

About clock signals

This section focuses on the available settings.

For detailed information on baseband trigger signals, see section "About trigger signals" in the R&S SMM100A user manual.

Settings:

[Clock Source](#)..... 159

Clock Source

Selects the clock source.

- "Internal"
The instrument uses its internal clock reference.

How to: ["Defining the clock"](#) on page 158

Remote command:

[\[:SOURce<hw>\]:BB:BT0oth:CLOCK:SOURce](#) on page 300

7.6 Local and global connectors settings

Opens 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 of baseband signal configuration dialogs that you can open via the "Baseband" block in the block diagram. These tabs are available, for example, for "ARB" baseband signals.



See also chapter "Local and global connectors settings" in the user manual.

8 Remote control commands

The following commands are required to perform signal generation with the Bluetooth options in a remote environment. We assume that the R&S SMM100A has already been set up for remote operation in a network as described in the R&S SMM100A 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 SMM100A user manual.

Common suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	1	Available baseband signals
OUTPut<ch>	1 to 3	Available marker signals

Programming examples

This section provides simple programming examples. The purpose of the examples is to present all commands for a given task. In real applications, you typically use an appropriate subset of these commands.

For verification and testing purposes, a software tool executed these programming examples. To keep the example as simple as possible, the examples report clean SCPI syntax elements. Non-executable command lines, for example comments, start with two characters `//`.

Before executing a SCPI sequence, most remote control programs reset or preset the instrument to a definite state. The commands `*RST` and `SYSTem:PRESet` are equivalent for this purpose. `*CLS` also resets the status registers and clears the output buffer.

The following chapters describe the commands specific to the Bluetooth options R&S SMM-K60, R&S SMM-K117 and R&S SMM-K178.

• General commands	161
• Dirty transmitter configuration	166
• Channel configuration commands - LE	173
• Event and frame configuration commands - LE	179
• Channel sounding commands - LE	189
• Packet configuration commands - LE	210
• Test packet configuration commands - LE	267
• Channel configuration commands - BR/EDR	271
• Packet configuration commands - BR/EDR	272
• Filter/clipping commands	281
• Power ramping commands	288

- [Trigger commands](#)..... 290
- [Marker commands](#)..... 295
- [Clock commands](#).....299

8.1 General commands

Example: To configure time units for timing and delay commands

The default time unit of timing and delay commands is millisecond. You can set time unit to millisecond or to second.

```
:SOURcel:BB:BT0oth:UNIT:TIME?
// Response: "MS"
// Change time unit to seconds.
:SOURcel:BB:BT0oth:UNIT:TIME S
```

Example: To save and recall settings

```
MMEM:CDIR "/var/user/"
:SOURcel:BB:BT0oth:PRESet
:SOURcel:BB:BT0oth:SETTING:STORe "/var/user/Bluetooth_EDR"
:SOURcel:BB:BT0oth:SETTING:CATalog?
// Response: Bluetooth_EDR,Bluetooth_SCO,BTO_test
:SOURcel:BB:BT0oth:SETTING:DELeTe "BTO_test"
:SOURcel:BB:BT0oth:SETTING:LOAD "BTO_dl"
:SOURcel:BB:BT0oth:SETTING:CATalog?
// Response: "Bluetooth_EDR,Bluetooth_SCO"
```

Example: To configure general Bluetooth BR/EDR settings

```
// *****
// Set time unit to ms.
// *****
:SOURcel:BB:BT0oth:UNIT:TIME MS
// *****
// Set frequency and level.
// Set BR/EDR PHY and transport modes.
// Query the version of the digital standard.
// Generate and save a waveform file in the current directory.
// *****
SOURcel:FREQuency:CW 2402000000
SOURcel:POWer:POWer -50
:SOURcel:BB:BT0oth:BMODE BAS
:SOURcel:BB:BT0oth:TMODE ACL
// :SOURcel:BB:BT0oth:TMODE SCO
// :SOURcel:BB:BT0oth:TMODE ESCO
:SOURcel:BB:BT0oth:VERSion?
// Supported Bluetooth version, for example, "4.2".
:SOURcel:BB:BT0oth:STATe ON
:SOURcel:BB:BT0oth:WAVEform:CREate "Bluetooth_EDR"
```

Example: To configure general Bluetooth LE settings

```
// *****
// Set time unit to ms.
// *****
:SOURce1:BB:BT0oth:UNIT:TIME MS
// *****
// Set frequency and level.
// Set LE PHY and query the version of the digital standard.
// Generate and save a waveform file in the current directory.
// *****
SOURce1:FREQuency:CW 240200000
SOURce1:POWer:POWer -10
:SOURce1:BB:BT0oth:BMODE BLEN
:SOURce1:BB:BT0oth:VERSion?
// Supported Bluetooth version, for example, "5.4".
:SOURce1:BB:BT0oth:STATe ON
:SOURce1:BB:BT0oth:WAVEform:CREate "Bluetooth_LE"
```

[:SOURce<hw>]:BB:BT0oth:BCText?	162
[:SOURce<hw>]:BB:BT0oth:BMODE	163
[:SOURce<hw>]:BB:BT0oth:PRESet	163
[:SOURce<hw>]:BB:BT0oth:SETTing:CATalog	164
[:SOURce<hw>]:BB:BT0oth:SETTing:DELeTe	164
[:SOURce<hw>]:BB:BT0oth:SETTing:LOAD	164
[:SOURce<hw>]:BB:BT0oth:SETTing:STORE	164
[:SOURce<hw>]:BB:BT0oth:STATe	165
[:SOURce<hw>]:BB:BT0oth:TMODE	165
[:SOURce<hw>]:BB:BT0oth:UNIT:TIME	165
[:SOURce<hw>]:BB:BT0oth:VERSion?	165
[:SOURce<hw>]:BB:BT0oth:WAVEform:CREate	166

[\[:SOURce<hw>\]:BB:BT0oth:BCText?](#)

Queries the state and controller role.

Return values:

<BcText> string

Connected
 (only data channel type)

Advertiser
 (only advertising channel type)
 ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND,
 ADV_SCAN_IND
 Within R&S SMM-K117 also ADV_EXT_IND, AUX_ADV_IND,
 AUX_SYNC_IND, AUX_CHAIN_IND

Scanner

(only advertising channel type)

SCAN_REQ, SCAN_RSP

Within R&S SMM-K117 also AUX_SCAN_REQ,
AUX_SCAN_RSP**Initiator**

(only advertising channel type)

CONNECT_IND

Within R&S SMM-K117 also AUX_CONNECT_REQ,
AUX_CONNECT_RSP

- Example:** See [Example "To configure general Bluetooth BR/EDR settings"](#) on page 161.
- Usage:** Query only
- Manual operation:** See ["Bluetooth Controller State"](#) on page 49

[:SOURCE<hw>]:BB:BTOoth:BMODE <BMode>

Sets the Bluetooth mode.

Parameters:

<BMode> BASic | BLENergy

BASic

Sets basic rate (BR) or enhanced data rate (EDR) Bluetooth mode.

BLENergy

Sets low energy (LE) Bluetooth mode.

*RST: BASic

- Example:** See [Example "To configure general Bluetooth BR/EDR settings"](#) on page 161.
- Manual operation:** See ["Bluetooth Mode"](#) on page 37

[:SOURCE<hw>]:BB:BTOoth: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:BTOoth:STATe.

- Example:** See [Example "To save and recall settings"](#) on page 161.
- Usage:** Event
- Manual operation:** See ["Set To Default"](#) on page 35

[:SOURce<hw>]:BB:BT0oth:SETTing:CATalog <Catalog>

Queries the files with settings in the default directory. Listed are files with the file extension *.bto.

Parameters:

<Catalog> string
Returns a string of file names separated by commas.

Example: See [Example "To save and recall settings"](#) on page 161.

Manual operation: See ["Save/Recall"](#) on page 36

[:SOURce<hw>]:BB:BT0oth:SETTing:DELeTe <Filename>

Deletes the selected file from the default or specified directory. Deleted are files with the file extension *.bto.

Parameters:

<Filename> string
file name or complete file path; file extension can be omitted

Example: See [Example "To save and recall settings"](#) on page 161.

Manual operation: See ["Save/Recall"](#) on page 36

[:SOURce<hw>]:BB:BT0oth:SETTing:LOAD <Filename>

Loads the selected file from the default or the specified directory. Loaded are files with extension *.bto.

Parameters:

<Filename> string
file name or complete file path; file extension can be omitted

Example: See [Example "To save and recall settings"](#) on page 161.

Manual operation: See ["Save/Recall"](#) on page 36

[:SOURce<hw>]:BB:BT0oth:SETTing:STORe <Filename>

Saves the current settings into the selected file; the file extension (*.bto) is assigned automatically.

Setting parameters:

<Filename> string
file name or complete file path

Example: See [Example "To save and recall settings"](#) on page 161.

Usage: Setting only

Manual operation: See ["Save/Recall"](#) on page 36

[[:SOURce<hw>]:BB:BT0oth: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 "To configure general Bluetooth BR/EDR settings"](#) on page 161.

Manual operation: See ["State"](#) on page 35

[[:SOURce<hw>]:BB:BT0oth:TMODe <TMode>

Selects the transport mode.

Parameters:

<TMode> ACL | SCO | ESCO

ACL

Asynchronous connection-less (ACL) mode used for a point-to-point multipoint link between a Central and all Peripherals.

SCO

Synchronous connection-oriented (SCO) mode used for a point-to-point link between a Central and a specific Peripheral.

ESCO

Enhanced SCO mode used for a symmetric or asymmetric point-to-point link between a Central and a specific Peripheral.

*RST: ACL

Example: See [Example "To configure general Bluetooth BR/EDR settings"](#) on page 161.

Manual operation: See ["Transport Mode"](#) on page 37

[[:SOURce<hw>]:BB:BT0oth:UNIT:TIME <Time>

Sets the time unit for remote control commands.

Parameters:

<Time> S | MS
*RST: MS

Example: See [Example "To configure time units for timing and delay commands"](#) on page 161.

[[:SOURce<hw>]:BB:BT0oth:VERSion?

Queries the version of the specification for Bluetooth wireless technology underlying the definitions.

Return values:

<Version> string

Example:

See [Example "To configure general Bluetooth BR/EDR settings"](#) on page 161.

Usage:

Query only

Options:

Version 5.x requires R&S SMM-K117.
Version 5.5 requires R&S SMM-K178.

Manual operation:

See ["Bluetooth Version"](#) on page 37

[[:SOURce<hw>]:BB:BT0oth:WAVEform:CREate <Filename>

Saves the current settings as an ARB signal in a waveform file (* .wv).

Setting parameters:

<Filename> string

Example:

See [Example "To configure general Bluetooth BR/EDR settings"](#) on page 161.

Usage:

Setting only

Manual operation:

See ["Generate Waveform"](#) on page 36

8.2 Dirty transmitter configuration

Example: To configure a dirty transmitter

```
// *****
// Set modulation index mode to stable.
// *****
SOURcel:BB:BT0oth:DTTest:MIMode STAB

// *****
// Reset dirty transmitter. Set frequency drift rate, start phase,
// frequency drift deviation and number of packets
// per dirty transmitter set (LE only). Enable dirty transmitter.
// *****
SOURcel:BB:BT0oth:DTTest:STDefault
SOURcel:BB:BT0oth:DTTest:FDRate 1.25
SOURcel:BB:BT0oth:DTTest:SPHase 0
SOURcel:BB:BT0oth:DTTest:FDDeviation 50
SOURcel:BB:BT0oth:DTTest:NPPSet NP50

// *****
// Enable all long sets for LE or BR dirty transmitter.
// *****
SOURcel:BB:BT0oth:DTTest:TABLE:LONG:SET1:STATe 1
SOURcel:BB:BT0oth:DTTest:TABLE:LONG:SET2:STATe 1
```

```

SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET3:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET4:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET5:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET6:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET7:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET8:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET9:STATE 1
SOURCE1:BB:BT00th:DTTest:TABLE:LONG:SET10:STATE 1

// *****
// Enable dirty transmitter.
// *****
SOURCE1:BB:BT00th:DTTest:DTTState 1

[:SOURCE<hw>]:BB:BT00th:DTTest:DTTState..... 167
[:SOURCE<hw>]:BB:BT00th:DTTest:FDDeviation..... 167
[:SOURCE<hw>]:BB:BT00th:DTTest:FDRate..... 168
[:SOURCE<hw>]:BB:BT00th:DTTest:MIMode..... 168
[:SOURCE<hw>]:BB:BT00th:DTTest:NPPSet..... 168
[:SOURCE<hw>]:BB:BT00th:DTTest:SPHase..... 169
[:SOURCE<hw>]:BB:BT00th:DTTest:STDefault..... 169
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE..... 169
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:LONG:SET<ch>:CFOffset..... 170
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:LONG:SET<ch>:MINDex..... 170
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:LONG:SET<ch>:STATE..... 171
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:LONG:SET<ch>:STERror..... 171
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:SHORT:SET<ch>:CFOffset..... 172
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:SHORT:SET<ch>:STATE..... 172
[:SOURCE<hw>]:BB:BT00th:DTTest:TABLE:SHORT:SET<ch>:STERror..... 173

```

[:SOURCE<hw>]:BB:BT00th:DTTest:DTTState <DttState>

Activates the "Dirty Transmitter Test".

For EDR packets, the parameter sets apply for 20 packets each.

Parameters:

<DttState> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Dirty Transmitter Test"](#) on page 41

[:SOURCE<hw>]:BB:BT00th:DTTest:FDDeviation <FdDeviation>

Sets a frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset. The maximum deviation reached during the drift equals the set frequency drift deviation.

Parameters:

<FdDeviation> integer
 Range: -100 to 100
 *RST: 25

Example: See [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Frequency Drift Deviation\(+/-\)"](#) on page 41

[[:SOURce<hw>]:BB:BT0oth:DTTest:FDRate <FdRate>

Sets a frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset with the set frequency drift rate.

Parameters:

<FdRate> 0.3 KHz | 0.5 KHz | 1.6 KHz | 10 KHz
 Range: depends on packet type to depends on packet type
 Increment: 0.001
 *RST: depends on packet type

Example: See [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Frequency Drift Rate"](#) on page 41

[[:SOURce<hw>]:BB:BT0oth:DTTest:MIMode <MIMode>

Determines standard or stable mode for the modulation index of dirty transmitter according to the Bluetooth core specification.

Parameters:

<MIMode> STANdard | STABLE
 *RST: STANdard

Example: See [Example "To configure a dirty transmitter"](#) on page 166.

Options: R&S SMM-K117

Manual operation: See ["Modulation Index Mode"](#) on page 41

[[:SOURce<hw>]:BB:BT0oth:DTTest:NPPSet <NumPack>

Specifies the number of packets per dirty transmitter set.

Specifies the number of packets or CS steps per dirty transmitter set.

Bluetooth mode	Channel type	Number of packets
BR + EDR	-	50, 2, 1 packets
LE	Advertising, data	50, 2, 1 packets
LE	Channel sounding	50, 20, 18, 16, 14, 12, 10, 8, 6, 4, 2, 1 CS steps

Parameters:

<NumPack> NP50 | NP2 | NP1 | NP4 | NP6 | NP8 | NP10 | NP12 | NP14 |
NP16 | NP18 | NP20
*RST: NP50

Example: See [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Number Of Packets Per Set/Number Of Steps Per Set"](#) on page 42

[[:SOURce<hw>]:BB:BT0oth:DTTest:SPHase <SPhase>

The command enters a start phase.

The start phase applies to the sine wave that is used to drift the modulated Bluetooth signal. The drift is around the center frequency plus the carrier frequency offset.

Parameters:

<SPhase> integer
Range: 0 to 359
Increment: 1
*RST: 0
Default unit: degree

Example: SOURce1:BB:BT0:DTT:SPH 0
enters a start phase.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Start Phase"](#) on page 41

[[:SOURce<hw>]:BB:BT0oth:DTTest:STDefault

The command calls the default settings for the Dirty Transmitter Test.

Example: SOURce1:BB:BT0:DTT:STD
calls the default settings.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Usage: Event

Manual operation: See ["Set To Default"](#) on page 40

[[:SOURce<hw>]:BB:BT0oth:DTTest:TABLE <Table>

Opens the table settings.

Parameters:

<Table> NOTable | SHORt | LONG

Example: `SOURce1:BB:BTO:PTYP DH1`
calls the default settings.
`SOURce1:BB:BTO:DTT:TABL LONG`
See also [Example "To configure a dirty transmitter"](#) on page 166.

Example: calls the default settings.

[:SOURce<hw>]:BB:BTOoth:DTTTest:TABLE:LONG:SET<ch>:CFOffset <CfOffset>

Sets a carrier frequency offset.

The carrier frequency offset shows the deviation of the transmitted initial center frequency from carrier frequency.

Parameters:

<CfOffset> integer
Range: -150 to 150
*RST: 1
Default unit: kHz

Example: `SOURce1:BB:BTO:PTYP DH1`
sets the packet type.
`SOURce1:BB:BTO:DTT:TABL LONG`
sets the table type
`SOURce1:BB:BTO:DTT:TABL:LONG:SET2:CFOF 14`
sets a carrier frequency offset.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Carrier Frequency Offset \(kHz\)"](#) on page 42

[:SOURce<hw>]:BB:BTOoth:DTTTest:TABLE:LONG:SET<ch>:MINDex <MIndex>

Sets the modulation index, that specifies the frequency deviation.

The modulation index h is defined as:

$$h = \frac{2\Delta f}{f_{symbol}}$$

with

f_{symbol} = "symbol rate", set with the command `[:SOURce<hw>]:BB:BTOoth:SRATE:VARIation`

Δf = "frequency deviation", set with the command `[:SOURce<hw>]:BB:BTOoth:MSETtings:FDEVIation`

According to the Bluetooth standard, the modulation index is allowed to vary between 0.28 and 0.35.

Parameters:

<MIndex> float
 Range: 0.28 to 0.55
 Increment: 0.01
 *RST: 0.28

Example:

SOURce1:BB:BTO:PTYP DH1
 sets the packet type.
 SOURce1:BB:BTO:DTT:TABL LONG
 enters the table type
 SOURce1:BB:BTO:DTT:TABL:LONG:SET2:MIND 0.3
 enters a modulation index.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Modulation Index"](#) on page 43

[:SOURce<hw>]:BB:BTOoth:DTTtest:TABLE:LONG:SET<ch>:STATE <State>

Activates the corresponding parameter set for the long table.

For basic rate packets, each set applies to 20 ms of signal.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 1

Example:

SOURce1:BB:BTO:PTYP DH1
 sets the packet type.
 SOURce1:BB:BTO:DTT:TABL LONG
 sets the table type
 SOURce1:BB:BTO:DTT:TABL:LONG:SET2:STAT ON
 activates the set 2 in the long table.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["State"](#) on page 42

[:SOURce<hw>]:BB:BTOoth:DTTtest:TABLE:LONG:SET<ch>:STERror <StError>

Sets a symbol timing error in ppm.

This parameter modifies the symbol clock frequency by the set value.

Parameters:

<StError> integer
 Range: -150 to 150
 *RST: 1
 Default unit: ppm

Example: `SOURce1:BB:BTO:PTYP DH1`
 sets the packet type.
 `SOURce1:BB:BTO:DTT:TABL LONG`
 sets the table type
 `SOURce1:BB:BTO:DTT:TABL:LONG:SET2:STER -20`
 sets a symbol timing error.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Symbol Timing Error \(ppm\)"](#) on page 43

[:SOURce<hw>]:BB:BT0oth:DTTtest:TABLE:SHORT:SET<ch>:CFOffset <CfOffset>

Sets a carrier frequency offset.

The carrier frequency offset shows the deviation of the transmitted initial center frequency from carrier frequency.

Parameters:

<CfOffset> integer
 Range: -150 to 150
 *RST: 1
 Default unit: kHz

Example: `SOURce1:BB:BTO:PTYP DH1`
 sets the packet type.
 `SOURce1:BB:BTO:DTT:TABL SHOR`
 sets the table type
 `SOURce1:BB:BTO:DTT:TABL:SHOR:SET2:CFOF 65`
 sets a carrier frequency offset.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Carrier Frequency Offset \(kHz\)"](#) on page 42

[:SOURce<hw>]:BB:BT0oth:DTTtest:TABLE:SHORT:SET<ch>:STATE <State>

Activates the corresponding parameter set in the short table. If a set deactivated, its parameters are skipped in the sequence. Instead, the next active set is used.

For EDR packets, each set applies to 20 packets.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 1

Example: `SOURce1:BB:BTO:PTYP DH1`
 sets the packet type.
 `SOURce1:BB:BTO:DTT:TABL SHOR`
 sets the table type
 `SOURce1:BB:BTO:DTT:TABL:SHOR:SET2:STAT ON`
 activates the set 2 in the short table.

Example: See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["State"](#) on page 42

[:SOURce<hw>]:BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:STERror <StError>

Sets a symbol timing error in ppm.

The symbol timing error modifies the symbol clock frequency by the set amount.

Parameters:

<StError>	integer
Range:	-150 to 150
Increment:	1
*RST:	1

Example:

SOURce1:BB:BT0:PTYP DH1

sets the packet type.

SOURce1:BB:BT0:DTT:TABL SHOR

enters the table type

SOURce1:BB:BT0:DTT:TABL:SHOR:SET2:STER 20

enters a symbol timing error.

Example:

See also [Example "To configure a dirty transmitter"](#) on page 166.

Manual operation: See ["Symbol Timing Error \(ppm\)"](#) on page 43

8.3 Channel configuration commands - LE

Example: To configure general channel settings for LE

```
// *****
// Set time unit to ms.
// *****
SOURce1:BB:BT0oth:UNIT:TIME MS

// *****
// Select channel type, test packet, packet format, sequence length,
// controller role. Enable CRC corruption for every second packet.
// *****
SOURce1:BB:BT0oth:CTYPe DATA
SOURce1:BB:BT0oth:UPTYPe TPAC
SOURce1:BB:BT0oth:PFORMAT L2M
SOURce1:BB:BT0oth:USLength 2
SOURce1:BB:BT0oth:BCRole CENTral
SOURce1:BB:BT0oth:CCRC:STATE 1

// *****
// Alternatively set duty cycle for ADV_DIRECT_IND
// *****
SOURce1:BB:BT0oth:CTYPe ADV
```

```
SOURce1:BB:BT0oth:UPTYPE ADIN
```

```
SOURce1:BB:BT0oth:DCYCLE LOW
```

[:SOURce<hw>]:BB:BT0oth:BCRole	174
[:SOURce<hw>]:BB:BT0oth:CCRC:STATE	174
[:SOURce<hw>]:BB:BT0oth:CTYPE	175
[:SOURce<hw>]:BB:BT0oth:DCYCLE	175
[:SOURce<hw>]:BB:BT0oth:PFORmat	175
[:SOURce<hw>]:BB:BT0oth:UPTYPE	176
[:SOURce<hw>]:BB:BT0oth:USLength	178
[:SOURce<hw>]:BB:BT0oth:MFORmat	178
[:SOURce<hw>]:BB:BT0oth:DURation	179

[:SOURce<hw>]:BB:BT0oth:BCRole <BcRole>

Sets the Bluetooth controller role.

Depending on the selected channel type different roles are assigned to the controller. For channel type "Data", you can assign Central or Peripheral.

If the channel type is "Advertising", the parameter is read only and displayed directly above the graph.

Parameters:

<BcRole> CENTral | PERipheral | ADvertiser | SCANner | INITiator

CENTral

Selects Central as controller role.

PERipheral

Selects Peripheral as controller role.

ADvertiser|SCANner|INITiator

Assigned roles depending on the selected packet type of the respective channel type.

*RST: CENTral

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Bluetooth Controller Role"](#) on page 48

[:SOURce<hw>]:BB:BT0oth:CCRC:STATE <State>

Enables/disables the corruption of CRC for every second generated packet. If enabled, only 50% of packets are generated with correct CRC.

Parameters:

<State> 1 | ON | 0 | OFF

*RST: 0

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Corrupted CRC Every 2nd Packet"](#) on page 49

[[:SOURce<hw>]:BB:BT0oth:CTYPe <CType>

Determines the channel type. Advertising and data are available.

Parameters:

<CType> ADVertising | DATA | | CS

ADVertising

Selects channel type advertising.

DATA

Selects channel type data. Devices in a connected state transmit data channel packets in connection events with a start point and an interval.

CS

Requires R&S SMM-K178.

Selects channel type channel sounding.

*RST: ADVertising

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Channel Type"](#) on page 46

[[:SOURce<hw>]:BB:BT0oth:DCYClE <DCycle>

Specifies duty cycle for directed advertising (packet type ADV_DIRECT_IND).

Parameters:

<DCycle> LOW | HIGH

*RST: HIGH

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Options: R&S SMM-K117

Manual operation: See ["Duty Cycle"](#) on page 48

[[:SOURce<hw>]:BB:BT0oth:PFORmat <PFormat>

Selects the packet format that is the format according to the physical layer (PHY) that supports the packet type or PDU type.

Parameters:

<PFormat> L1M | L2M | LCOD | L2M2B

L1M

LE uncoded PHY with 1 Msymbol/s modulation.

L2M

LE uncoded PHY with 2 Msymbol/s modulation and bandwidth time product BT = 0.5.

LCOD

LE coded PHY with 1 Msymbol/s modulation.

L2M2B

LE uncoded PHY with 2 Msymbol/s modulation and bandwidth time product $BT = 2$.

*RST: L1M

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Options: L2M and LCOB require option R&S SMM-K117.
L2M2B requires option R&S SMM-K178.

Manual operation: See ["Packet Format"](#) on page 48
See ["PHY"](#) on page 128

[<SOURce<hw>]:BB:BT0oth:UPTYPE <UpType>

Selects the packet type.

The available packets depend on the selected channel type and installed options. The tables below provide an overview.

Table 8-1: R&S SMM-K60 packet/PDU types

<UpType>	Packet/PDU type	<UpType>	Packet/PDU type
AIND	ADV_IND	ERSP	LL_ENC_RSP
ADIND	ADV_DIRECT_IND	SEReq	LL_START_ENC_REQ
ANIND	ADV_NONCONN_IND	SERSp	LL_START_ENC_RSP
SREQ	SCAN_REQ	URSP	LL_UNKNONW_RSP
SRSP	SCAN_RSP	FREQ	LL_FEATURE_REQ
CREQ	CONNECT_IND	FRSP	LL_FEATURE_RSP
ADCind	ADV_SCAN_IND	TPACKET	TEST PACKET
DATA	DATA	PEReq	LL_PAUSE_ENC_REQ
CUReq	LL_CONNECTION_UPDATE_IND	PERSp	LL_PAUSE_ENC_RSP
CMReq	LL_CHANNEL_MAP_IND	VIND	LL_VERSION_IND
TIND	LL_TERMINATE_IND	RIND	LL_REJECT_IND
EREQ	LL_ENC_REQ		

Table 8-2: R&S SMM-K117 packet/PDU types

<UpType>	Packet/PDU type	<UpType>	Packet/PDU type
PREQ	LL_PHY_REQ	ACINd	AUX_CHAIN_IND
PRSP	LL_PHY_RSP	ASINd	AUX_SYNC_IND
PUIN	LL_PHY_UPDATE_IND	ASReq	AUX_SCAN_REQ
LREQ	LL_LENGTH_REQ	ASPSp	AUX_SCAN_RSP
LRSP	LL_LENGTH_RSP	ACRSp	AUX_CONNECT_RSP
SFR	LL_PERIPHERAL_FEATURE_REQ	ACReq	AUX_CONNECT_REQ
CPR	LL_CONNECTION_PARAM_REQ	MUCH	LL_MIN_USED_CHANNELS_IND
CPRS	LL_CONNECTION_PARAM_RSP	CONT	CONTINUOUS
REIN	LL_REJECT_EXT_IND	CTEQ	LL_CTE_REQ
PIR	LL_PING_REQ	CTEP	LL_CTE_RSP
PIRS	LL_PING_RSP	PSIND	LL_PERIODIC_SYNC
AEINd	ADV_EXT_IND	CAReq	LL_CLOCK_ACCURACY_REQ
AAINd	AUX_ADV_IND	CARSp	LL_CLOCK_ACCURACY_RSP

Table 8-3: R&S SMM-K178 packet/PDU types

<UpType>	Packet/PDU type	<UpType>	Packet/PDU type
CSSEq	CS_SEQUENCE	CSREQ	LL_CS_REQ
CSRQ	LL_CS_SEC_REQ	CSRSP	LL_CS_RSP
CSRP	LL_CS_SEC_RSP	CSIND	LL_CS_IND
CCRQ	LL_CS_CAPABILITIES_REQ	CTI	LL_CS_TERMINATE_IND
CCRP	LL_CS_CAPABILITIES_RSP	CFRQ	LL_CS_FAE_REQ
COREQ	LL_CS_CONFIG_REQ	CFRP	LL_CS_FAE_RSP
CORSP	LL_CS_CONFIG_RSP	CCMI	LL_CS_CHANNEL_MAP_IND

For more information, refer to the specifications document.

Parameters:

<UpType> AIND | ADINd | ANINd | SREQ | SRSP | CREQ | ADCind | DATA | CUReq | CMReq | TIND | EREQ | ERSP | SEReq | SERSp | URSP | FREQ | FRSP | TPACket | PEReq | PERSp | VIND | RIND | PREQ | PRSP | PUIN | LREQ | LRSP | SFR | CPR | CPRS | REIN | PIR | PIRS | AEINd | AAINd | ACINd | ASINd | ASReq | ASPSp | ACRSp | ACReq | MUCH | CONT | CTEQ | CTEP | PSIND | CAReq | CARSp | CSSEQ | CSRQ | CSRSP | CCRQ | CCRP | COREQ | CORSP | CSREQ | CSRSP | CSIND | CTI | CFRQ | CFRP | CCMI

*RST: AIND

Example:

IdPDbBtoCsCtrlRfu

See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Packet Type"](#) on page 46

[:SOURce<hw>]:BB:BT0oth:USLength <UsLength>

Selects the number of frames or events depending on the packet type. The signal repeats after the specified number of frames/events.

For SCAN_REQ and CONNECT_IND packet, the sequence length is expressed in "Frames".

For AUX_SCAN_REQ and AUX_CONNECT_REQ packet, the sequence length is expressed in "Frames".

For LL_TERMINATE_IND packets, a default value according to the specification is given:

Central: PeripheralLatency + 6

Peripheral: 6

For all other packet types the sequence length is expressed in "Events".

Parameters:

<UsLength> integer
 Range: depends on the number of states in dirty transmitter test to dynamic
 *RST: 1

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Sequence Length"](#) on page 48

[:SOURce<hw>]:BB:BT0oth:MFORmat <ModFmt>

Sets the LE PHY for continuous payload transmission. This transmission requires a CONTINUOUS packet:

```
:SOURce1:BB:BT0oth:UPTYPE CONT
```

Parameters:

<ModFmt> L1M | L2M | LCOD
L1M: LE 1M
L2M: LE 2M
LCOD: LE coded
 See also [:SOURce<hw>]:BB:BT0oth:PFORmat on page 175.
 *RST: L1M

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Options: L2M and LCOD require R&S SMM-K117.

Manual operation: See ["Modulation Format"](#) on page 49

[:SOURce<hw>]:BB:BT0oth:DURation <Duration>

Sets the transmission duration for continuous payload transmission. This transmission requires a CONTINUOUS packet:

```
:SOURce1:BB:BT0oth:UPTYPE CONT
```

Command sets the values in ms. Query returns values in s.

The duration range, increment and default value depend on the modulation format, symbols per a bit and payload type.

For more information, refer to the specifications document.

Parameters:

<Duration>	float
Range:	depends on settings
Increment:	depends on settings
*RST:	depends on settings
Default unit:	ms

Example: See [Example "To configure general channel settings for LE"](#) on page 173.

Manual operation: See ["Duration"](#) on page 49

8.4 Event and frame configuration commands - LE

Example: Configure event and frame configuration settings

```
// *****
// For ADV_SCAN_IND, select advertising event interval.
// *****
SOURce1:BB:BT0oth:CTYPE ADV
SOURce1:BB:BT0oth:UPTYPE ADC
SOURce1:BB:BT0oth:ECONfiguration:AEInterval 20

// *****
// Alternatively set advertising event interval for ADV_DIRECT_IND.
// *****
SOURce1:BB:BT0oth:CTYPE ADV
SOURce1:BB:BT0oth:UPTYPE ADIN
SOURce1:BB:BT0oth:ECONfiguration:ADInterval 3.75
// *****
// Set advertising event delay, activate channel 37.
// *****
SOURce1:BB:BT0oth:ECONfiguration:AEDelay 0
SOURce1:BB:BT0oth:ECONfiguration:ACTable:CHANnel0:STATE 1
// *****
// For packet type SCAN_REQ, set length of the window,
// time interval.
```

Event and frame configuration commands - LE

```

// *****
SOURCEl:BB:BT0oth:CTYPe ADV
SOURCEl:BB:BT0oth:UPTYpe SREQ
SOURCEl:BB:BT0oth:ECONfiguration:SWINdow 10
SOURCEl:BB:BT0oth:ECONfiguration:SINTErval 3500

// *****
// For packet type CONNECT_IND set transmit window,
// start point of the transmit window,
// LL connection timeout and time interval.
// *****
SOURCEl:BB:BT0oth:CTYPe ADV
SOURCEl:BB:BT0oth:UPTYpe CREQ
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:WSIZE 8.25
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:WOFFset 800
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:LCTimeouT 7500
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CINTErval 6400

// *****
// Alternatively select packet type LL_CONNECTION_UPDATE_IND,
// set transmit window, start point of the transmit
// window, LL connection timeout and time interval.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYpe CUR
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NWSize 8.25
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NWOffset 800
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NLCTimeouT 7500
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NCINTErval 6400

// *****
// Set time interval for advertising channel and events.
// Set time delay for advertising events.
// *****
SOURCEl:BB:BT0oth:ECONfiguration:APIINTErval 1.3
SOURCEl:BB:BT0oth:ECONfiguration:AEINTErval 15
SOURCEl:BB:BT0oth:ECONfiguration:AEDelay 5

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:ACTable:CHANnel<ch0>:STATE..... 181
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:DCTable:CHANnel<ch0>:STATE..... 181
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DCMTable:
    CHANnel<ch0>:STATE..... 181
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:AEDelay.....181
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:ADINTErval..... 182
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:AEINTErval.....182
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:APIINTErval.....183
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:LCMode..... 183
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:LTKey..... 184
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MNINTErval..... 184
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MXINTErval.....184
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:OFFSet<ch0>:STATE..... 185
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:OFFSet<ch0>:VALue..... 185

```

<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:PAINterval</code>	186
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:PPERiodicity</code>	186
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RCECount</code>	186
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PNUMBER</code>	187
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:SDCI?</code>	187
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:SINterval</code>	187
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:SWINdow</code>	188
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:WOINfo?</code>	188
<code>[:SOURce<hw>]:BB:BT0oth:ECONfiguration:WSINfo?</code>	189

`[:SOURce<hw>]:BB:BT0oth:ECONfiguration:ACTable:CHANnel<ch0>:STATe`
<State>

`[:SOURce<hw>]:BB:BT0oth:ECONfiguration:DCTable:CHANnel<ch0>:STATe`
<State>

`[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DCMTable:`
`CHANnel<ch0>:STATe` <State>

Indicates used and unused data channels.

Note: The previously used syntax `. . . :SET<ch>:STATe` has been replaced by `. . . :CHANnel<ch>:STATe`. Compatibility to the previous commands is given.

This parameter is relevant for data event and advertising frame configuration with the packet types LL_CHANNEL_MAP_IND, CONNECT_IND.

Within the option R&S SMM-K117, the following packet types are also relevant for the setting: AUX_CONNECT_IND, AUX_EXT_IND, AUX_ADV_IND, AUX_CHAIN_IND, AUX_SYNC_IND, AUX_SCAN_RSP.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example:

```
SOURce1:BB:BT0:ECON:ACT:CHAN:STAT ON
State in Advertising Channel Table and Secondary Advertising
Channel Table
SOURce1:BB:BT0:ECON:DCT:CHAN:STAT ON
State in Data Channel Table and Secondary Advertising Chan-
nel Table
SOURce1:BB:BT0:ECON:PCON:DCMT:CHAN:STAT ON
State in Data Channel Map Table
```

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See "[Channel Table](#)" on page 57

`[:SOURce<hw>]:BB:BT0oth:ECONfiguration:AEDelay` <AeDelay>

Sets a time delay between the start times of two consecutive advertising events. The value is added to the advertising event interval.

Command sets the values in ms. Query returns values in s.

Parameters:

<AeDelay> float
 Range: 0 s to 10E-3 s
 Increment: 0.1E-3
 *RST: 0
 Default unit: ms

Example: SOURCE1:BB:BTO:ECON:AEDelay 5
 Sets a delay of 5 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["Advertising Event Delay"](#) on page 53

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:ADINterval <AdInterval>

Sets the time interval between two consecutive advertising events for packet type "ADV_DIRECT_IND" and duty cycle high.

Command sets the values in ms. Query returns values in s.

Parameters:

<AdInterval> float
 Range: 1.05E-3 s to 3.75E-3 s
 Increment: 0.01E-3
 *RST: 3.75E-3
 Default unit: ms

Example: SOURCE1:BB:BTO:ECON:ADIN 13
 Sets a time interval of 13 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["Advertising Event Interval"](#) on page 52

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:AEINterval <AeInterval>

Sets the time interval between two consecutive advertising events, with regard to the starting points.

Command sets the values in ms. Query returns values in s.

Parameters:

<AeInterval> float
 Range: 5E-3 s to depends on oversampling
 Increment: 0.1E-3
 *RST: 20E-3
 Default unit: ms

Example: SOURCE1:BB:BTO:ECON:AEIN 15
 Sets a time interval of 15 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["Advertising Event Interval"](#) on page 52

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:APInterval <ApInterval>

Sets the time interval between packets starting points of two consecutive packets in the advertising channel.

Parameters:

<ApInterval> float
 Range: 1.3E-3 to 28E-3
 Increment: 0.1E-3
 *RST: 10E-3
 Default unit: ms

Example: SOURCE1:BB:BT0:ECOn:APIN 1.3
 Sets a time interval of 1.3 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["Advertising Packet Interval"](#) on page 53

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:LCMode <LcMode>

Selects the link layer connection mode. In order to provide safe transmission of payload data, the data in the packet can be encrypted. If activated, the payload data follows MIC (Message authentication Code).

Parameters:

<LcMode> UENC | ENC
UENC
 Payload data is transmitted without encoding.
ENC
 The link layer connection runs in encrypted mode.
 *RST: UENC

Example: SOURCE1:BB:BT0:ECOn:LCM UENC
 without encoding.
 SOURCE1:BB:BT0:ECOn:LCM ENC
 in encrypted mode.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["LL Connection Mode"](#) on page 55

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:LTKey <LtKey>, <BitCount>

Indicates the time the controller needs to receive the long-term key from the host. After this time, the controller is ready to enter into the last phase of encryption mode setup.

Parameters:

<LtKey> numeric
 *RST: #H0

<BitCount> integer
 Range: 128 to 128
 *RST: 128

Example: SOURce1:BB:BT0:ECOn:LCM ENC
 SOURce1:BB:BT0:ECOn:LTK
 #H00000000000000000000000000000000,128
 In encrypted mode, the code can be edited.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See "[Long Term Key\(hex\)](#)" on page 56

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:MNInterval <MNInterval>

Specifies the minimum allowed connection interval.

Command sets the values in ms. Query returns values in s.

Parameters:

<MNInterval> float
 Range: 7.5E-3 s to depending on Max. Interval
 Increment: 1.25E-3 s
 *RST: 7.5E-3

Example: SOURce1:BB:BT0:ECOn:PCOn:MNIN 7.5
 Sets a time interval of 7.5 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Options: R&S SMM-K117

Manual operation: See "[Min. Interval](#)" on page 84

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:MXInterval <MInterval>

Specifies the maximum allowed connection interval.

Command sets the values in ms. Query returns values in s.

Parameters:

<MInterval> float
 Range: 7.5E-3 s to 4000E-3 s
 Increment: 1.25E-3
 *RST: 7.5E-3

Example:

SOURce1:BB:BTO:ECON:PCON:MXIN 12.5
 Sets a time interval of 12.5 ms.

Example:

See also [Example"Configure event and frame configuration settings"](#) on page 179.

Options:

R&S SMM-K117

Manual operation:

See "[Max. Interval](#)" on page 84

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:OFFSet<ch0>:STATE <State>

Enables / disables Offset0 to Offset5 of the offset setting table.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example:

See [Example"Configure event and frame configuration settings"](#) on page 179.

Options:

R&S SMM-K117

Manual operation:

See "[Offset Setting Table](#)" on page 85

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:OFFSet<ch0>:VALue <Offset>

Specifies Offset0 to Offset5 of the offset setting table.

Command sets the values in ms. Query returns values in s.

Parameters:

<Offset> float
 Range: 0 s to depending on Max. Interval
 Increment: 1.25
 *RST: 0
 Default unit: ms

Example:

SOURce1:BB:BTO:ECON:PCON:OFFSet0:VALue 7
 SOURce1:BB:BTO:ECON:PCON:OFFSet0:VALue?
 // Response: "7.5"

Sets the Offset0 to 7.5 ms. The setting 7 ms is automatically changed to the closest multiple of 1.25 ms, which is 7.5 ms.

Example:

See also [Example"Configure event and frame configuration settings"](#) on page 179.

Options: R&S SMM-K117

Manual operation: See ["Offset Setting Table"](#) on page 85

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:PAInterval
<Interval>**

Sets the time interval between the start of two AUX_SYNC_IND PDUs from the same advertising set.

Command sets the values in ms. Query returns values in s.

Parameters:

<Interval> float
 Range: 7.5E-3 s to depending on oversampling
 Increment: 0.01E-3
 *RST: 20E-3
 Default unit: ms

Example: SOURce1:BB:BT0oth:ECON:PCON:PAInterval 10
 Sets a time interval of 10 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["Periodic Advertising Interval"](#) on page 53

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:PPERiodicity
<PPERiodicity>**

Specifies a value the connection interval is preferred to be a multiple of.

Parameters:

<PPERiodicity> float
 Range: 0 to depends on Max. Interval
 Increment: 0.01E-3
 *RST: 0

Example: See [Example"Configure event and frame configuration settings"](#) on page 179.

Options: R&S SMM-K117

Manual operation: See ["Preferred Periodicity"](#) on page 84

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RCECount
<RCECount>**

Specifies the ReferenceConnEventCount field of LL_CONNECTION_PARAM_REQ.

Parameters:

<RCECount> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example"Configure event and frame configuration settings"](#) on page 179.

Options: R&S SMM-K117

Manual operation: See ["Ref. Connection Event Count"](#) on page 85

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PNUMber <PNumber>

Sets the number of Tx packets per event.

Each connection contains at least one data channel packet. The maximum number of packets per event is determined by the duration of the connection event interval.

Parameters:

<PNumber> integer
 Range: 1 to depends on connection event interval
 *RST: 1

Example: SOURCE1:BB:BT0:ECOn:PNUM 2580
 Sets the number of Tx packets per event.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See ["No. Of Tx Packets/Event"](#) on page 55

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:SDCI?

Queries the number of the first active data channel.

Return values:

<SelectedChannel> integer
 Range: 0 to 36
 *RST: 0

Example: SOURCE1:BB:BT0oth:ECOnfiguration:SDCI?

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Usage: Query only

Manual operation: See ["Selected Data Channel Index"](#) on page 56

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:SINterval <SInterval>

Sets the time interval between the starting points of two consecutive windows during which the scanner is operating in an advertising channel.

Command sets the values in ms. Query returns values in s.

Parameters:

<SInterval> float
 Range: 10E-3 s to depends on oversampling and the number of advertising channel table states
 Increment: 0.625E-3
 *RST: 10E-3
 Default unit: ms

Example: `SOURce1:BB:BTO:ECON:SINT 3.5`
 Sets a time interval of 3.5 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See "[Scan Interval](#)" on page 53

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:SWINDOW <SWindow>

Sets the length of the window during which the scanner is operating in the advertising channel.

Note that the scan window is less or equal to the value of the scan interval.

Command sets the values in ms. Query returns values in s.

Parameters:

<SWindow> float
 Range: 10E-3 s to 10240E-3 s
 Increment: 0.625E-3
 *RST: 10E-3
 Default unit: ms

Example: `SOURce1:BB:BTO:ECON:SWIN 10`
 Sets the length of the window to 10 ms.

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See "[Scan Window](#)" on page 53

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:WOInfo?

Requires data event and advertising frame configuration with the packet type CONNECT_IND.

Queries the start point of the transmit window.

Return values:

<WoInfo> string

Example:	<pre>SOURce1:BB:BTO:UPTY CREQ</pre> <p>Sets packet type CONNECT_IND</p> <pre>SOURce1:BB:BTO:ECON:PCON:WOIN?</pre> <p>Queries the start point of the transmit window.</p>
Example:	See also Example"Configure event and frame configuration settings" on page 179.
Usage:	Query only

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:WSINfo?

Requires data event and advertising frame configuration with the packet type CONNECT_IND.

Queries the size of the transmit window, regarding to the start point.

Return values:

<WslInfo> string

Example:	<pre>SOURce1:BB:BTO:UPTY CREQ</pre> <p>Sets packet type CONNECT_IND</p> <pre>SOURce1:BB:BTO:ECON:PCON:WSIN?</pre> <p>Queries the size of the transmit window.</p>
-----------------	---

Example: See also [Example"Configure event and frame configuration settings"](#) on page 179.

Usage: Query only

Manual operation: See "[Transmit Window Size](#)" on page 54

8.5 Channel sounding commands - LE

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8.5.1 CS general commands

Example: To configure CS sequence settings

```
:SOURce1:BB:BT0oth:CINterval 10
// The connection interval is 10 microseconds.
:SOURce1:BB:BT0oth:EINterval 2
// The number of event intervals is two.
:SOURce1:BB:BT0oth:EOFFset?
// Response: "500"
// The event offset is 500 microseconds.
:SOURce1:BB:BT0oth:CS:ROLE?
// Response: "INITIATOR"
// The instrument initiates a channel sounding procedure.
```

Commands:

[:SOURce<hw>]:BB:BT0oth:CS:CINterval	190
[:SOURce<hw>]:BB:BT0oth:CS:EINterval	190
[:SOURce<hw>]:BB:BT0oth:CS:EOFFset	191
[:SOURce<hw>]:BB:BT0oth:CS:ROLE	191

[\[:SOURce<hw>\]:BB:BT0oth:CS:CINterval](#) <ConnectInterval>

Sets the time of the LE connection interval. The anchor points of two consecutive CS events define the length of this interval.

Parameters:

<ConnectInterval>	float
	Range: 7.5 to 4000
	Increment: 0.1
	*RST: 7.5

Example: See [Example "To configure CS sequence settings"](#) on page 190.

Manual operation: See ["Connection Interval"](#) on page 50

[\[:SOURce<hw>\]:BB:BT0oth:CS:EINterval](#) <EventInterval>

Sets the number of LE connection event intervals.

Parameters:

<EventInterval>	integer
	Range: 1 to 65535
	*RST: 1

Example: See [Example "To configure CS sequence settings"](#) on page 190.

Manual operation: See ["Event Intervals/Event_Interval"](#) on page 50
 See ["Event_Interval"](#) on page 124
 See ["Event_Interval"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:E0FFset <EventOffset>

Sets the time between the anchor point of the LE connection event and the beginning of the CS event.

Parameters:

<EventOffset> integer
 Range: 500 to 4e6
 *RST: 500

Example: See [Example "To configure CS sequence settings"](#) on page 190.

Manual operation: See ["Event Offset"](#) on page 50

[:SOURce<hw>]:BB:BT0oth:CS:ROLE <Role>

Sets the role of the channel sounding device that is the R&S SMM100A.

Parameters:

<Role> INITIATOR | REFLECTOR
INITIATOR
 The instrument initiates a CS procedure.
REFLECTOR
 The instrument responds to a CS procedure.
 *RST: INITIATOR

Example: See [Example "To configure CS sequence settings"](#) on page 190.

Manual operation: See ["Role"](#) on page 50

8.5.2 CS subevent commands

Example: To configure CS subevent settings

```
// *****
// Configure general settings of a CS subevent.
// *****
// Configure general subevent settings.
:SOURce1:BB:BT0oth:CS:SLENgth 1250
// CS subevent sequence length is 1250 microseconds.
:SOURce1:BB:BT0oth:CS:INTerval 1875
// CS subevent interval is 1875 microseconds.
:SOURce1:BB:BT0oth:CS:SSCHeduling?
// Response: "AUTO"
// CS step scheduling is automatic.
:SOURce1:BB:BT0oth:CS:SNUMber?
// Response: "1"
// Number of subevents is 1 subevent.
```

```
// *****
// Configure channel selection settings of a CS subevent.
// *****
:SOURce1:BB:BT0oth:CS:CFChM?
// Response: "#H00000000000000000001,80"
// CSFilteredChM value is 00000000000000000001 in hexadecimal representation.
:SOURce1:BB:BT0oth:CS:CMRepetition 1
// Sets one cycle of the ChM field for non-Mode-0 steps within the CS procedure.
:SOURce1:BB:BT0oth:CS:CSEL?
// Response: "SEL_3B"
// The channel selection algorithm is Algorithm #3b.
// Optionally, enable and configure Algorithm #3c parameters.
:SOURce1:BB:BT0oth:CS:CSEL SEL_3C
:SOURce1:BB:BT0oth:CS:CTCShape HAT
// The channel has a rising ramp and a falling ramp.
:SOURce1:BB:BT0oth:CS:CTCJump JUMP_2
```

Commands:

[:SOURce<hw>]:BB:BT0oth:CS:SLENgth	192
[:SOURce<hw>]:BB:BT0oth:CS:SINterval	192
[:SOURce<hw>]:BB:BT0oth:CS:SSCHeduling	193
[:SOURce<hw>]:BB:BT0oth:CS:SNUMber	193
[:SOURce<hw>]:BB:BT0oth:CS[:SEvent<ch0>]:NOSTep	193
[:SOURce<hw>]:BB:BT0oth:CS[:SEvent<ch0>]:SSPace?	194
[:SOURce<hw>]:BB:BT0oth:CS[:SEvent<ch0>]:TFCS	194
[:SOURce<hw>]:BB:BT0oth:CS[:SEvent<ch0>]:MZSTeps	194

[\[:SOURce<hw>\]:BB:BT0oth:CS:SLENgth <SubLength>](#)

Sets the subevent length that is the duration of a CS subevent.

You can set values in multiples of 625 μ s. Settable subevent lengths depend on the number of event intervals, the connection interval, the event offset and the subevent interval.

Parameters:

<SubLength>	integer
	Range: 1250 to 4e6
	*RST: 1250

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Subevent Length"](#) on page 92

[\[:SOURce<hw>\]:BB:BT0oth:CS:SINterval <SubInterval>](#)

Sets the subevent interval. This interval is the time in multiples of 625 μ s between the beginning of a CS subevent and the beginning of the next CS subevent within the same CS event.

For :SOURce1:BB:BT0:CS:SNUM 1, the subevent interval is 0 μ s.

For `:SOURCE1:BB:BTO:CS:SNUM` 2 or higher, settable subevent intervals depend on the number of event intervals, the connection interval, the event offset and the subevent length.

See also `[:SOURCE<hw>] :BB:BT0oth:CS:SNUMber` on page 193.

Parameters:

`<SubInterval>` integer
 Range: 0 to 2.7e11
 *RST: 0

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Subevent Interval"](#) on page 92

`[:SOURCE<hw>] :BB:BT0oth:CS:SSCHeduling <StepScheduling>`

Sets the step scheduling mode.

Parameters:

`<StepScheduling>` AUTO | MANUAL

AUTO

Automatic CS step scheduling. The subevent length, the subevent interval and the number of subevents are configurable. The number of CS steps is 2.

MANUAL

Manual CS step scheduling. The subevent length is 1250 μ s, the subevent interval is 0 μ s and the number of subevents is 1. The number of CS steps is configurable.

*RST: AUTO

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Step Scheduling"](#) on page 93

`[:SOURCE<hw>] :BB:BT0oth:CS:SNUMber <SubNumber>`

Sets number of subevents. Settable values depend on the subevent interval.

Parameters:

`<SubNumber>` integer
 Range: 1 to 32
 *RST: 1

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Number of Subevents"](#) on page 93

`[:SOURCE<hw>] :BB:BT0oth:CS[:SEVent<ch0>]:NOSTep <NumOfSteps>`

Sets or display the number of CS steps.

Setting requires manual step scheduling. Settable minimum values are 1 or equal to the number of non-zero Mode-0 steps. See also [\[:SOURce<hw>\]:BB:BT0oth:CS:SSCHeduling](#) on page 193.

Parameters:

<NumOfSteps> integer
 Range: 2 to 160
 *RST: 2

Example: See [Example "To configure CS steps for subevent 0"](#) on page 195.

Manual operation: See ["Number of Steps"](#) on page 94

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SSPace?

Queries the subevent space in microseconds.

Return values:

<SubeventSpace> integer
 Range: 150 to 65535
 *RST: 150

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["Subevent Space \(μs\)"](#) on page 94

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:TFCS <TFcs>

Sets the frequency change period (T_FCS) between consecutive CS steps. The period ranges from 15 μs to 150 μs.

Parameters:

<TFcs> TFCS_15 | TFCS_20 | TFCS_30 | TFCS_40 | TFCS_50 |
 TFCS_60 | TFCS_80 | TFCS_100 | TFCS_120 | TFCS_150
 TFCS_x, x represents values in microseconds.
 *RST: TFCS_150

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["T_FCS \(μs\)"](#) on page 94

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MZSteps <Mode0Steps>**Parameters:**

<Mode0Steps> integer
 Range: 1 to 3
 *RST: 1

Manual operation: See ["Mode-0 Steps"](#) on page 94

8.5.3 CS step configuration commands

Example: To configure CS steps for subevent 0

```
// *****
// Configure general CS step settings of the first subevent "Subevent 0".
// *****
// Configure general subevent settings.
:SOURcel:BB:BT0oth:CS:SLENgth 1250
// CS subevent sequence length is 1250 microseconds.
:SOURcel:BB:BT0oth:CS:INTerval 1875
// CS subevent interval is 1875 microseconds.
:SOURcel:BB:BT0oth:CS:SSCHeduling?
// Response: "AUTO"
// CS step scheduling is automatic.
:SOURcel:BB:BT0oth:CS:SNUMber?
// Response: "1"
// Number of subevents is 1 subevent.
```

Commands:

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMODE.....	195
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SMODE.....	196
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMASteps.....	196
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMISteps.....	196
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMSTeps?.....	197
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMRepetition.....	197
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SMSSTep?.....	197
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MONE:TIPO.....	197
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MZERo:TIPO.....	197
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTHRee:TSW?.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTWO:TSW?.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTHRee:NAP?.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTWO:NAP?.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTHRee:TPM.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTWO:TPM.....	198
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTHRee:TIPT.....	199
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTWO:TIPT.....	199
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:STYPe.....	199
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SEQLength.....	199
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:UPAYload.....	199
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:UPPattern.....	200

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMODE <mainMode>

Sets the main mode for the first subevent SEVent0. All following subevents use the same main mode.

For an overview on available submodes per main mode, see [Table 5-8](#).

Parameters:

<mainMode> MODE1 | MODE2 | MODE3

MODE1

Mode-1 mode with no submode available.

MODE2

Mode-2 mode with submodes Mode-1 and Mode-3 available.

MODE3

Mode-3 mode with submodes Mode-1 and Mode-2 available.

*RST: MODE1

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Main_Mode"](#) on page 100

[[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SMODE <SubMode>

Sets the submode of the main mode.

Parameters:

<SubMode> MODE1 | MODE2 | MODE3 | NONE

See the table [Table 5-8](#) for an overview on available submodes per main mode.

*RST: NONE

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Sub_Mode"](#) on page 101

[[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMASSteps <MMMaxSteps>

Sets the maximum number of main mode steps.

Parameters:

<MMMaxSteps> integer

Range: 2 to 255

*RST: 2

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Main_Mode_Max_Steps"](#) on page 101

[[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMISSteps <MMMinSteps>

Sets the minimum number of main mode steps.

Parameters:

<MMMinSteps> integer

Range: 2 to 255

*RST: 2

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Main_Mode_Min_Steps"](#) on page 101

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMSTeps?

Queries the number of main mode CS steps.

Return values:

<MMSTeps> integer
 Range: 2 to 160
 *RST: 2

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["Main_Mode_Steps"](#) on page 101

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MMRepetition <MMRepetition>

Sets the main mode repetition.

Parameters:

<MMRepetition> integer
 Range: 0 to 3
 *RST: 0

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Main_Mode_Repetition"](#) on page 101

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SMSTep?

Sets the number of submode CS steps.

Return values:

<SubModeStep> integer
 Range: 0 to 160
 *RST: 0

Example: See [Example "To configure CS steps for subevent 0"](#) on page 195.

Usage: Query only

Manual operation: See ["Sub_Mode_Steps"](#) on page 101

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MONE:TIPO <TIPO> [:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MZERo:TIPO <TIPO>

Sets the time "T_IP1" for Mode-0 and Mode-1 CS steps.

Parameters:

<TIPO> TIP1_10 | TIP1_20 | TIP1_30 | TIP1_40 | TIP1_50 | TIP1_60 |
TIP1_80 | TIP1_145

TIP1_x, x represents values in microseconds.

*RST: TIP1_145

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["T_IP1"](#) on page 102

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTHRee:TSW?

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTWO:TSW?

Sets the time "T_SW" for Mode-2 or Mode-3 CS steps.

Return values:

<Tsw> TSW_0 | TSW_1 | TSW_2 | TSW_4 | TSW_10

TSW_x, x represents values in microseconds.

*RST: TSW_0

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Usage:

Query only

Manual operation: See ["T_SW"](#) on page 105

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTHRee:NAP?

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTWO:NAP?

Sets the number of antenna path in the N_AP field for Mode-2 and Mode-3 CS steps.

Return values:

<Nap> NAP_1 | NAP_2 | NAP_3 | NAP_4

NAP_x, x represents the path number.

*RST: NAP_1

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Usage:

Query only

Manual operation: See ["N_AP"](#) on page 105

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTHRee:TPM <Tpm>

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:MTWO:TPM <Tpm>

Sets the time "T_PM" for Mode-2 or Mode-3 CS steps.

Parameters:

<Tpm> TPM_10 | TPM_20 | TPM_40 | TPM_652

TPM_x, x represents values in microseconds.

*RST: TPM_40

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["T_PM"](#) on page 105

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTHRee:TIPt <TIPT>
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:MTWO:TIPt <TIPT>
```

Sets the time "T_IP2" for Mode-2 or Mode-3 CS steps.

Parameters:

<TIPT> TIP2_10 | TIP2_20 | TIP2_30 | TIP2_40 | TIP2_50 | TIP2_60 |
TIP2_80 | TIP2_145

TIP2_x, x represents values in microseconds.

*RST: TIP2_145

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["T_IP2"](#) on page 105

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:STYPe <SeqType>
```

Sets the sequence type.

Parameters:

<SeqType> SOUNDING | RANDOM

SOUNDING

Sounding sequence

RANDOM

Random sequence

*RST: SOUNDING

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Sequence Type"](#) on page 103

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:SEQLength <SeqLen>
```

Sets the sequence length. The length is discrete and depends on the sequence type.

Parameters:

<SeqLen> SL_32 | SL_64 | SL_96 | SL_128

*RST: SL_32

Example: See [Example "To configure CS steps for subevent 0"](#) on page 195.

Manual operation: See ["Sequence Length"](#) on page 103

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:UPAYload <UserPayload>
```

Selects a data list file as the data source for a random CS sequence.

This sequence uses the CS_SYNC_User_Payload for CS step configuration modes Mode-1 or Mode-3.

Select the file from the default instrument directory or a specific directory.

Parameters:

<UserPayload> string

Example: See [Example](#) "To configure CS step settings for a subevent" on page 201.

Manual operation: See ["Select Data List"](#) on page 104

[:SOURce<hw>] :BB:BT0oth:CS[:SEVent<ch0>]:UPPattern <Pattern>

Selects the user payload pattern for a random CS sequence.

This pattern is the payload type for CS step configuration modes Mode-1 or Mode-3.

Parameters:

<Pattern> PRBS09 | RE1S | RE2S | PRBS15 | RE3S | RE4S | RE5S | RE6S | UPLD

PRBS09|PRBS15

Pseudo random bit sequence with 9-bit length or 15-bit length in accordance with the IUT-T.

RE1S|RE2S|RE3S|RE4S|RE5S|RE6S

Repeated 8-digit sequences of zeroes and ones.

UPLD

Uses the CS_SYNC_User_Payload. Set this payload via a data list file and the following command:

```
:SOURce1:BB:BT0oth:CS:SEVent<ch0>:UPAYload
```

See also [\[:SOURce<hw> \] :BB:BT0oth:CS\[:SEVent<ch0>\]:UPAYload](#) on page 199.

```
*RST: PRBS09
```

Example: See [Example](#) "To configure CS step settings for a subevent" on page 201.

Manual operation: See ["User Payload Pattern"](#) on page 104

8.5.4 CS step info commands

Example: To configure CS step settings for a subevent

```
// *****
// Configure general settings of a CS subevent.
// *****
// Configure general subevent settings.
:SOURce1:BB:BT0oth:CS:SLENgth 1250
// CS subevent sequence length is 1250 microseconds.
:SOURce1:BB:BT0oth:CS:INTerval 1875
// CS subevent interval is 1875 microseconds.
:SOURce1:BB:BT0oth:CS:SSCHeduling?
// Response: "AUTO"
// CS step scheduling is automatic.
:SOURce1:BB:BT0oth:CS:SNUMber?
// Response: "1"
// Number of subevents is 1 subevent.
```

Commands:

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:MTPe?	201
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CINdex	202
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CAADdress	202
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:SCONtent	202
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CSIGNal	203
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:DATA	203
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:DLISt	203
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:PATtern	204
[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CTEXtension	204

[\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]\[:STEP<st0>\]:MTPe?](#)

Queries the mode type for individual CS steps.

For the first CS step, the mode type is the Mode-0. For the other CS steps, the mode type is the main mode in the CS step configuration.

Return values:

<ModeType> MODE0 | MODE1 | MODE2 | MODE3
 For a description, see [\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMODE](#) on page 195.
 *RST: MODE0

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Usage: Query only

Manual operation: See ["Mode Type"](#) on page 109

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CINdex
<ChannlIndex>
```

Queries the channel index for individual CS steps.

Parameters:

```
<ChannlIndex>      integer
                    Range:    0 to 78
                    *RST:    0
```

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Channel Index"](#) on page 110

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CAAddress
<AccessAddress>, <BitCount>
```

Sets or queries the 32-bit CS access address for individual CS steps.

Setting require manual step scheduling:

```
:SOURce1::BB:BT0oth:CS:SSCHeduling MANUAL
```

See also [\[:SOURce<hw>\]:BB:BT0oth:CS:SSCHeduling](#) on page 193.

Parameters:

```
<AccessAddress>    numeric
                    *RST:    #H00000000

<BitCount>        integer
                    Range:    32 to 32
                    *RST:    32
```

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["CS Access Address"](#) on page 110

```
[ :SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:SCONtent
<SeqContent>, <BitCount>
```

Queries the content and the length of a sounding sequence or random sequence. The content depends on the subevent mode.

For CS test packets, you can set the content for a sounding sequence and random sequence.

Parameters:

```
<SeqContent>      numeric
                    *RST:    #H00000000
```

<BitCount> integer
 Range: 32 to 128
 *RST: 32

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Sounding Sequence Content/Random Sequence Content"](#) on page 110

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>][:STEP<st0>]:CSIgnal
 <CompanionSignal>

Sets the companion signal.

Parameters:

<CompanionSignal> NONE | P2 | M2 | P4 | M4 | M2P2 | M4P4

NONE

Companion signal is disabled.

P2|P4

Positive companion signal with values 2 or 4.

M2|M4

Negative companion signal with values -2 or -4.

M2P2|M4P4

Positive and negative companion signal with values -2 and 2 or -4 and 4.

*RST: NONE

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Companion Signal"](#) on page 110

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:DATA <DataSource>

Sets the data source for the companion signal.

Parameters:

<DataSource> ALL0 | ALL1 | PATtern | PN09 | PN11 | PN15 | PN16 | PN20 |
 PN21 | PN23 | DLISt

*RST: PN09

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Companion Signal"](#) on page 110

[:SOURce<hw>]:BB:BT0oth:CS[:SEVent<ch0>]:DLISt <DataList>

Selects a data list file as the data source for the companion signal.

Select the file from the default instrument directory or a specific directory.

Parameters:

<DataList> string

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Companion Signal"](#) on page 110

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>]:PATtern <Pattern>, <BitCount>

Sets the data pattern for the companion signal.

Parameters:

<Pattern> numeric
 *RST: #H0

<BitCount> integer
 Range: 1 to 64
 *RST: 1

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["Companion Signal"](#) on page 110

[:SOURce<hw>]:BB:BTOoth:CS[:SEVent<ch0>][:STEP<st0>]:CTEXtension
 <CsToneExt>

Enables CS tone extension for mode-2 and mode-3 CS steps.

Parameters:

<CsToneExt> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure CS step settings for a subevent"](#) on page 201.

Manual operation: See ["CS Tone Ext."](#) on page 112

8.5.5 CS channel table commands

[:SOURce<hw>]:BB:BTOoth:CS:CTABLE[:CHANnel<ch0>]:CFRequency?	204
[:SOURce<hw>]:BB:BTOoth:CS:CTABLE[:CHANnel<ch0>]:CINdex?	205
[:SOURce<hw>]:BB:BTOoth:CS:CTABLE[:CHANnel<ch0>]:CTYPe?	205
[:SOURce<hw>]:BB:BTOoth:CS:CTABLE[:CHANnel<ch0>]:CALLowed	205

[:SOURce<hw>]:BB:BTOoth:CS:CTABLE[:CHANnel<ch0>]:CFRequency?

Queries the center frequency of the channel.

Return values:

<CenterFreq> float
 For a description, see also table [Table 2-13](#).
 Range: 2402 to 2480
 Increment: 2
 *RST: 2402

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["Center Frequency \(MHz\)"](#) on page 95

[:SOURce<hw>]:BB:BT0oth:CS:CTABLE[:CHANnel<ch0>]:CINdex?

Queries the channel index of the channel.

Return values:

<CsChannelIndex> integer
 For a description, see also table [Table 2-13](#).
 Range: 0 to 78
 *RST: 0

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["Channel Index"](#) on page 96

[:SOURce<hw>]:BB:BT0oth:CS:CTABLE[:CHANnel<ch0>]:CTYPE?

Queries the channel type that is Channel Sounding for all channels.

Return values:

<ChannelType> CS
CS
 Channel type is Channel Sounding.
 *RST: CS

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["Channel Type"](#) on page 96

[:SOURce<hw>]:BB:BT0oth:CS:CTABLE[:CHANnel<ch0>]:CALLowed
 <ChannelAllowed>

Enables transmission of the subevent via the selected channel.

Parameters:

<ChannelAllowed> 1 | ON | 0 | OFF
 For a description, see also table [Table 2-13](#).

1|ON

Enables transmission of the subevent for the selected channel.

0|OFF

Disables transmission of the subevent for the selected channel.

*RST: 0

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Channel Allowed"](#) on page 96

8.5.6 CS security commands

[:SOURce<hw>]:BB:BT0oth:CS:CIVC	206
[:SOURce<hw>]:BB:BT0oth:CS:CIVP	206
[:SOURce<hw>]:BB:BT0oth:CS:CINC	207
[:SOURce<hw>]:BB:BT0oth:CS:CINP	207
[:SOURce<hw>]:BB:BT0oth:CS:CSPVc	208
[:SOURce<hw>]:BB:BT0oth:CS:CPVP	208

[:SOURce<hw>]:BB:BT0oth:CS:CIVC <CslvC>, <BitCount>

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IV_C parameter. The parameter is 64-bit in hexadecimal representation.

Parameters:

<CslvC>	numeric CS_IV_C value in hexadecimal representation. *RST: #H0
<BitCount>	integer Fixed bit count of 64 bits. Range: 64 to 64 *RST: 64

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["CS_IV_C\(hex\)"](#) on page 97

[:SOURce<hw>]:BB:BT0oth:CS:CIVP <CslvP>, <BitCount>

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IV_P parameter. The parameter is 64-bit in hexadecimal representation.

Parameters:

<CslvP>	numeric CS_IV_P value in hexadecimal representation. *RST: #H0
---------	--

<BitCount> integer
 Fixed bit count of 64 bits.
 Range: 64 to 64
 *RST: 64

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["CS_IV_P\(hex\)"](#) on page 97

[:SOURce<hw>]:BB:BT0oth:CS:CINC <CsInC>, <BitCount>

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IN_C parameter. The parameter is 32-bit in hexadecimal representation.

Parameters:

<CsInC> numeric
 CS_IN_C value in hexadecimal representation.
 *RST: #H0

<BitCount> integer
 Fixed bit count of 32 bits.
 Range: 32 to 32
 *RST: 32

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["CS_IN_C\(hex\)"](#) on page 97

[:SOURce<hw>]:BB:BT0oth:CS:CINP <CsInP>, <BitCount>

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_IN_P parameter. The parameter is 32-bit in hexadecimal representation.

Parameters:

<CsInP> numeric
 CS_IN_P value in hexadecimal representation.
 *RST: #H0

<BitCount> integer
 Fixed bit count of 32 bits.
 Range: 32 to 32
 *RST: 32

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["CS_IN_P\(hex\)"](#) on page 97

[[:SOURce<hw>]:BB:BT0oth:CS:CSPVc <csPvC>

Parameters:

<csPvC> 64 bits

Manual operation: See "["CS_PV_C\(hex\)"](#) on page 97

[[:SOURce<hw>]:BB:BT0oth:CS:CPVP <CsPvP>, <BitCount>

Requires packet type CS SEQUENCE or LL_CS_SEC_REQ.

Sets the CS_PV_P parameter. The parameter is 64-bit in hexadecimal representation.

Parameters:

<CsPvP> numeric
 CS_PV_P value in hexadecimal representation.

*RST: #H0

<BitCount> integer
 Fixed bit count of 64 bits.
 Range: 64 to 64
 *RST: 64

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See "["CS_PV_P\(hex\)"](#) on page 97

8.5.7 CS channel selection commands

[:SOURce<hw>]:BB:BT0oth:CS:CFCHm?	208
[:SOURce<hw>]:BB:BT0oth:CS:CMRepetition	209
[:SOURce<hw>]:BB:BT0oth:CS:CSEL	209
[:SOURce<hw>]:BB:BT0oth:CS:CTCJump	209
[:SOURce<hw>]:BB:BT0oth:CS:CTCShape	210

[[:SOURce<hw>]:BB:BT0oth:CS:CFCHm? <BitCount>

Queries the value of the field CSFilteredChM.

This value determines the bit map for the Channel Sounding channel map update procedure. The parameter is 64-bit in hexadecimal representation.

Parameters:

<BitCount> integer
 Fixed bit count of 80 bits.
 Range: 80 to 80
 *RST: 80

Return values:

<CsFilteredChM> numeric
 CSFilteredChM value in hexadecimal representation.
 *RST: #H0

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Usage: Query only

Manual operation: See ["CSFilteredChM\(hex\)"](#) on page 98

[:SOURce<hw>]:BB:BT0oth:CS:CMRepetition <ChMRepetition>

Sets the 3-bit ChM_Repetition field.

The value equals the number of cycles of the ChM field for non-Mode-0 steps within a CS procedure.

Parameters:

<ChMRepetition> integer
 Range: 1 to 3
 *RST: 1

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["ChM_Repetition"](#) on page 98

[:SOURce<hw>]:BB:BT0oth:CS:CSEL <ChSel>

Sets the algorithm to select the channels.

Parameters:

<ChSel> SEL_3B | SEL_3C
SEL_3B
 Sets for Algorithm #3b channel selection algorithm.
SEL_3C
 Sets for Algorithm #3c channel selection algorithm.
 For related parameters, see [Table 5-7](#).
 *RST: SEL_3B

Example: See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["ChSel"](#) on page 98

[:SOURce<hw>]:BB:BT0oth:CS:CTCJump <ChThreeCJump>

Determines the number of skipped channels when rendering the channel shapes. The Ch3cJump field has a length of 1 octet and relates to the channel index values.

Configure this field when using the channel selection algorithm Algorithm #3c:

```
:SOURce1:BB:BT0oth:CS:CSEL SEL_3C
```

Parameters:

<ChThreeCJump> JUMP_2 | JUMP_3 | JUMP_4 | JUMP_5 | JUMP_6 | JUMP_7 | JUMP_8

For Ch3cJump field parameters, see [Table 5-7](#).

*RST: JUMP_2

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Ch3cJump"](#) on page 99

[:SOURce<hw>]:BB:BT0oth:CS:CTCShape <ChThreeCShape>

Sets the bits of the Ch3cShape field. The field has a length of 4 bits and sets the shaping method of the rising and falling ramps of the channels.

Configure this field when using the channel selection algorithm Algorithm #3c:

```
:SOURce1:BB:BT0oth:CS:CSEL SEL_3C
```

Parameters:

<ChThreeCShape> HAT | X

HAT

Channel with a rising ramp and a falling ramp.

X

Channel with interleaved rising and falling ramps.

*RST: HAT

Example:

See [Example "To configure CS subevent settings"](#) on page 191.

Manual operation: See ["Ch3cShape"](#) on page 99

8.6 Packet configuration commands - LE

Example: To configure advertising packets

```
// *****
// Configure packet for ADV_SCAN_IND: switch off whitening,
// set Tx device address type, AdvA, data source and length
// *****
SOURce1:BB:BT0oth:CTYPE ADV
SOURce1:BB:BT0oth:UPTYPE ADC
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:DWhitening 0
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:TATYPE PUBL
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:ANUap #H017412,24
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:ALAP #H9E8B00,24
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:DATA PN09
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:DLENGTH 31
```

Packet configuration commands - LE

```

// *****
// Alternatively set periodic advertising interval for AUX_SYNC_IND
// *****
SOURCEl:BB:BT0oth:CTYPe ADV
SOURCEl:BB:BT0oth:UPTYpe ASIN
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:PAINterval

// *****
// Select packet type AUX_ADV_IND. (All parameters of
// extended header are configurable with AUX_ADV_IND packet
// type.) Set channel selection,
// Tx device address type, advertising mode.
// Enable extended header for advertising PDUs. Enable all
// flags: AdvA, TargetA, AdvData Info, Aux Ptr, Sync Info,
// TxPow. Set Tx power value and ACAD length and pattern.
// *****
SOURCEl:BB:BT0oth:CTYPe ADV
SOURCEl:BB:BT0oth:UPTYpe AAIN
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CSElection CS1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:TATYPe PUBL
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:AMODE NCNS
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:EHEader:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:AADDRESS:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:TADDRESS:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:ADINfo:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:APTR:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:SINfo:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:TPOWER:STATE ON
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:TPOWER -100
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:ALENgtH 16
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:ACAD PN16

// *****
// Alternatively set user-defined pattern.
// *****
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:ACAD PATTern
SOURCEl:BB:BT0oth:ECONfiguration:PCON:ACAD:APATtern #B011000011,9
// *****
// Alternatively set pattern from data list.
// *****
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:ACAD DLISt
SOURCEl:BB:BT0oth:ECON:PCON:ACAD:ASEL "p:/pattern1.dm_iqd

// *****
// Enable AdvData Info flag, set advertising data ID and
// advertising data set ID.
// *****
SOURCEl:BB:BT0oth:ECONfiguration:PCON:EHFLags:ADINfo:STATE ON

```

Packet configuration commands - LE

```

SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ADID #H01FF,12
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ASID #H0F,4
// *****
// Enable and specify AuxPtr for the secondary advertising
// channel: select AUX channel, set clock accuracy, offset unit,
// AUX offset, AUX PHY.
// *****
SOURCEl:BB:BT0oth:ECOnfiguration:PCOn:EHFLags:APTR:STATe ON
SOURCEl:BB:BT0oth:ECOnfiguration:DCTable:CHANnel0:STATe 1
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:CACCuracy T500
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:AOUNits U30
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:AOffset 100
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:APHY L1M
// *****
// Enable and specify SyncInfo field for the AUX_SYNC_IND
// packet: set sync packet offset, offset unit, periodic adv
// interval, sleep clock accuracy, access address, CRC initial
// value. Reset event counter. Configure channel map.
// *****
SOURCEl:BB:BT0oth:ECOnfiguration:PCOn:EHFLags:SIInfo:STATe ON
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:PAInTerval 20
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SCACCuracy SCA0
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:AADdress #HACDE48AC,32
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:CIV #H000000,24
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SPOffset 100
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SOUNits U30
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:OADJust 1
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SPOffset?
// 99.9
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ECOUNTER 0
SOURCEl:BB:BT0oth:ECOnfiguration:PCOn:DCMTable:CHANnel0:STATe 1

// *****
// Configure advertiser, scanner and initiator device addresses.
// Company_Assigned and Company_Id in Advertiser's Device Address
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ACAS #H000000,24
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ACID #H000000,24
// Company_Assigned and Company_Id in Scanners Device Address
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SCAS #H000000,24
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:SCID #H000000,24
// Company_Assigned and Company_Id in Initiators Device Address
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ICAS #H000000,24
SOURCEl:BB:BT0oth:ECOnfiguration:PCOnfiguration:ICID #H000000,24
// *****

```

Example: To configure data packets

```
// *****
// Configure signal for DATA: select channel type, packet type,
// packet format, sequence length, role, enable CRC corruption.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe CUR
SOURCEl:BB:BT0oth:PFORmat L1M
SOURCEl:BB:BT0oth:USLength 12
SOURCEl:BB:BT0oth:BCRole CENTRAL
SOURCEl:BB:BT0oth:CCRC:STATe 1

// *****
// Configure packet type DATA: access address, CRC initial,
// NESN start, SN start values, data source, data length
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe DATA
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:AADDRESS #HDAB85479,32
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CIVAlue #H000000,24
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NSValue 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:SSValue 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:DATA PN09
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:DLENGth 251

// *****
// Configure payload of LL_CONNECTION_UPDATE_IND: transmit
// window size and offset, connection event interval, Peripheral
// latency, LL connection timeout, connection instant.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe CUR
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:AADDRESS #HDAB85479,32
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CIVAlue #H000000,24
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NSValue 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:SSValue 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NWSize 1.25
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NWOffset 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NCINterval 7.5
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:PSLatency 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:NLCTimeout 100
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CINStant 0

// *****
// Configure the payload of LL_FEATURE_REQ: set packet
// type, feature set length and configure feature set.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe FREQ
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:FSLength 8
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:FSBit0:STATe 1
```

Packet configuration commands - LE

```

SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit1:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit2:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit3:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit4:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit5:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit6:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit7:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit8:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit9:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit10:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit11:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit12:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit13:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit14:STATe 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit15:STATe 0
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:FSBit16:STATe 0

// *****
// Configure the payload of LL_CONNECTION_PARAM_REQ: max. and min.
// interval, Peripheral latency, LL connection timeout, preferred
// periodicity, reference connection even count
// *****
SOURCEl:BB:BT00th:CTYPe DATA
SOURCEl:BB:BT00th:UPTYpe CPR
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MXINterval 10
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MNINterval 7.5
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:PSLatency 1
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:NLCTimeout 100
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:PPERiodicity 1.25
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:RCECount 10
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet0:STATe ON
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet0:VALue 3.75
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet1:STATe ON
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet1:VALue 5
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet2:STATe ON
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet2:VALue 6.25
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet3:STATe OFF
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet4:STATe OFF
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:OFFSet5:STATe OFF

// *****
// Configure the payload of LL_LENGTH_REQ: max. Rx and TX
// payload octets, max. time to receive and transmit a packet.
// *****
SOURCEl:BB:BT00th:CTYPe DATA
SOURCEl:BB:BT00th:UPTYpe LREQ
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MROctets 27
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MTOctets 27
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MRTime 0.328
SOURCEl:BB:BT00th:ECONfiguration:PCONfiguration:MTTime 0.328

```

Packet configuration commands - LE

```

// *****
// Set the payload of LL_PHY_REQ: specify preferred Tx, Rx PHYs.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe PREQ
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:TPHYs:L1M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:TPHYs:L2M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:TPHYs:LCOD:STATe 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:RPHYs:L1M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:RPHYs:L2M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:RPHYs:LCOD:STATe 0

// *****
// Set the payload of LL_PHY_UPDATE_IND: specify PHYs for
// Central-to-Peripheral and Peripheral-to-Central direction and instant.
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe PUIN
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L1M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L2M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:LCOD:STATe 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L1M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L2M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:LCOD:STATe 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:CINStant 1

// *****
// Set the payload of LL_REJECT_EXT_IND: set reject opcode
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:UPTYPe REIN
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:ROPCode #H02,8

// *****
// Set the payload of LL_MIN_USED_CHANNELS_IND: set the controller
// role to Peripheral, set the packet type, specify PHYs and minimum
// used channels requirement
// *****
SOURCEl:BB:BT0oth:CTYPe DATA
SOURCEl:BB:BT0oth:BCRole PERipheral
SOURCEl:BB:BT0oth:UPTYPe MUCH
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:PHYS:L1M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:PHYS:L2M:STATe 1
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:PHYS:LCOD:STATe 0
SOURCEl:BB:BT0oth:ECONfiguration:PCONfiguration:MUCHannels 2

// *****
// Set header and payload of LL_PERIODIC_SYNC_IND: enable CTE and

```

```
// configure CTE method, set event counter properties, specify PHYs
// and address type.
// *****
:SOURcel:BB:BT0oth:CTYPe DATA
:SOURcel:BB:BT0oth:UPTYPe PSIN
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:CPResent 1
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:CTIME 0.016
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:CTYPe AOA
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:ID #HAAAA,16
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SPOffset 245.7
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SOUNits U30
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:OADJust 1
// Enabling offset adjust sets the Sync packet offset to 300 us.
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SOUNits U300
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:CECount 65535
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:LPECounter 65535
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SID #H1,4
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:ATYPe PUBL
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SCACcuracy SCA0
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:PHY:L1M:STATe 1
// Enabling another PHY automatically disables the previous PHY.
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:PHY:L2M:STATe 1
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:PHY:LCOD:STATe 1
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:PHY:L1M:STATe? 0
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:PHY:L2M:STATe? 0
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:ACASigned #H000080,24
:SOURcel:BB:BT0oth:ECONfiguration:PCONfiguration:SCECounter 65535
```

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8.6.1 General configuration

```
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[ :SOURce<hw> ]:BB:BT0oth:ECONfiguration:PCONfiguration:AADDRESS..... 217
[ :SOURce<hw> ]:BB:BT0oth:ECONfiguration:PCONfiguration:CIValue..... 217
```

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DWHitening
 <DWhitening>

Activates or deactivates the Data Whitening. Evenly distributed white noise is ideal for the transmission and real data can be forced to look similar to white noise with different methods called Data Whitening. Applied to the PDU and CRC fields of all packet types, whitening is used to avoid long equal sequences in the data bit stream.

Parameters:

<DWhitening> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Data Whitening"](#) on page 59

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:AADDRESS
 <AAddress>, <BitCount>

Sets the access address of the link layer connection (32-bit string).

Parameters:

<AAddress>	numeric
	*RST: #HACDE48AC
<BitCount>	integer
	Range: 32 to 32
	*RST: 32

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["Access Address"](#) on page 59

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:CIValue <CiValue>,
 <BitCount>

Sets the initialization value for the CRC (Cyclic Redundancy Check, 24 bits) calculation. A packet has been received correctly, when it has passed the CRC check.

Parameters:

<CiValue>	numeric
	*RST: #H0
<BitCount>	integer
	Range: 24 to 24
	*RST: 24

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["CRC Initial Value\(hex\)"](#) on page 60

8.6.2 Header configuration

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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:CTYPE	219
[:SOURce<hw>]:BB:BT0oth:ECONfig:PCONfig:ANTGain<ch0>	220
[:SOURce<hw>]:BB:BT0oth:ECONfig:PCONfig:ANTNumber	220

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:CSElection
 <CSelection>

Specifies the algorithm of channel selection.

Parameters:

<CSelection> CS1 | CS2
 Algorithm #1 or algorithm #2
 *RST: CS1

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Channel Selection"](#) on page 61

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:NSValue <NsValue>

Sets the start value of the next expected packet from the same device in the LL connection ("N"ext"E"xpected "S"equence"N"umber). This parameter can be set in the first event. From the second event this field is not indicated.

Parameters:

<NsValue> integer
 Range: 0 to 1
 *RST: 1

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["NESN Start Value"](#) on page 60

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:SSValue <SsValue>

Sets the sequence number of the packet. This parameter can be set in the first event. From the second event, this field is not indicated.

Parameters:

<SsValue> integer
 Range: 0 to 1
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["SN Start Value"](#) on page 61

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:CPResent <State>

Activates the CTEInfo field in the header of Bluetooth LE data packets in the LE un-coded PHY.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["CTEInfo Present"](#) on page 61

[:SOURCE<hw>] : BB : BTOoth : ECONFIGuration : PCONFIGuration : CTIME <CTime>

Sets the CTETime comprising the length of constant tone extension field of the Bluetooth LE PDU.

Parameters:

<CTime> float
 Range: 16E-6 to 160E-6
 Increment: 8E-6
 *RST: 16E-6

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["CTETime"](#) on page 62

[:SOURCE<hw>] : BB : BTOoth : ECONFIGuration : PCONFIGuration : CTReq <CTReq>

Sets the CTE type in the CTETypeReq field of the CtrData field of the LL_CTE_REQ PDU.

Parameters:

<CTReq> AOD1 | AOA | AOD2
AOA
 AoA Constant Tone Extension
AOD1
 AoD Constant Tone Extension with 1 μ s time slots
AOD2
 AoD Constant Tone Extension with 2 μ s time slots
 *RST: AOA

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["CTETypeReq"](#) on page 89

[:SOURCE<hw>] : BB : BTOoth : ECONFIGuration : PCONFIGuration : CTYPE <CType>

Sets the type of constant tone extension. The type specifies the CTE AoA/AoD method and for AoD the length of the switching and I/Q sampling slots.

Parameters:

<CType> AOD1 | AOA | AOD2
AOA
 AoA Constant Tone Extension
AOD1
 AoD Constant Tone Extension with 1 μ s time slots

AOD2AoD Constant Tone Extension with 2 μ s time slots

*RST: AOA

Example: See [Example "To configure data packets"](#) on page 213.**Manual operation:** See ["CTEType"](#) on page 63**[[:SOURce<hw>]:BB:BT0oth:ECONfig:PCONfig:ANTGain<ch0> <AntennaGain>**

Specifies the gain of the antenna. You can specify the antenna gain information of up to four individual antennas for direction finding.

Parameters:

<AntennaGain>	float
Range:	-10 to 10
Increment:	0.01
*RST:	0

Example: See [Example "To configure data packets"](#) on page 213.**Manual operation:** See ["AntennaX Gain"](#) on page 63**[[:SOURce<hw>]:BB:BT0oth:ECONfig:PCONfig:ANTNumber <AntennaNum>**

Specifies the number of antennas for angle of departure (AoD) direction finding method. You select up to four antennas, that are used for direction finding.

Parameters:

<AntennaNum>	integer
Range:	1 to 4
*RST:	1

Example: See [Example "To configure data packets"](#) on page 213.**Manual operation:** See ["Antenna Number"](#) on page 63

8.6.3 Payload configuration

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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTTime.....	237
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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L1M:STATe.....	238
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L2M:STATe.....	238
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:LCOD:STATe.....	238
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L1M:STATe.....	238
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L2M:STATe.....	238
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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:NWSize.....	240
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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RPHYs:L2M:STATe.....	242
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RPHYs:LCOD:STATe.....	242
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:TPHYs:L1M:STATe.....	242
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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SCACcuracy.....	243
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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ACAD <Data>

Specifies the pattern source used for additional controller advertising data (ACAD).

Parameters:

<Data> ALL0 | ALL1 | PATtern | PN09 | PN11 | PN15 | PN16 | PN20 |
 PN21 | PN23 | DLISt

ALL0 / ALL1

All 0 or all 1 pattern

PATtern

User-defined pattern. The pattern can be specified via:

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:APATtern` on page 223

PNxx

Pseudo-random bit sequences (PRBS) of a length of xx bits. The length in bit can be 9, 11, 15, 16, 20, 21, or 23.

DLIST

Internal ACAD data list is used. The data list can be specified via:

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:ASELectio` on page 223

*RST: PN09

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["ACAD"](#) on page 70

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:APATtern`
`<DPattern>, <BitCount>`

Specifies user-defined pattern. The settings is relevant for

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD`
 PATtern

Parameters:

`<DPattern>` numeric
 *RST: #H0

`<BitCount>` integer
 Range: 1 to 64
 *RST: 1

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AList / Pattern"](#) on page 70

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACAD:ASELectio`
`<DSelection>`

Specifies data list file. The settings is relevant for

`[:SOURCE<hw>] :BB:BT00th:ECOnfiguration:PCOnfiguration:ACADDLIST`

Parameters:

`<DSelection>` string
 Path and file name.

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AList / Pattern"](#) on page 70

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ACID <Acid> ,
<BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ACASsigned
<AcAssigned> , <BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:SCASsigned
<ScAssigned> , <BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:SCID <Scid> ,
<BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ICASsigned
<IcAssigned> , <BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ICID <Icid> ,
<BitCount>**

Sets the advertiser's device address. For advertising channel packets, the format of the device address differs, depending on the selected address type.

- "Public Address Types"
The public address is given from the registration authority IEEE and is composed of:
 - LSB: 24 bits = company_assigned
 - MSB: 24 bits = company_id
- "Random Address Type" is a 48-bits random static device address.
- "Private Address Type"
A private address is optional and composed of:
 - LSB: 24 bits = hash
 - MSB: 24 bits = random

Parameters:

<Icid>	numeric
	*RST: #HACDE48
<BitCount>	integer
	Range: 24 to 24
	*RST: 24

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["Initiator's Device Addr"](#) on page 77

**[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ADID <Adid> ,
<BitCount>**

Specifies "Advertising Data ID" in hexadecimal format to be signaled within an extended header.

Parameters:

<Adid>	numeric
	*RST: #H000
<BitCount>	integer
	Range: 12 to 12
	*RST: 12

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Advertising Data ID\(hex\)"](#) on page 71

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ALAP <Lap>, <BitCount>

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ILAP <Lap>, <BitCount>

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:SLAP <Lap>, <BitCount>

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:TLAP <Lap>, <BitCount>

Sets the lower address part (LAP) of Bluetooth device address. Commands for the advertising . . . :ALAP, initiating . . . :ILAP, scanning . . . :SLAP PDUs of advertising channel type are provided. In addition, a command is provided for scanner's or initiator's target device address to which the advertisement is directed . . . :TLAP.

Parameters:

<Lap>	numeric
	*RST: #H000080
<BitCount>	integer
	Range: 24 to 24
	*RST: 24

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Target's Device Addr"](#) on page 65

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ALENgtH <Length>

Specifies the length of ACAD data pattern.

Parameters:

<Length>	integer
	Range: 0 to 62
	*RST: 27

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["ACAD Length"](#) on page 70

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:AMODE <AMode>

Indicates the mode of the advertisement.

Parameters:

<AMode> NCNS | CNS | NCS
NCNS: Non-connectable, non-scannable
CNS: Connectable, non-scannable
NCS: Non-connectable, non-scannable
 *RST: NCNS

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Advertising Mode"](#) on page 67

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:ANUap <NapUap>, <BitCount>

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:INUap <NapUap>, <BitCount>

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:SNUap <NapUap>, <BitCount>

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:TNUap <NapUap>, <BitCount>

Sets the non-significant address part (NAP) and upper address part (UAP) of Bluetooth device address. Commands for the advertising . . . : ANUap, initiating . . . : INUap, and scanning . . . : SNUap PDUs of advertising channel type are provided. In addition, a command is provided for scanner's or initiator's target device address to which the advertisement is directed . . . : TNUap.

Parameters:

<NapUap> numeric
 *RST: #HACDE48
 <BitCount> integer
 Range: 24 to 24
 *RST: 24

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Target's Device Addr"](#) on page 65

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:AOffSet <AOffset>

Specifies the time from the start of the packet containing the AuxPtr field to the approximate start of the auxiliary packet. The offset is determined by multiplying the value by the unit, see

`[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:AOUNits`

Parameters:

<AOffset> float
Range: 0 to 245.7 or 246 to 2457 depending on offset unit

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AUX Offset"](#) on page 72

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:AOUNits <Unit>

Indicates the units used by the "Aux Offset" parameter, see

`[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:AOffSet`

Parameters:

<Unit> U30 | U300
U30: 30 μs
U300: 300 μs
 *RST: U30

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Offset Units"](#) on page 72

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:APHY <APhy>

Sets the physical layer (PHY) to transmit the auxiliary packet.

Parameters:

<APhy> L1M | L2M | LCOd | L2M2B
 For a description, see `[:SOURce<hw>]:BB:BT0oth:PFORmat` on page 175.
 *RST: L1M

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: L2M and LCOd require option R&S SMM-K117.
 L2M2B requires option R&S SMM-K178.

Manual operation: See ["AUX PHY"](#) on page 72

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:ASID <Asid>, <BitCount>

Specifies the "Advertising Set ID" in hexadecimal format to be signaled within an extended header.

Parameters:

<Asid> numeric
 *RST: #H0

<BitCount> integer
 Range: 4 to 4
 *RST: 4

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Advertising Set ID\(hex\)"](#) on page 71

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:CACCuracy <CAccuracy>

Specifies the clock accuracy of the advertiser used between the packet containing this data and the auxiliary packet.

Parameters:

<CAccuracy> T500 | T50
 T500: 51 ppm to 500 ppm
 T50: 0 ppm to 50 ppm
 *RST: T500

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Clock Accuracy"](#) on page 72

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:CID <Cid>, <BitCount>

Sets the company identifier of the manufacturer of the Bluetooth Controller. A 16 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

Parameters:

<Cid> numeric
 *RST: 0

<BitCount> integer
 Range: 16 to 16
 *RST: 16

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Company Id\(hex\)"](#) on page 84

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:CINstant
 <CInstant>

Sets a connection instant for indicating the connection event at which the new connection parameters are taken in use.

Parameters:

<CInstant> integer
 Range: 1 to depends on sequence length
 *RST: 1

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Connection Instant"](#) on page 82
 See ["Connection Instant"](#) on page 129

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:CINterval
 <CInterval>

Sets the time interval between the start points of two consecutive connection events for the packet type DATA and all CONTROL_DATA packet types.

Command sets the values in ms. Query returns values in s.

Parameters:

<CInterval> float
 Range: 7.5E-3 s to depends on oversampling
 Increment: 1.25E-3 s
 *RST: 7.5E-3 s
 Default unit: ms

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Connection Event Interval"](#) on page 55

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA <Data>

Selects the pattern source used for the payload.

Parameters:

<Data> ALL0 | ALL1 | PATtern | PN09 | PN11 | PN15 | PN16 | PN20 |
 PN21 | PN23 | DLISt
ALL0 / ALL1
 All 0 or all 1 pattern

PATtern

User-defined pattern. The pattern can be specified via:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DPATtern` on page 230

PNxx

Pseudo-random bit sequences (PRBS) of a length of xx bits. The length in bit can be 9, 11, 15, 16, 20, 21, or 23.

DLISt

Internal data list is used. The data list can be specified via:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DSELection` on page 230

*RST: PN09

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["Data Source"](#) on page 65

[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DPATtern
 <DPattern>, <BitCount>

Specifies the user-defined pattern. The setting is relevant for

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA`
 PATtern

Parameters:

<DPattern>	numeric
*RST:	#H0
<BitCount>	integer
Range:	1 to 64
*RST:	1

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Data Source"](#) on page 65

[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DSELection
 <DSelection>

Selects a data list file from the default directory or from the specific directory.

Using data list (DLISt) data requires one of the following commands:

- BB:BT0:ECOn:PCOn:DATA DLISt
 See `[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA` on page 229.
- BB:BT0:DTT:TPC:UPS DLISt
 See `[:SOURCE<hw>] :BB:BT0oth:DTTTest:TPCOnfiguration:UPSsource` on page 270.

Parameters:

<DSelection> string

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["Data Source"](#) on page 65

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:DLENGth
<DLength>

Sets the payload data length in bytes.

Parameters:

<DLength> integer

Range: 0 to 255 (advertiser) or 251 (data)

*RST: 31

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["Data Length"](#) on page 65

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:ECODE <ECode>,
<BitCount>

Sets the error code value to inform the remote device why the connection is about to be terminated in case of LL_TERMINATE_IND packet. On the other hand, this parameter for LL_REJECT_IND packet is used for the reason a request was rejected. A 8 bit value is set.

Note: This parameter is relevant for data frame configuration and the packet type:

- LL_TERMINATE_IND
- LL_REJECT_IND

Parameters:

<ECode> numeric

*RST: #H00

<BitCount> integer

Range: 8 to 8

*RST: 8

Example: SOURCE1:BB:BTO:ECON:PCON:ECOD #H00,8
Sets the error code.

Manual operation: See ["Error Code\(hex\)"](#) on page 82

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:ECOUNTER
<ECOUNTER>

Counts the AUX_SYNC_IND packets that the SyncInfo field describes.

Parameters:

<ECounter> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Event Counter"](#) on page 74

**[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EDIVersifier
 <EDiversifier>, <BitCount>**

Sets the encrypted diversifier of the Central for device identification. The parameter is an initialization vector provided by the host in the HCI_ULP_Start_Encryption command.

Parameters:

<EDiversifier> numeric
 *RST: #H0000

<BitCount> integer
 Range: 16 to 16
 *RST: 16

Example: SOURCE1:BB:BT0:CON:PCON:EDIV #H0000,16
 Sets the encrypted diversifier of the Central.

Manual operation: See ["Encrypted DIVersifier\(hex\)"](#) on page 82

**[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EHEader:STATe
 <State>**

Enables / disables extended header for advertising packets with scanning PDUs.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 1

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Extended Header"](#) on page 67

**[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EHFLags:
 AADDRESS:STATe <State>**

If enabled, the R&S SMM100A includes the signaling of non-significant advertising address part (NAP) and upper address part (UAP).

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AdvA"](#) on page 68

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EHFLags:ADINfo:STATE <State>

Enables / disables the signaling of advertising data information consisting of "Advertising Data ID" and "Advertising Set ID".

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AdvDataInfo"](#) on page 69

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EHFLags:APTR:STATE <State>

Enables / disables secondary advertising channel.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["AuxPtr"](#) on page 69

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:EHFLags:CINfo:STATE <State>

Activates the CTEInfo field in the extended header of Bluetooth LE advertising packets in the LE uncoded PHY.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Manual operation: See ["CTEInfo"](#) on page 68

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:EHFLags:SIInfo:STATe <State>

Enables / disables the signaling of SynclInfo field for periodic advertisement.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["SynclInfo/SynclInfo Configuration"](#) on page 69

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:EHFLags:TADDRESS:STATe <State>

Enables / disables the signaling of non-significant address part (NAP) and upper address part (UAP) of a target address.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["TargetA"](#) on page 68

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:EHFLags:TPOWER:STATe <State>

Enables the signaling of required transmit power.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["TxPow\(dBm\)"](#) on page 69

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:FSBit<ch0>:STATe <State>

Requires link layer control PDUs LL_FEATURE_REQ, LL_FEATURE_RSP or LL_PERIPHERAL_FEATURE_REQ, see [\[:SOURce<hw>\]:BB:BT0oth:UPTYpe](#) on page 176.

Enables features of the feature set within the the link layer control PDU. See also [Table 5-5](#).

Suffix:

<ch0> 0 to 27
Bit number that relates to a feature

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["FeatureSet configuration table"](#) on page 90

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:FSLength
<FsLength>

Enables that the feature set length is indicated.

Parameters:

<FsLength> integer
Range: 1 to 26
*RST: 8

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["FeatureSet Length"](#) on page 83

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:HLENGTH
<HLength>

Requires data event and advertising frame configuration with the packet type CONNECT_IND.

Sets the difference from the current channel to the next channel.

The Central and Peripherals determine the data channel in use for every connection event from the channel map. Hop_length is set for the LL connection and communicated in the CONNECT_IND and LL_CHANNEL_MAP_IND packets.

Parameters:

<HLength> integer
Range: 5 to 16
*RST: 5

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Hop Length"](#) on page 79

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:LCTimeout
 <LcTimeout>

Defines the maximum time between two correctly received Bluetooth LE packets in the LL connection before the connection is considered lost for the packet type CONNECT_IND.

Command sets the values in ms. Query returns values in s.

Parameters:

<LcTimeout> float
 Range: 100E-3 s to 32000E-3 s
 Increment: 10E-3 s
 *RST: 100E-3 s
 Default unit: ms

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See "[LL Connection Timeout](#)" on page 78

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:MIVector
 <MiVector>, <BitCount>

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:SIVector
 <SiVector>, <BitCount>

Sets the portion of Central or the portion of the Peripheral of the initialization vector (IVm/IVs).

Parameters:

<SiVector> numeric
 *RST: #H0

<BitCount> integer
 Range: 32 to 32
 *RST: 32

Example: SOURce1:BB:BT0:ECOn:PCON:MIV
 #H0000000000000000,32
 (Central).
 SOURce1:BB:BT0:ECOn:PCON:SIV
 #H0000000000000000,32
 (Peripheral).

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:MROctets
 <MROctets>

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:MTOctets
 <MTOctets>

Specifies the maximum allowed payload length of a packet to be received (. . :MROctets) or transmitted (. . :MTOctets). Information is signaled via LL_LENGTH_REQ and LL_LENGTH_RSP.

Parameters:

<MTOctets> integer
 Range: 27 to 251
 *RST: 27

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["MaxRxOctets/MaxTxOctets"](#) on page 85

**[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MSKD <Mskd>,
 <BitCount>**

**[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SSKD <Sskd>,
 <BitCount>**

Sets the portion of Central or the portion of the Peripheral of the session key diversifier (SKDm/SKDs).

Parameters:

<Sskd> numeric
 *RST: #H0

<BitCount> integer
 Range: 64 to 64
 *RST: 64

Example:

SOURCE1:BB:BT0:ECON:PCON:MSKD
 #H0000000000000000,64
 (Central).
 SOURCE1:BB:BT0:ECON:PCON:SSKD
 #H0000000000000000,64
 (Peripheral).

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MRTime <MRTime>

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTTime <MTTime>

Specifies the maximum allowed time to receive (..:MRTime) or transmit (..:MTTime) a packet. Information is signaled via LL_LENGTH_REQ and LL_LENGTH_RSP.

Parameters:

<MTTime> float
 Range: 0.328E-3 to 17.04E-3
 Increment: 0.001E-3
 *RST: 17.04E-3

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["MaxRxTime/MaxTxTime"](#) on page 86

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MUChannels
 <Muchannels>

Specifies the minimum number of channels to be used on the specified PHYs, see

[\[:SOURce<hw>\]:BB:BT0oth:ECONfiguration:PCONfiguration:PHYS:L1M:STATE](#) etc.

Parameters:

<Muchannels> integer
 Range: 2 to 37
 *RST: 2

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["Min Used Channels"](#) on page 87

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L1M:
STATE <MTSP>

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:L2M:
STATE <MTSP>

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:MTSPHy:LCOD:
STATE <MTSP>

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L1M:
STATE <STMP>

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:L2M:
STATE <STMP>

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:STMPHy:LCOD:
STATE <STMP>

Specifies the physical layers in Central-to-Peripheral (. . :MTSPHy: . .) or Peripheral-to-Central (. . :STMPHy: . .) direction. Information is signaled via LL_PHY_UPDATE_IND.

You can enable one or more PHYs:

- L1M: for LE uncoded 1 Msymbol/s PHY.
- L2M: for LE uncoded 2 Msymbol/s PHY.
- LCOD: for LE coded 1 Msymbol/s PHY.

Parameters:

<STMP> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["M_TO_S_PHY/S_TO_M_PHY"](#) on page 86

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:NCInterval
<NcInterval>**

Sets the time interval new connection events for the packet types CONNECT_IND and LL_CONNECTION_UPDATE_IND.

Command sets the values in ms. Query returns values in s.

Parameters:

<NcInterval> float
 Range: 7.5E-3 s to depends on oversampling
 Increment: 1.25E-3 s
 *RST: 7.5E-3 s
 Default unit: ms

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Connection Event Interval"](#) on page 78

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:NLCTimeout
<NlcTimeout>**

Defines the maximum time between two correctly received Bluetooth LE packets in the LL connection before the connection is considered lost only for the packet type LL_CONNECTION_UPDATE_IND.

Command sets the values in ms. Query returns values in s.

Parameters:

<NlcTimeout> float
 Range: 100E-3 s to 32000E-3 s
 Increment: 10E-3 s
 *RST: 100E-3 s
 Default unit: ms

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["LL Connection Timeout"](#) on page 78

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:NSLatency
<NsLatency>**

Requires a data event and advertising frame configuration with the packet type LL_CONNECTION_UPDATE_IND.

Sets the number of consecutive connection events the Peripheral can ignore for asymmetric link layer connections.

Parameters:

<NsLatency> integer
 Range: 0 to depends on LL connection timeout and connection event interval
 *RST: 0

Example: `SOURce1:BB:BTO:UPTY CUR`
 sets packet type LL_CONNECTION_UPDATE_IND
 `SOURce1:BB:BTO:ECON:PCON:NSLatency 10`
 sets the number of consecutive connection events.

Manual operation: See ["Peripheral Latency"](#) on page 78

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:NWOffset
 <NwOffset>

Sets the start point of the transmit window for data event and advertising frame configuration with the packet type LL_CONNECTION_UPDATE_IND.

Command sets the values in ms. Query returns values in s.

Parameters:

<NwOffset> float
 Range: 0 s to depends on connection event interval
 Increment: 1.25E-3 s
 *RST: 0
 Default unit: ms

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Transmit Window Offset"](#) on page 77

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:NWSize <NwSize>

Sets the size of the transmit window, regarding to the start point for data event and advertising frame configuration with the packet type LL_CONNECTION_UPDATE_IND.

Parameters:

<NwSize> float
 Range: 1.25E-3 to depends on connection event interval
 Increment: 1.25E-3
 *RST: 1.25E-3

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Transmit Window Size"](#) on page 77

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:OADJust <State>

Adjusts the "Sync Packet Offset" automatically to the next value, which is a multiple of the "Offset Units".

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Offset Adjust"](#) on page 74

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHYS:L1M:STATe
<State>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHYS:L2M:STATe
<State>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHYS:LCOD:STATe
<State>
```

Specifies the physical layers for which the Peripheral has a minimum number of used channels requirement. Information is signaled via LL_MIN_USED_CHANNELS_IND.

You can enable one or more PHYs:

- L1M: for LE uncoded 1 Msymbol/s PHY.
- L2M: for LE uncoded 2 Msymbol/s PHY.
- LCOD: for LE coded 1 Msymbol/s PHY.

Parameters:

```
<State>          1 | ON | 0 | OFF
                  *RST:      0
```

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["PHYs"](#) on page 87

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:TAType <TaType>
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:RAType <RaType>
```

Selects the address type of the controller device.

Depending on the Bluetooth controller role either Tx or Rx or both address types are assigned. Subdivided into private and random, a Bluetooth LE device address consists of 48 bits. The format of the device address differs depending on the selected address type.

Parameters:

```
<RaType>          PUBLIC | RANDom
```

PUBLIC

Allocates a unique 48 bit address to each Bluetooth LE device. The public address is given from the registration authority IEEE.

RANDom

Allocates a 48-bit address to each Bluetooth LE device. A random address is optional.

```
*RST:          PUBLIC
```

Example:

```
SOURce1:BB:BT0:ECOn:PCON:TATY PUBL
SOURce1:BB:BT0:ECOn:PCON:RATY RAND
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:ROPCode
    <ROpcode>, <BitCount>
```

Specifies the Opcode of rejected LL control PDU. information is signaled via LL_REJECT_EXT_IND.

Parameters:

```
<ROpcode>          numeric
                   *RST:      #H00

<BitCount>         integer
                   Range:     8 to 8
                   *RST:      8
```

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["Reject Opcode"](#) on page 85

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:RPHYs:L1M:STATe
    <RPhys>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:RPHYs:L2M:STATe
    <RPhys>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:RPHYs:LCOD:
    STATe <RPhys>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:TPHYs:L1M:STATe
    <TPhys>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:TPHYs:L2M:STATe
    <TPhys>
```

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:TPHYs:LCOD:
    STATe <TPhys>
```

Specifies preferred physical layers in Rx (..:RPHYs:..) or Tx (..:TPHYs:..) direction. Information is signaled via LL_PHY_REQ and LL_PHY_RSP.

You can enable one or more PHYs: :L1M: for LE uncoded 1 Msymbol/s PHY, :L2M: for LE uncoded 2 Msymbol/s PHY, and :LCOD: for LE coded 1 Msymbol/s PHY.

Parameters:

```
<TPhys>            1 | ON | 0 | OFF
                   *RST:      0
```

Example: See [Example "To configure data packets"](#) on page 213.

Options: R&S SMM-K117

Manual operation: See ["TX PHYS/RX PHYS"](#) on page 86

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:RVEctor
    <RVector>, <BitCount>
```

Sets the random vector of the Central for device identification.

The parameter is an initialization vector provided by the Host in the HCI_ULP_Start_Encryption command.

Parameters:

<RVector> numeric
 *RST: #H0

<BitCount> integer
 Range: 64 to 64
 *RST: 64

Example:

```
SOURce1:BB:BTO:ECON:PCON:RVEC
#H0000000000000000,64
Sets the random vector of the Central.
```

Manual operation: See "[Random Vector\(hex\)](#)" on page 82

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SCACcuracy
 <ScAccuracy>

Defines the clock accuracy of the Central with specified encoding.

This parameter is used by the Peripheral to determine required listening windows in the LL connection. It is a controller design parameter known by the bluetooth controller.

Parameters:

<ScAccuracy> SCA0 | SCA1 | SCA2 | SCA3 | SCA4 | SCA5 | SCA6 | SCA7
 *RST: SCA0

Example:

```
SOURce1:BB:BTO:ECON:PCON:SCAC SCA1
Sets the encoding value.
```

Manual operation: See "[Sleep Clock Accuracy](#)" on page 79

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SLATency
 <SLatency>

Requires data event and advertising frame configuration with the packet type CONNECT_IND.

Sets the number of consecutive connection events the Peripheral can ignore for asymmetric link layer connections.

Parameters:

<SLatency> integer
 Range: 0 to depends on LL connection timeout and connection event interval
 *RST: depends on LL connection timeout and connection event interval

Example: SOURce1:BB:BTO:UPTY CREQ
 Sets packet type CONNECT_IND.
 SOURce1:BB:BTO:ECON:PCON:SLAT 10
 Sets the number of consecutive connection events.

Manual operation: See ["Peripheral Latency"](#) on page 78

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SOUNits <Unit>

Indicates the units used by the "Sync Packet Offset" parameter, see

[\[:SOURce<hw>\]:BB:BT0oth:ECONfiguration:PCONfiguration:SPOffset](#)

Parameters:

<Unit> U30 | U300
 U30
 30 µs
 U300
 300 µs
 *RST: U30

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Offset Units"](#) on page 74

**[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SPOffset
 <SPOffset>**

Specifies the time from the start of the AUX_ADV_IND packet containing the SyncInfo field to the start of the AUX_SYNC_IND packet. The offset is determined by multiplying the value by the unit, see

[\[:SOURce<hw>\]:BB:BT0oth:ECONfiguration:PCONfiguration:SOUNits](#)

Parameters:

<SPOffset> float
 Range: 0 to 245.7 or 246 to 2457 depending on offset unit

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See ["Sync Packet Offset"](#) on page 73

**[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SVNumber
 <SvNumber>, <BitCount>**

Sets a unique value for each implementation or revision of an implementation of the Bluetooth Controller. A 16-bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type:

LL_VERSION_IND.

Parameters:

<SvNumber> numeric
 *RST: 0

<BitCount> integer
 Range: 16 to 16
 *RST: 16

Example: SOURCE1:BB:BTO:ECON:PCON:SVN #H0000,16
 Sets the sub version number.

Manual operation: See "[SubVersion Number\(hex\)](#)" on page 84

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:TPOWER <TPower>

Sets the required transmit power to be signaled within an extended header.

Parameters:

<TPower> integer
 Range: -127 to 126
 *RST: 0

Example: See [Example "To configure advertising packets"](#) on page 210.

Options: R&S SMM-K117

Manual operation: See "[TxPow\(dBm\)](#)" on page 69

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:UTYPE <UType>, <BitCount>

Enables that an invalid control packet is indicated.

The CtrType field indicates the value of the LL control packet that caused the transmission of this packet.

Parameters:

<UType> numeric
 *RST: #H0

<BitCount> integer
 Range: 8 to 8
 *RST: 8

Example: SOURCE1:BB:BTO:ECON:PCON:UTYP #H00,8
 Enables that an invalid control packet is indicated.

Manual operation: See "[Unknown Type\(hex\)](#)" on page 83

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:VNUMber
 <VNumber>, <BitCount>

Sets the company identifier of the manufacturer of the Bluetooth controller. An 8-bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

Parameters:

<VNumber>	numeric
	*RST: 0
<BitCount>	integer
	Range: 8 to 8
	*RST: 8

Example: SOURce1:BB:BT0:ECOn:PCON:VNUM #H00,8
 Sets the version number.

Manual operation: See "[Version Number\(hex\)](#)" on page 83

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:WOffset
 <WOffset>

Sets the start point of the window transmit for data event and advertising frame configuration with the packet type CONNECT_IND.

Command sets the values in ms. Query returns values in s.

Parameters:

<WOffset>	float
	Range: 0 s to depending on connection event interval
	Increment: 1.25E-3 s
	*RST: 0 s
	Default unit: ms

Example: See [Example"Configure event and frame configuration settings"](#) on page 179.

Manual operation: See "[Transmit Window Offset](#)" on page 54
 See "[Transmit Window Offset](#)" on page 77

[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:WSize <WSize>

Sets the size of the transmit window, regarding to the start point for data event and advertising frame configuration with the packet type CONNECT_IND.

Parameters:

<WSize>	float
	Range: 1.25E-3 to depends on connection event interval
	Increment: 1.25E-3
	*RST: 1.25E-3

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Transmit Window Size"](#) on page 77

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:AType <AType>

Sets the address type in the payload of Bluetooth LE LL_PERIODIC_SYNC_IND packets.

Parameters:

<AType> PUBLIC | RANDom
*RST: PUBLic

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Address Type"](#) on page 88

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:CECount <CECount>

Specifies the connection event count in the CtrData field of the LL_PERIODIC_SYNC_IND control data PDU.

Parameters:

<CECount> integer
Range: 0 to 65535
*RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Connection Event Count"](#) on page 87

[:SOURCE<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:ID <Id>, <BitCount>

Specifies the ID in the CtrData field of the LL_PERIODIC_SYNC_IND PDU.

Parameters:

<Id> numeric
*RST: #HAAAA

<BitCount> integer
Range: 16 to 16
*RST: 16

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["ID\(hex\)"](#) on page 87

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:LPECOUNTER
<LPECOUNTER>**

Specifies the lastPaEventCounter field in the CtrData field of the LL_PERIODIC_SYNC_IND PDU.

Parameters:

<LPECOUNTER> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Last Pa Event Counter"](#) on page 88

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:MCLREQ
<MCLREQ>**

Specifies the minimum CTE length in the CtrData field of the LL_CTE_REQ PDU.

Parameters:

<MCLREQ> float
 Range: 16E-6 to 160E-6
 Increment: 8E-6
 *RST: 16E-6

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["MinCTELenReq"](#) on page 89
 See ["CTETypeReq"](#) on page 89

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHY:L1M:STATE
<State>**

Sets the LE 1M PHY in the CtrData field of the LL_PERIODIC_SYNC_IND PDU.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["PHY"](#) on page 88

**[[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHY:L2M:STATE
<State>**

Sets the LE 2M PHY in the CtrData field of the LL_PERIODIC_SYNC_IND PDU.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["PHY"](#) on page 88

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:PHY:LCOD:STATE <State>

Sets the LE Coded PHY in the CtrData field of the LL_PERIODIC_SYNC_IND PDU.

Parameters:

<State> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["PHY"](#) on page 88

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:SCECounter <SCECounter>

Parameters:

<SCECounter> integer
Range: 0 to 65535
*RST: 0

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["Sync Connection Event Counter"](#) on page 89

[:SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCONfiguration:SID <Sid>, <BitCount>

Specifies the SID in the CtrData field of the LL_PERIODIC_SYNC_IND.

Parameters:

<Sid> numeric
*RST: #H0

<BitCount> integer
Range: 4 to 4
*RST: 4

Example: See [Example "To configure data packets"](#) on page 213.

Manual operation: See ["SID\(hex\)"](#) on page 88

8.6.4 Cs payload configuration

Example: To configure CS control PDUs

```
// *****
// Configure settings of an LE uncoded PHY test packet.
// *****
// Set for a data channel test packet in the LE uncoded PHY.
:SOURcel:BB:BT0oth:CTYPE CS
:SOURcel:BB:BT0oth:UPTYPE CCRQ
// Sets for an LL_CS_CAPABILITIES_REQ control PDU.
:SOURcel:BB:BT0oth:PFORmat L2M

// *****
// Configure and check LL_CS_CONFIG_REQ PDU settings.
// *****
:SOURcel:BB:BT0oth:CS:CDATA:CID 1
// The Config_ID is one.
:SOURcel:BB:BT0oth:CS:CMRepetition 1
// Sets one cycle of the ChM field for non-Mode-0 steps within the CS procedure.
:SOURcel:BB:BT0oth:CS:CDATA:MMODE MODE1
// The main mode is Mode-1.
:SOURcel:BB:BT0oth:CS:CDATA:MMRepetition 0
// The main mode repetition bit is zero.
:SOURcel:BB:BT0oth:CS:CDATA:MMISSteps 2
// The minimum number of main mode steps is two.
:SOURcel:BB:BT0oth:CS:CDATA:MMASSteps 2
// The maximum number of main mode steps is two.
// Enable the companion signal.
:SOURcel:BB:BT0oth:CS:CDATA:MZSteps 1
// There is one Mode-0 step.
:SOURcel:BB:BT0oth:CS:CDATA:CSIGnal 1
:SOURcel:BB:BT0oth:CS:CDATA:RFU 0

// *****
// Configure and check LL_CS_CAPABILITIES_REQ PDU settings.
// *****
:SOURcel:BB:BT0oth:CS:CDATA:CSPCapability?
// Response: "LE2M"
// The PHY is LE 2M.
:SOURcel:BB:BT0oth:CS:CDATA:MAPath 1
:SOURcel:BB:BT0oth:CS:CDATA:MPSupported 1
:SOURcel:BB:BT0oth:CS:CDATA:MTYPE?
// Response: "MODE3"
// The mode type is Mode-3.
:SOURcel:BB:BT0oth:CS:CDATA:NANT?
// Response: "1"
// The number of antenna elements is 1.
:SOURcel:BB:BT0oth:CS:CDATA:NCONfig?
// Response: "1"
```

Packet configuration commands - LE

```

// There is one unique Cs configuration. You can have up to four independent
// Cs configurations.
:SOURcel:BB:BT0oth:CS:CDATa:NFAE 1
// The transmitting LE device only supports an FAE of zero.
:SOURcel:BB:BT0oth:CS:CDATa:SPEStimate?
// Response: "0"
// The device does not support PCT estimates from a sounding sequence.
:SOURcel:BB:BT0oth:CS:CDATa:TSW TSW_1
// The duration of the antenna switch period is one microsecond.

// Configure timing capabilities.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion0:TIPO:CAPAbility 1
// Enables the T_IP1 capability for bit position 0. The T_IP1 time is 10 microseconds.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion1:TIPO:CAPAbility?
// Response: "0"
// The T_IP1 capability for bit position 1 is disabled.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion0:TIPT:CAPAbility 1
// Enables the T_IP2 capability for bit position 0. The T_IP2 time is 10 microseconds.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion1:TIPT:CAPAbility?
// Response: "0"
// The T_IP2 capability for bit position 1 is disabled.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion0:TFCAPAbility 1
// Enables the T_FCS capability for bit position 0. The T_FCS time is 15 microseconds.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion1:TFCAPAbility?
// Response: "0"
// The T_FCS capability for bit position 1 is disabled.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion0:TPCAPAbility 1
// Enables the T_PM capability for bit position 0. The T_PM time is 10 microseconds.
:SOURcel:BB:BT0oth:CS:CDATa:BPOStion1:TPCAPAbility?
// Response: "0"
// The T_PM capability for bit position 1 is disabled.

// *****
// Configure and check LL_CS_TERMINATE_IND PDU settings.
// *****
:SOURcel:BB:BT0oth:CS:CDATa:ECODE #HFF,8
// Sets the error code "FF" in hexadecimal representation.

// *****
// Configure and check LL_CS_IND PDU settings.
// *****
:SOURcel:BB:BT0oth:CS:CDATa:EOFFset 500
// Sets an event offset of 500 microseconds.

// *****
// Configure and check LL_CS_REQ PDU settings.
// *****
:SOURcel:BB:BT0oth:CS:CDATa:MPLength 2.5
// The maximum procedure length is 2.5 milliseconds.

```

Commands:

[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOSition<ch0>]:TFCapability.....	253
[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOSition<ch0>]:TIPO:CAPability.....	253
[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOSition<ch0>]:TIPT:CAPability.....	253
[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOSition<ch0>]:TPCapability.....	254
[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:CHANnel<ch0>]:CFAE.....	254
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:ACI.....	254
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CECount.....	255
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CCID:STATe.....	255
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CID.....	255
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSATHreec.....	255
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSIGnal.....	256
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:ECODE.....	256
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:EOFFset.....	256
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MAPath.....	256
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MMASteps.....	257
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MMISteps.....	257
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MMODE.....	257
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MMRepetition.....	257
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MPLength.....	258
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MPSupported.....	258
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MTYPe?.....	258
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MZSTeps.....	258
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NANT.....	259
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NCONfig.....	259
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NFAE.....	259
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NRSCapability.....	260
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NSCapability.....	260
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:OMAX.....	260
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:OMIN.....	260
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PCount.....	261
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PDELta.....	261
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PHY?.....	261
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PINTerval.....	262
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PPANtenna.....	262
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RAONLY.....	262
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RCAPability.....	262
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RFU.....	263
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RTYPE.....	263
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TFCs.....	263
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TIONe.....	264
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TITWo.....	264
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TPM.....	264
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TSW.....	264
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RRSequence.....	265
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RSounding.....	265
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SINTerval.....	265
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SLEngth.....	266
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SNUMber.....	266

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SPeStimate.....	266
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SMODE.....	267
[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSPCaPability?.....	267

[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOsition<ch0>]:TFCaPability
<TfcsCaPability>

Enables the T_FCS capability including the T_FCS time per bit position.

Suffix:

BPOsition<ch0> 0 to 9
Bit position (optional suffix)

Parameters:

<TfcsCaPability> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See "[T_FCS_Capability Table](#)" on page 118

[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOsition<ch0>]:TIPO:CaPability
<TIOCaPability>

Enables the T_IP1 capability including the T_IP1 time per bit position.

See also [\[:SOURce<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MZERo:TIPO](#)
on page 197.

Suffix:

BPOsition<ch0> 0 to 7
Bit position (optional suffix)

Parameters:

<TIOCaPability> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See "[T_IP1_Capability Table](#)" on page 117

[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOsition<ch0>]:TIPT:CaPability
<TITCaPability>

Enables the T_IP2 capability including the T_IP2 time per bit position.

Suffix:

BPOsition<ch0> 0 to 7
Bit position (optional suffix)

Parameters:

<TITCaPability> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_IP2_Capability Table"](#) on page 118

**[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:BPOSition<ch0>]:TPCapability
<TpmCapability>**

Enables the T_PM capability including the T_PM time per bit position.

Suffix:

BPOSition<ch0> 0 to 2
Bit position (optional suffix)

Parameters:

<TpmCapability> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_PM_Capability Table"](#) on page 119

[:SOURce<hw>]:BB:BT0oth:CS:CDATa[:CHANnel<ch0>]:CFAE <ChFae>

Sets the value of the fractional frequency offset actuation error (FAE) value per channel.

Suffix:

CHANnel<ch0> 0 to 71
Channel number (optional suffix)

Parameters:

<ChFae> integer
Range: -128 to 127
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Channel FAE Table"](#) on page 129

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:ACI <ACI>

Sets the antenna configuration index (ACI) field. The value has a length of 1 octet or 0 to 7 in decimal representation.

Parameters:

<ACI> ACI0 | ACI1 | ACI2 | ACI3 | ACI4 | ACI5 | ACI6 | ACI7
*RST: ACI0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["ACI"](#) on page 125
See ["ACI"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CECount <ConnEventCount>

Sets the 16-bit connEventCount field bits in hexadecimal representation.

Parameters:

<ConnEventCount> integer
 Range: 0 to 65535
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["connEventCount"](#) on page 123
 See ["connEventCount"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CCID:STATE <State>

Enables the CS configuration ID. Set this ID with the following command:

[\[:SOURce<hw>\]:BB:BT0oth:CS:CDATa:CID](#) on page 255

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["State"](#) on page 119

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CID <ConfigId>

Sets the 6-bit Config_ID field that is the CS configuration ID. Settable ID values are 2 bits in decimal representation. All other values are for future use.

Parameters:

<ConfigId> integer
 Range: 0 to 3
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Config_ID"](#) on page 119

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSAThreec <CsaThreec>

Enables the channel selection algorithm #3c.

Parameters:

<CsaThreec> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Channel Selection Algorithm #3c"](#) on page 116

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSIGnal <CompanionSignal>

Enables the companion signal.

See also "[Companion Signal](#)" on page 110.

Parameters:

<CompanionSignal> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See "[Companion_Signal](#)" on page 116

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:ECODE <ECode>, <BitCount>

Sets an 8-bit error code. For an LL_CS_TERMINATE_IND packet, informs the remote device about the termination of the connection.

Parameters:

<ECode> numeric
*RST: #H00

<BitCount> integer
Range: 8 to 8
*RST: 8

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See "[Error Code\(hex\)](#)" on page 128

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:EOFFset <EventOffset>

Sets the time value of the Offset field. The value has a length of three octets or 9 bits.

Parameters:

<EventOffset> integer
Range: 500 to 4e6
*RST: 500

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See "[Offset](#)" on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:MAPath <MaxAntPath>

Sets the maximum Num_Ant paths.

Parameters:

<MaxAntPath> integer
Range: 1 to 4
*RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Max_Ant_Path"](#) on page 115

[:SOURCE<hw>]:BB:BT0oth:CS:CDATa:MMASteps <MMMaxSteps>

Sets the maximum number of main mode steps.

Parameters:

<MMMaxSteps> integer
 Range: 2 to 255
 *RST: 2

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Main_Mode_Max_Steps"](#) on page 120

[:SOURCE<hw>]:BB:BT0oth:CS:CDATa:MMISteps <MMMinSteps>

Sets the minimum number of main mode steps.

Parameters:

<MMMinSteps> integer
 Range: 2 to 255
 *RST: 2

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Main_Mode_Min_Steps"](#) on page 120

[:SOURCE<hw>]:BB:BT0oth:CS:CDATa:MMODE <MainMode>

Sets the main mode of the CS LL Control PDU.

For an overview on available submodes per main mode, see [Table 5-8](#).

Parameters:

<MainMode> MODE1 | MODE2 | MODE3
 For a description, see [\[:SOURCE<hw>\]:BB:BT0oth:CS\[:SEVent<ch0>\]:MMODE](#) on page 195.
 *RST: MODE1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Main_Mode"](#) on page 120

[:SOURCE<hw>]:BB:BT0oth:CS:CDATa:MMRepetition <MMRepetition>

Sets the main mode repetition.

Parameters:

<MMRepetition> integer
 Range: 0 to 3
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Main_Mode_Repetition"](#) on page 120

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:MPLength <MPLength>

Sets the time value of the Max_Procedure_Len field. The value has a length of two octets or 6 bits.

Parameters:

<MPLength> float
 Range: 2.5 to 40959375
 Increment: 0.001
 *RST: 2.5

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Max_Procedure_Len"](#) on page 124

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:MPSupported <MPSupported>

Sets the bits of the Max_Procedures_Supported field.

Parameters:

<MPSupported> integer
 Range: 0 to 4
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Max_Procedures_Supported"](#) on page 117

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:MTYPE?

Queries the CS LL control packet mode type that is Mode-3.

Return values:

<ModeType> MODE3
 *RST: MODE3

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Usage: Query only

Manual operation: See ["Mode_Types"](#) on page 114

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:MZSteps <Mode0Steps>

Sets the number of Mode-0 steps.

Parameters:

<Mode0Steps> integer
 Range: 1 to 3
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Mode_0_Steps"](#) on page 120

[:SOURce<hw>]:BB:BTOoth:CS:CDATa:NANT <NumAnt>

Sets the bits of the Num_Ant field. This field indicates the number of antenna elements of the channel sounding device.

Parameters:

<NumAnt> integer
 Range: 1 to 4
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Num_Ant"](#) on page 115

[:SOURce<hw>]:BB:BTOoth:CS:CDATa:NCONfig <NumConfig>

Sets the Num_Configs field that relates to the number of independent CS configurations.

Parameters:

<NumConfig> integer
 Range: 1 to 4
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Num_Configs"](#) on page 117

[:SOURce<hw>]:BB:BTOoth:CS:CDATa:NFAE <NoFae>

Sets the No_FAE bit. This bit indicates if the transmitting LE device supports a fractional frequency offset actuation error (FAE) or not.

Parameters:

<NoFae> 1 | ON | 0 | OFF

1|ON

The transmitting LE device only supports an FAE of zero.

0|OFF

The transmitting LE device supports FAE values as listed in an FAE table.

*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["No_FAE"](#) on page 116

[[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NRSCapability <NRSCapability>

Sets the NADM random sequence capability.

Parameters:

<NRSCapability> NONADM | NADM
 NONADM
 NADM disabled
 NADM
 NADM enabled
 *RST: NONADM

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["NADM_Random_Sequence_Capability"](#) on page 115

[[:SOURce<hw>]:BB:BT0oth:CS:CDATa:NSCapability <NSCapability>

Sets the NADM sounding sequence capability.

Parameters:

<NSCapability> NONADM | NADM
 NONADM
 NADM disabled
 NADM
 NADM enabled
 *RST: NONADM

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["NADM_Sounding_Capability"](#) on page 115

[[:SOURce<hw>]:BB:BT0oth:CS:CDATa:OMAX <OffsetMax>

Sets the time value of the Offset_Max field. The value has a length of 3 octets or 9 bits.

Parameters:

<OffsetMax> integer
 Range: 500 to 16777215
 *RST: 500

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Offset_Max"](#) on page 124

[[:SOURce<hw>]:BB:BT0oth:CS:CDATa:OMIN <OffsetMin>

Sets the time value of the Offset_Min field. The value has a length of 3 octets or 9 bits.

Parameters:

<OffsetMin> integer
 Range: 500 to 4e6
 *RST: 500

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Offset_Min"](#) on page 123

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PCOUNT <ProcCount>

Sets the bits in the Procedure_Count field. The value has a length of 2 octets.

Parameters:

<ProcCount> integer
 Range: 1 to 65535
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Procedure_Count"](#) on page 125

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PDELta <PwrDelta>

Sets the bits in the Pwr_Delta field. The value has a length of 1 octets or 3 bits.

Parameters:

<PwrDelta> integer
 Range: 0 to 255
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Pwr_Delta"](#) on page 126
 See ["Pwr_Delta"](#) on page 128

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:PHY?

Queries the PHY field value.

This value indicates the TX PHY of the remote device to which the Pwr_Delta field in this PDU applies.

Return values:

<Phy> L1M | L2M | LCOd | L2M2B
 For a description, see [\[:SOURce<hw>\]:BB:BT0oth:PFORmat](#) on page 175.
 *RST: L1M

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Usage: Query only

Manual operation: See "PHY" on page 120
See "PHY" on page 125

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:PINterval <Proclnterval>

Sets the procedure interval in the Procedure_Interval field. The value has a length of two octets or 6 bits.

Parameters:

<Proclnterval> integer
Range: 0 to 65535
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Procedure_Interval"](#) on page 125

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:PPAntenna <PPAntenna>

Sets the bits in the Preferred_Peer_Ant field. The value has a length of one octet or 3 bits.

The table [Table 5-11](#) lists all possible values and their meaning.

Parameters:

<PPAntenna> ANT0 | ANT1 | ANT2 | ANT3
*RST: ANT0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Preferred_Peer_Ant"](#) on page 125

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:RAONly <RttAaOnly>

Queries or sets the time values of the RTT_AA_Only_N field.

Setting the value depends on the bits of the RTT_Capability field via the command:

```
:SOURCE1:BB:BTOoth:CS:CDATa:RCAPability
```

See also the table [Table 5-9](#) for an overview.

Parameters:

<RttAaOnly> AR150 | AR10 | AR0
*RST: AR150

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RTT_AA_Only"](#) on page 114

[:SOURCE<hw>]:BB:BTOoth:CS:CDATa:RCAPability <RttCapability>

Sets the bits in the RTT_Capability field.

These bits determine the time values for the RTT_AA_Only_N field, the RTT_Sounding_N field and the RTT_Random_Sequence_N field.

Parameters:

<RttCapability> CAP0 | CAP1 | CAP2
See the table [Table 5-9](#) for an overview.
*RST: CAP0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RTT_Capability"](#) on page 114

[:SOURCE<hw>]:BB:BT0oth:CS:CDATA:RFU <RFU>

Sets the bits that are reserved for future use (RFU).

The number of RFU bits can vary depending on the CS_Control_Data PDU.

Parameters:

<RFU> integer
Range: 0 to 3
*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RFU"](#) on page 117

[:SOURCE<hw>]:BB:BT0oth:CS:CDATA:RTYPE <RttType>

Sets the RTT type determined by the 4-bit RTT_Type field. This field indicates the round trip time (RTT) variant within the CS procedure.

Parameters:

RttType RAAOT | R32SS | R96SS | R32RS | R64RS | R96RS | R128RS
For a description, see the table [Table 5-10](#).
*RST: RAAOT

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RTT_Type"](#) on page 121

[:SOURCE<hw>]:BB:BT0oth:CS:CDATA:TFCS <TFcs>

Sets the frequency change period (T_FCS) between consecutive CS steps. The period ranges from 15 µs to 150 µs.

Parameters:

<TFcs> TFCS_15 | TFCS_20 | TFCS_30 | TFCS_40 | TFCS_50 |
TFCS_60 | TFCS_80 | TFCS_100 | TFCS_120 | TFCS_150
TFCS_x, x represents values in microseconds.
*RST: TFCS_150

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_FCS"](#) on page 122

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TIONe <TipOne>

Sets the time "T_IP1" in microseconds.

Parameters:

<TipOne> TIP1_10 | TIP1_20 | TIP1_30 | TIP1_40 | TIP1_50 | TIP1_60 |
TIP1_80 | TIP1_145

TIP1_x, x represents values in microseconds.

*RST: TIP1_145

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_IP1"](#) on page 122

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TITWo <TipTwo>

Sets the time "T_IP2" in microseconds.

Parameters:

<TipTwo> TIP2_10 | TIP2_20 | TIP2_30 | TIP2_40 | TIP2_50 | TIP2_60 |
TIP2_80 | TIP2_145

TIP2_x, x represents values in microseconds.

*RST: TIP2_145

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_IP2"](#) on page 122

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TPM <TPM>

Sets the time "T_PM" in microseconds.

Parameters:

<TPM> TPM_10 | TPM_20 | TPM_40 | TPM_652

TPM_x, x represents values in microseconds.

*RST: TPM_40

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_PM"](#) on page 122

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:TSW <Tsw>

Sets the T_SW field values that relate to the duration of the antenna switch period.

The local controller uses this period when switching antennas during active transmissions.

Parameters:

<Tsw> TSW_0 | TSW_1 | TSW_2 | TSW_4 | TSW_10
 Duration of the antenna switch period is 0, 1, 2, 4 or 10 micro-seconds.
 *RST: n.a. (no preset. default: TSW_0)

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["T_SW"](#) on page 117

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RRSequence <RRSequence>

Queries or sets the time values of the RTT_Random_Sequence_N field.

Setting the value depends on the bits of the RTT_Capability field via the command:

:SOURce1:BB:BT0oth:CS:CDATa:RCAPability

See also the table [Table 5-9](#) for an overview.

Parameters:

<RRSequence> AR150 | AR10 | AR0
 *RST: AR150

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RTT_Random_Sequence_N"](#) on page 115

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:RSounding <RSounding>

Queries or sets the time values of the RTT_Sounding_N field.

Setting the value depends on the bits of the RTT_Capability field via the command:

:SOURce1:BB:BT0oth:CS:CDATa:RCAPability

See also the table [Table 5-9](#) for an overview.

Parameters:

<RSounding> AR150 | AR10 | AR0
 *RST: AR150

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["RTT_Sounding_N"](#) on page 115

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SINterval <SubInterval>

Sets or queries the subevent interval.

Setting requires BB:BT0oth:CS:SNUMber 2 or higher. Query is for BB:BT0oth:CS:SNUMber 1.

See [\[:SOURce<hw> \]:BB:BT0oth:CS:CDATa:SNUMber](#) on page 266.

Parameters:

<SubInterval> integer
 Range: 0 to 2.7e11
 *RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Subevent_Interval"](#) on page 124
 See ["Subevent_Interval"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SEnLength <SubLength>

Sets the subevent length in the Subevent_Len field. The value has a length of three octets or 9 bits.

Parameters:

<SubLength> integer
 Range: 1250 to 4e6
 *RST: 1250

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Subevent_Len"](#) on page 125
 See ["Subevent_Len"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SNUMber <SubNumber>

Sets the number of subevents per event.

Parameters:

<SubNumber> integer
 Range: 1 to 32
 *RST: 1

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Subevent_Per_Event"](#) on page 124
 See ["Subevents_Per_Event"](#) on page 127

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SPEStimate <SPEStimate>

Sets the Sounding_PCT_Estimate bit. This bit indicates if the device supports phase correction term (PCT) estimates from a sounding sequence or not.

Parameters:

<SPEStimate> 1 | ON | 0 | OFF

1|ON

The Sounding_PCT_Estimate bit is 1. The device supports PCT estimates from a sounding sequence.

0|OFF

The Sounding_PCT_Estimate bit is 0. The device does not support PCT estimates from a sounding sequence.

*RST: 0

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Sounding_PCT_Estimate"](#) on page 116

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:SMODE <SubMode>

Sets the submode of the main mode.

Parameters:

<SubMode> MODE1 | MODE2 | MODE3 | NONE

See the table [Table 5-8](#) for an overview on available submodes per main mode.

*RST: NONE

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Manual operation: See ["Sub_Mode"](#) on page 120

[:SOURce<hw>]:BB:BT0oth:CS:CDATa:CSPCapability?

Queries the value of the CS_SYNC_PHY_Capability field that is the LE 2M PHY.

Return values:

<SyncPhy> LE2M

*RST: LE2M

Example: See [Example "To configure CS control PDUs"](#) on page 250.

Usage: Query only

Manual operation: See ["CS_SYNC_PHY_Capability"](#) on page 115

8.7 Test packet configuration commands - LE

Example: To configure test packets

```
// *****
// Configure settings of an LE uncoded PHY test packet.
// *****
// Set for a data channel test packet in the LE uncoded PHY.
SOURce1:BB:BT0oth:CTYPe DATA
SOURce1:BB:BT0oth:UPTYPe TPAC
SOURce1:BB:BT0oth:PFORmat L1M

// Configure packet interval and header settings.
SOURce1:BB:BT0oth:DTTest:TPConfiguration:TPINterval 12.5
// Sets a test packet interval of 12.5 ms.
SOURce1:BB:BT0oth:ECONfiguration:PCONfiguration:CPResent 0
```

Test packet configuration commands - LE

```

SOURCE1:BB:BT00th:ECONfiguration:PCONfiguration:SWORD SW
// Fixed sync word value of 0x94826E8E.
// Alternatively, set a user-defined sync word.
SOURCE1:BB:BT00th:ECONfiguration:PCONfiguration:SWORD UPAT
SOURCE1:BB:BT00th:ECONfiguration:PCONfiguration:USER FFFFFFFF
// Sync word is 0xFFFFFFFF.

// Configure payload settings.
SOURCE1:BB:BT00th:DTTest:TPConfiguration:UPSource PAT3
// Sets a fixed pattern 11111111 as payload.
SOURCE1:BB:BT00th:DTTest:TPConfiguration:UPLength 255
// Sets a payload length of 255 bytes.

// *****
// Also, configure LE coded PHY test packet settings.
// *****
SOURCE1:BB:BT00th:PFORMAT LCOD
SOURCE1:BB:BT00th:ECONfiguration:PCONfiguration:SPBIT TWO
// Sets 2 symbols per bit for forward error correction coding.

[:SOURCE<hw>]:BB:BT00th:ECONfiguration:PCONfiguration:SPBIT..... 268
[:SOURCE<hw>]:BB:BT00th:ECONfiguration:PCONfiguration:SYNCword.....268
[:SOURCE<hw>]:BB:BT00th:ECONfiguration:PCONfiguration:USERpatt..... 269
[:SOURCE<hw>]:BB:BT00th:DTTest:TPConfiguration:TPInterval..... 269
[:SOURCE<hw>]:BB:BT00th:DTTest:TPConfiguration:UPLength..... 270
[:SOURCE<hw>]:BB:BT00th:DTTest:TPConfiguration:UPSource..... 270

```

[:SOURCE<hw>]:BB:BT00th:ECONfiguration:PCONfiguration:SPBIT <SPB>

Specifies a coding for LE coded packets. The specification for Bluetooth wireless technology defines two values S for forward error correction: S = 2 symbol/bit and S = 8 symbol/bit.

Parameters:

<SPB> TWO | EIGHT
*RST: TWO

Example: See [Example "To configure test packets"](#) on page 267.

Options: R&S SMM-K117

Manual operation: See ["Symbols per a Bit"](#) on page 130

**[:SOURCE<hw>]:BB:BT00th:ECONfiguration:PCONfiguration:SYNCword
<syncWord>**

Sets the 32-bit Sync Word in the packet header field in hexadecimal representation.

Parameters:

<syncWord> SW | UPAT
SW
Fixed value of 0x94826E8E.

UPAT

User-defined pattern allowing 8-digit hexadecimal input via the following command:

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:USERpatt on page 269
```

```
*RST: SW
```

Example: See [Example "To configure test packets"](#) on page 267.

Manual operation: See ["Sync Word"](#) on page 131

```
[ :SOURce<hw>]:BB:BT0oth:ECOnfiguration:PCOnfiguration:USERpatt
<userPatt>, <BitCount>
```

Sets a user-defined pattern of the 32-bit Sync Word.

Using this Sync Word requires the following setting:

```
SOURce1:BB:BT0oth:ECOnfiguration:PCOnfiguration:SYNCword UPAT
```

Parameters:

```
<userPatt>      numeric
                *RST: #H0

<BitCount>     integer
                Range: 1 to 32
                *RST: 1
```

Example: See [Example "To configure test packets"](#) on page 267.

Manual operation: See ["User Pattern\(hex\)"](#) on page 131

```
[ :SOURce<hw>]:BB:BT0oth:DTTest:TPCOnfiguration:TPInterval <TpInterval>
```

Sets the time interval between two consecutive test packets, regarding the starting points.

Command sets the values in ms. Query returns values in s.

Parameters:

```
<TpInterval>   float
                Range: 0.625E-3 s to 27.5E-3 s - depends on packet char-
                    characteristics
                Increment: 0.625E-3 s
                *RST: 0.625E-3 s
                Default unit: ms
```

Example: See [Example "To configure test packets"](#) on page 267.

Manual operation: See ["Packet Interval"](#) on page 130

[:SOURce<hw>] :BB:BT0oth:DTTest:TPConfiguration:UPLength <UpLength>

Sets the payload length.

Parameters:

<UpLength> integer
 Range: 0 to 255
 *RST: 37

Example: See [Example "To configure test packets"](#) on page 267.

Manual operation: See ["Payload Length"](#) on page 132

[:SOURce<hw>] :BB:BT0oth:DTTest:TPConfiguration:UPSource <UpSource>

Selects the data source used for the payload test packets.

Parameters:

<UpSource> PN09 | PAT1 | PAT2 | PN15 | PAT3 | PAT4 | PAT5 | PAT6 | DLIS

PN9|PN15

Pseudo random bit sequences (PRBS) with length in bits. The length can be 9 bits or 15 bits.

PAT1

Predefined pattern: 11110000

PAT2

Predefined pattern: 10101010

PAT3

Predefined pattern: 11111111

PAT4

Predefined pattern: 00000000

PAT5

Predefined pattern: 00001111

PAT6

Predefined pattern: 01010101

DLIS

Binary data from data lists as a data source. Set the data list file via the following command:

[\[:SOURce<hw> \] :BB:BT0oth:ECONfiguration:PCONfiguration:DATA:DSElection](#) on page 230

*RST: PN09

Example: See [Example "To configure test packets"](#) on page 267.

Manual operation: See ["Payload Type"](#) on page 131

8.8 Channel configuration commands - BR/EDR

<code>[:SOURce<hw>]:BB:BT0oth:PTYPE</code>	271
<code>[:SOURce<hw>]:BB:BT0oth:SLENgth</code>	271
<code>[:SOURce<hw>]:BB:BT0oth:STIMing</code>	271

`[:SOURce<hw>]:BB:BT0oth:PTYPE <PType>`

The available packets depend on the selected transport mode. All packet types as defined in the Bluetooth specifications are supported.

Parameters:

<PType> ID | NULL | POLL | FHS | DM1 | DH1 | DM3 | DH3 | DM5 | DH5 |
 AUX1 | ADH1 | ADH3 | ADH5 | AEDH1 | AEDH3 | AEDH5 |
 HV1 | HV2 | HV3 | DV | EV3 | EV4 | EV5 | EEV3 | EEV5 |
 EEEV3 | EEEV5
 *RST: DH1

Example: `BB:BTO:PTYP NULL`
 Sets a null packet.

Manual operation: See "[Packet Type](#)" on page 134

`[:SOURce<hw>]:BB:BT0oth:SLENgth <SLength>`

Sets the sequence length of the Bluetooth signal in number of frames. This signal is calculated in advance and output in the arbitrary waveform generator.

Parameters:

<SLength> integer
 Range: depends on the number of states in dirty transmitter
 test to dynamic
 *RST: 1

Example: `BB:BTO:SLEN 10`
 sets the sequence length to 10 frames.

Manual operation: See "[Sequence Length](#)" on page 134

`[:SOURce<hw>]:BB:BT0oth:STIMing <SlotTiming>`

Selects the Rx slot timing mode.

Parameters:

<SlotTiming> TX | LOOPback
 *RST: TX

Example: `BB:BTO:PTYP DH3`
 sets the packet type.
`BB:BTO:STIM LOOP`
 selects loopback test mode.

Manual operation: See "Slot Timing" on page 134

8.9 Packet configuration commands - BR/EDR

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`[:SOURce<hw>]:BB:BT0oth:PCONfiguration:ACKNowledgement` <Acknowledgement>

Sets the ARQN bit of the packet header..

Parameters:

<Acknowledgement> NAK | ACK

NAK

Request to retransmit the previous payload.

ACK

Previous payload has been received successfully.

*RST: ACK

Example:

```
BB:BT0:PTYP DH1
```

selects the packet type DH1.

```
BB:BT0:PCON:DSFP PED
```

enable packet editor under data source for packet

```
BB:BT0:PCON:ACKN ACK
```

sets positive acknowledgement

Manual operation: See "Acknowledgment" on page 138

[[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDALap <BdaLap>, <BitCount>

Sets the lower address part of Bluetooth Device Address. The length of LAP is 24 bits or 6 hexadecimal figures.

Parameters:

<BdaLap>	numeric
	Range: #H000000 to #FFFFFFF
	*RST: 80
<BitCount>	integer
	Range: 8 to 24
	*RST: 24

Example: BB:BT0:PCON:BDAL #H000000,24
Sets the lower address part.

Manual operation: See "[Bluetooth Device Address \(BD_ADDR\)](#)" on page 137

[[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDANap <BdaNap>, <BitCount>

Enters the non-significant address part of Bluetooth Device Address. The length of NAP is 16 bits or 4 hexadecimal figures.

Parameters:

<BdaNap>	numeric
	Range: #H0000 to #FFFFF
	*RST: ABCD
<BitCount>	integer
	Range: 16 to 16
	*RST: 16

Example: BB:BT0:PCON:BDAN #H0000,16
Sets the non-significant address part.

Manual operation: See "[Bluetooth Device Address \(BD_ADDR\)](#)" on page 137

[[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDAUap <BdaUap>, <BitCount>

Enters the upper address part of Bluetooth Device Address. The length of UAP is 8 bits or 2 hexadecimal figures.

Parameters:

<BdaUap>	numeric
	Range: #H00 to #HFF
	Increment: 1
	*RST: 48
<BitCount>	integer
	Range: 8 to 8
	*RST: 8

Example: BB:BTO:PCON:BDAN #H00,8
Sets the non-significant address part.

Manual operation: See "[Bluetooth Device Address \(BD_ADDR\)](#)" on page 137

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:CODevice <CoDevice>, <BitCount>

A parameter received during the device discovery procedure, indicates the type of device and which types of service that are supported.

Parameters:

<CoDevice> numeric
Range: #H000000 to #FFFFFFF
*RST: #H0

<BitCount> integer
Range: 24 to 24
*RST: 24

Example: BB:BTO:PTYP FHS
Sets the packet type.
BB:BTO:PCON:DSFP PED
Enables the packet editor under data source for the packet.
BB:BTO:PCON:COD #H020104,24
Sets the class of device.

Manual operation: See "[Class of Device](#)" on page 140

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA <Data>

Selects the data source used for the payload.

Parameters:

<Data> ALL0 | ALL1 | PATtern | PN09 | PN11 | PN15 | PN16 | PN20 |
PN21 | PN23 | DLISt
*RST: PN09

Example: BB:BTO:PTYP FHS
sets the packet type
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:DATA ALL1
sets the data type.

Manual operation: See "[Data Source](#)" on page 138

**[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:DPATtern <DPattern>,
<BitCount>**

Selects the data for a pattern.

Parameters:

<DPattern> numeric
 *RST: #H0

<BitCount> integer
 Range: 1 to 64
 *RST: 1

Example:

```
BB:BTO:PCON:DATA PATT
```

Sets the data type.

```
BB:BTO:PCON:DATA:DPAT #B010101,6
```

Selects the data for a pattern with the length of 6 bits.

Manual operation: See ["Data Source"](#) on page 138

[[:SOURce<hw>]:BB:BTOoth:PCONfiguration:DATA:DSElection <DSelection>

The command selects data list file.

Parameters:

<DSelection> string
 Increment: 1

Example:

```
BB:BTO:PCON:DATA DLIS
```

selects the data type.

```
BB:BTO:PCON:DSEL bluetooth_1
```

selects the file for the data.

Manual operation: See ["Data Source"](#) on page 138

[[:SOURce<hw>]:BB:BTOoth:PCONfiguration:DATA:VDPattern <VdPattern>, <BitCount>

Sets the bit pattern for the voice data.

Parameters:

<VdPattern> numeric
 *RST: #H0

<BitCount> integer
 Range: 1 to 64
 *RST: 1

Example:

```
BB:BTO:PCON:DATA:PATT
```

Selects the data type.

```
BB:BTO:PCON:DATA:VDPA #B010101,6
```

Selects the bit pattern for the voice data with the length of 24 bits.

Manual operation: See ["Data Source \(Voice Field\)"](#) on page 140

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:VDSElection <VdSelection>

Selects the data list for voice data.

Parameters:

<VdSelection> string

Example:

BB:BT0:PCON:VDAT DLIS

selects the data type.

BB:BT0:PCON:VDSE bluetooth_1

selects the file for the data.

Manual operation: See "[Data Source \(Voice Field\)](#)" on page 140

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DLENGTH <DLength>

Sets the payload data length in bytes.

Parameters:

<DLength> integer

Range: 0 to depends on packet type

Increment: 1

*RST: depends on packet type

Example:

BB:BT0:PTYP DH1

sets the packet type.

BB:BT0:PCON:DSFP PED

enable packet editor under data source for packet

BB:BT0:PCON:DLEN 25

sets the data length.

Manual operation: See "[Data Length](#)" on page 139

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DSFPacket <DsfPacket>

Selects the data source for the selected packet type.

Parameters:

<DsfPacket> PEdit | ADATa

PEd

Enables the "Packet Editor". All packet fields can be configured individually.

ADAT

Fills the generated packets with the selected data source. Useful if predefined data contents are loaded with a data list file or the data contents of the packet are not of interest.

*RST: PEdit

Example:

BB:BT0:PCON:DSFP PED

enables packet editor under data source for packet.

Manual operation: See "[Data Source for Packet](#)" on page 136

[:SOURce<hw>]:BB:BT0oth:PCONfiguration:DWHitening <DWhitening>

Activates the "Data Whitening".

Parameters:

<DWhitening> 1 | ON | 0 | OFF
 *RST: 0

Example:

BB:BT0:PCON:DWH ON
 activates data whitening.

Manual operation: See "[Data Whitening](#)" on page 136

[:SOURce<hw>]:BB:BT0oth:PCONfiguration:EIRPacketfollows <EirPacketFollow>

Indicates that an extended inquiry response packet can follow.

Parameters:

<EirPacketFollow> YES | NO
YES
 Indicates that EIR packet follows.
NO
 Indicates that EIR packet does not follow.
 *RST: NO

Example:

BB:BT0:PCON:PTYP FHS
 sets the packet type.
 BB:BT0:PCON:DSFP PED
 enables the packet editor under data source for the packet
 BB:BT0:PCON:EIRP YES
 the EIR packet follows.

Manual operation: See "[EIR packet follows](#)" on page 139

[:SOURce<hw>]:BB:BT0oth:PCONfiguration:HFCControl <HfControl>

The command sets the FLOW bit in the header. This bit indicates start or stop of transmission of packets over the ACL logical transport.

Parameters:

<HfControl> GO | STOP
GO
 Allows the other devices to transmit new data.
STOP
 Stops the other devices from transmitting data temporarily.
 *RST: GO

Example: BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet.
BB:BTO:PCON:HFC GO
allows the other devices to transmit new data.

Manual operation: See "[Flow Control](#)" on page 137

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:LFSWord <LapForSW>, <BitCount>

Sets the lower address part (LAP) of the sync word for FHS packets. The length of LAP is 24 bits or 6 hexadecimal figures.

Parameters:

<LapForSW> numeric
Range: #H000000 to #HFFFFFF
*RST: #H000080

<BitCount> integer
Range: 8 to 24
*RST: 24

Example: BB:BTO:PCON:LFSW #H000080,24
Sets the lower address part.

Manual operation: See "[LAP for Sync Word](#)" on page 136

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:LTAddress <LtAddress>

The command enters the logical transport address for the header. Each Peripheral active in a piconet is assigned a primary logical transport address (LT_ADDR). The all-zero LT_ADDR is reserved for broadcast messages.

Parameters:

<LtAddress> integer
Range: 0 to 7
Increment: 1
*RST: 0

Example: BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:LTAD 0
sets the logical transport address equal zero.

Manual operation: See "[Logical Transport Address](#)" on page 137

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:PFControl <PfControl>

The command sets the FLOW bit in the payload (flow control per logical link).

Parameters:

<PfControl>

GO | STOP

GO

Indicates the start of transmission of ACL packets after a new connection has been established.

STOP

Indicates the stop of transmission of ACL packets before an additional amount of payload data is sent.

*RST: GO

Example:

BB:BTO:PCON:PTYP DH1

sets the packet type.

BB:BTO:PCON:DSFP PED

enable packet editor under data source for packet

BB:BTO:PCON:PFC GO

allows the flow per logical link.

Manual operation: See "[Flow Control](#)" on page 139

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:PLENgtth <PLength>

Sets the packet length in symbols.

Parameters:

<PLength>

integer

Range: 1 to depends on packet type

Increment: 1

*RST: depends on packet type

Example:

BB:BTO:PCON:DSFP ADAT

fills the all data under data source for packet.

BB:BTO:PCON:PLEN 1

sets the packet length.

Manual operation: See "[Packet Length](#)" on page 142

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:SLAP <State>

Activates synchronization of the lower address part (LAP) of the sync word and Bluetooth device address.

Parameters:

<State>

1 | ON | 0 | OFF

*RST: 1

Example: BB:BTO:PCON:SLAP 0
deactivates LAP synchronization.
BB:BTO:PCON:LFSW #H000080,24
sets LAP of the sync word separately.

Manual operation: See "[Synchronize LAP with BD_ADDR](#)" on page 136

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:SNsValue <SnSvalue>

Sets the start value of the header SEQN bit. The SEQN bit is present in the header to filter out retransmissions in the destination. The signal generator is altering this bit automatically on consecutive frames, if a sequence length of at least 2 frames is set.

Parameters:

<SnSvalue> integer
Range: 0 to 1
*RST: 1

Example: BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enables packet editor under data source for packet.
BB:BTO:PCON:SNsv ONE
sets the SEQN bit of the first CRC data packet at the start of a connection.

Manual operation: See "[SEQN Start Value](#)" on page 138

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:SRMode <SrMode>

The command indicates the interval between two consecutive page scan windows, determines the behavior of the paging device.

Parameters:

<SrMode> R0 | R1 | R2
R0
The scan interval is equal to the scan window T w page scan (continuous nscan) and maximal 1.28s.
R1
The scan interval is maximal 1.28s.
R2
The scan interval is maximal 2.56s.
*RST: R0

Example: BB:BTO:PCON:PTYP FHS
sets the packet type.
BB:BTO:PCON:DSFP PED
enables packet editor under data source for packet.
BB:BTO:PCON:SRM R0
sets the scan repetition mode.

Manual operation: See "Scan Repetition Mode" on page 140

[:SOURce<hw>]:BB:BTOoth:PCONfiguration:VDATA <VData>

Selects the data source for the voice field.

Parameters:

<VData> ALL0 | ALL1 | PATtern | PN09 | PN11 | PN15 | PN16 | PN20 |
PN21 | PN23 | DLISt
*RST: PN09

Example: BB:BTO:PCON:VDAT ALL1
sets the voice data type.

Manual operation: See "Data Source (Voice Field)" on page 140

8.10 Filter/clipping commands

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[:SOURce<hw>]:BB:BTOoth:CLIPping:LEVel <Level>

Sets the limit for level 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.

Parameters:

<Level> integer
 Range: 1 to 100
 Increment: 1
 *RST: 100
 Default unit: PCT

Example:

SOURce1:BB:BTO:CLIP:LEV 80
 Sets the limit for level clipping to 80% of the maximum level.
 SOURce1:BB:BTO:CLIP:STAT ON
 Activates level clipping.

Manual operation: See ["Clipping Level"](#) on page 148

[:SOURce<hw>]:BB:BTOoth:CLIPping:MODE <Mode>

The command sets the method for level clipping.

Parameters:

<Mode> VECTor | SCALar
VECTor
 The reference level is the amplitude $|i+jq|$.
SCALar
 The reference level is the absolute maximum of the I and Q values.
 *RST: VECTor

Example:

SOURce1:BB:BTO:CLIP:MODE VECT
 Sets the amplitude as reference level.

Manual operation: See ["Clipping Mode"](#) on page 149

[:SOURce<hw>]:BB:BTOoth:CLIPping:STATe <State>

Activates level clipping.

The value is defined with the command `BB:BTO:CLIPping:LEVe1`, the mode of calculation with the command `BB:BTO:CLIPping:MODE`.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: OFF

Example:

SOURce1:BB:BTO:CLIP:STAT ON
 Activates level clipping.

Manual operation: See ["Filter/Clipping"](#) on page 37
 See ["State"](#) on page 148

[:SOURce<hw>]:BB:BTOoth:FILTer:FILTer?

Queries all configured baseband filters.

These filters are the common GFSK baseband filter and, for some EDR packets, a DPSK filter. See also [Table 7-1](#).

Return values:

<filters> string

Example:

```
SOURce1:BB:BTO:FILT:FILT?
// Response: "GFSK, Root Raised Cosine (RRC)"
GFSK is a common baseband filter. Root raised cosine (RRC) is
the  $\pi/4$  DQPSK filter.
SOURce1:BB:BTO:TMOde?
// Response: "ESCO"
SOURce1:BB:BTO:PTYPE?
// Response: "EEV3"
SOURce1:BB:BTO:PTYPE EV3
SOURce1:BB:BTO:FILT:FILT?
// Response: "GFSK"
GFSK is the only filter.
```

Usage: Query only

Manual operation: See "[Filter/Clipping](#)" on page 37

[:SOURce<hw>]:BB:BTOoth:FILTer:TYPE <Type>

Selects the filters used for $\pi/4$ DQPSK and 8DPSK modulations. This opens a selection window containing all the filters available to the instrument.

Parameters:

<Type> RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 |
COEqualizer | COFequalizer | C2K3x | APCO25 | SPHase |
RECTangle | PGAuss | LPASs | DIRac | ENPShape |
EWPSshape
*RST: RCOSine

Example:

```
SOURce1:BB:BTO:FILT:TYPE RCOS
Sets the filter type RCOSine.
```

Manual operation: See "[Filter](#)" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:ILENgtH <Length>

Sets the impulse length (the number of filter taps).

Parameters:

<Length> integer
Range: 1 to depends on oversampling
*RST: 32

Example:

```
SOURce1:BB:BTO:FILT:ILEN 10
Sets the number of filter tabs to 10.
```

Manual operation: See "[Impulse Length](#)" on page 145

[[:SOURce<hw>]:BB:BT0oth:FILTer:ILENgtH:AUTO[:STATe] <State>

Activates the impulse length state.

If activated, the most sensible parameter values are selected. The value depends on the coherence check.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 1

Example:

SOURce1:BB:BT0:FILT:ILEN:AUTO ON
 Selects the most sensible parameters automatically.

Manual operation: See "[Impulse Length](#)" on page 145

[[:SOURce<hw>]:BB:BT0oth:FILTer:OSAMplng <OSampling>

Sets the upsampling factor.

Parameters:

<OSampling> integer
 Range: 1 to 32
 *RST: 10

Example:

SOURce1:BB:BT0:FILT:OSAM 10
 Sets the upsampling factor to 10.

Manual operation: See "[Oversampling](#)" on page 145

[[:SOURce<hw>]:BB:BT0oth:FILTer:OSAMplng:AUTO[:STATe] <State>

Activates the upsampling factor state. If activated, the most sensible parameter values are selected. The value depends on the coherence check. If deactivated, the values can be changed manually.

Parameters:

<State> 1 | ON | 0 | OFF
 *RST: 1

Example:

SOURce1:BB:BT0:FILT:OSAM:AUTO ON
 The most sensible parameters are selected automatically.

Manual operation: See "[Oversampling](#)" on page 145

[[:SOURce<hw>]:BB:BT0oth:FILTer:MINdex <MIndex>

Queries the modulation index resulting from the entered frequency deviation value.

Parameters:

<MIndex> string

Example: SOURce1:BB:BTO:FILT:MIND?
 Queries the modulation index
 // Response: "0.5"

Manual operation: See "[Modulation Index](#)" on page 147

[:SOURce<hw>]:BB:BTOoth:FILTer:MTYPe <MType>

Queries the modulation type used for the current packet selection.

Parameters:

<MType> string

Example: SOURce1:BB:BTO:FILT:MTYP?
 Queries the modulation type

Manual operation: See "[Modulation Type](#)" on page 147

[:SOURce<hw>]:BB:BTOoth:MSETtings:FDEVIation <FDeviation>

Sets the frequency deviation.

Parameters:

<FDeviation> float

Range: Depends on Bluetooth mode

Increment: 0.1

*RST: depends on Bluetooth mode

Example: SOURce1:BB:BTO:MSET:FDEV 160
 Sets a frequency deviation of 160 kHz.

Manual operation: See "[Frequency Deviation](#)" on page 147

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:APCO25 <Apco25>

Sets the roll-off factor for filter type APCO25.

Parameters:

<Apco25> float

Range: 0.05 to 0.99

Increment: 0.01

*RST: 0.2

Example: SOURce1:BB:BTO:FILT:PAR:APCO25 0.2
 Sets the roll-off factor to 0.2 for filter type APCO25.

Manual operation: See "[B*T](#)" on page 144
 See "[Roll Off Factor/B*T](#)" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:COSSine <Cosine>

Sets the roll-off factor for the Cosine filter type.

Parameters:

<Cosine> float
 Range: 0 to 1
 Increment: 0.01
 *RST: 0.1

Example:

SOURce1:BB:BTO:FILT:PAR:COS 0.35
 Sets the roll-off factor to 0.35 for filter type Cosine.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:FGAUss <FGauss>

Sets the B x T for the Gauss filter type.

Parameters:

<FGauss> float
 Range: 0.15 to 2.5
 Increment: 0.01
 *RST: 0.5

Example:

SOURce1:BB:BTO:FILT:PAR:FGA 0.5
 Sets B x T to 0.5 for the Gauss filter type for the GFSK section of the packet.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:GAUSs <Gauss>

Sets the B x T for the Gauss filter type.

Parameters:

<Gauss> float
 Range: 0.15 to 2.5
 Increment: 0.01
 *RST: 0.5

Example:

SOURce1:BB:BTO:FILT:PAR:GAUS 0.5
 Sets B x T to 0.5 for the Gauss filter type for $\pi/4$ DQPSK or 8DPSK sections.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:LPASs <LPass>

Sets the cut off frequency factor for a lowpass filter (ACP Opt.).

Parameters:

<LPass> float
 Range: 0.05 to 2
 Increment: 0.01
 *RST: 0.5

Example:

SOURce1:BB:BTO:FILT:PAR:LPAS 1
 Sets the cut off frequency factor for a lowpass filter.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146
 See "Cut Off Frequency Factor" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:PGAuss <PGauss>

Sets the B x T for the Pure Gauss filter type.

Parameters:

<PGauss> float
 Range: 0.15 to 2.5
 Increment: 0.01
 *RST: 0.5

Example:

SOURce1:BB:BTO:FILT:PAR:PGA 0.5
 Sets B x T to 0.5 for the Pure Gauss filter type.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:RCOSine <RCosine>

Sets the roll-off factor for the Root Cosine filter type.

Parameters:

<RCosine> float
 Range: 0 to 1
 Increment: 0.01
 *RST: 0.4

Example:

SOURce1:BB:BTO:FILT:PAR:RCOS 0.22
 Sets the roll-off factor to 0.22 for filter type Root Cosine.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:SPHase <SPHase>

Sets the BxT for the split phase filter type.

Parameters:

<SPhase> float
 Range: 0.15 to 2.5
 Increment: 0.01
 *RST: 2

Example:

SOURce1:BB:BTO:FILT:PAR:SPH 0.5
 Sets B x T to 0.5 for the Split Phase filter type.

Manual operation:

See "B*T" on page 144
 See "Roll Off Factor/B*T" on page 146

[:SOURce<hw>]:BB:BTOoth:SRATe:VARiation <Variation>

Sets the symbol rate.

Parameters:

<Variation> float
 Range: 4E2 to 15E6
 Increment: 1E-3
 *RST: 1E6

Example:

BB:BTO:SRAT:VAR 1
 sets the symbol rate variation to 1 MHz.

Manual operation:

See "Symbol Rate Variation" on page 148

8.11 Power ramping commands

[:SOURce<hw>]:BB:BTOoth:PRAMping:FOFFset	288
[:SOURce<hw>]:BB:BTOoth:PRAMping:RFUNction	289
[:SOURce<hw>]:BB:BTOoth:PRAMping:ROFFset	289
[:SOURce<hw>]:BB:BTOoth:PRAMping:RTIME	289

[:SOURce<hw>]:BB:BTOoth:PRAMping:FOFFset <FOffset>

Sets the offset of the falling edge of a burst. The offset is specified by the selected number of symbols.

Negative values shift the falling edge to earlier positions, which results in a corresponding number of skipped symbols at the end of the burst.

Positive values shift the falling edge to later positions, which results in a corresponding number of added 0 padding symbols following the burst.

Parameters:

<FOffset> integer
 Range: -32 to 32
 Increment: 1
 *RST: 0

Example: `BB:BTO:PRAM:FOFF 8`
Adds eight symbols at the end of the burst.

Manual operation: See "[Fall Offset](#)" on page 150

[[:SOURce<hw>]:BB:BTOoth:PRAMping:RFUNction <RFunction>

The command selects the form of the transmitted power, i.e. the shape of the rising and falling edges during power ramp control.

Parameters:

<RFunction> LINear | COSine
*RST: COSine

Example: `BB:BTO:PRAM:RFUN LIN`
sets linear shape for the rising and falling edges during power ramp control.

Manual operation: See "[Ramp Function](#)" on page 150

[[:SOURce<hw>]:BB:BTOoth:PRAMping:ROFFset <ROffset>

Sets the offset of the rising edge of a burst. The offset is specified by the selected number of symbols.

Negative values shift the rising edge to earlier positions, which results in a corresponding number of added 0 padding symbols before the burst.

Positive values shift the rising edge to later positions, which results in a corresponding number of skipped symbols at the beginning of the burst.

Parameters:

<ROffset> integer
Range: -32 to 32
Increment: 1
*RST: -2

Example: `BB:BTO:PRAM:ROFF 8`
Skips eight symbols at the beginning of the burst.

Manual operation: See "[Rise Offset](#)" on page 150

[[:SOURce<hw>]:BB:BTOoth:PRAMping:RTIME <RTime>

Sets the ramp time, which extends the burst by a corresponding number of 0 padding symbols at the beginning and the end of a burst. During this period of time, power ramping is based on the specified ramp function.

Parameters:

<RTime> integer
Range: 1 to 32
Increment: 1
*RST: 2

Example: BB:BTO:PRAM:TIME 2
Extends the burst by 2 symbols at the beginning and end of the burst.

Manual operation: See "[Ramp Time](#)" on page 150

8.12 Trigger commands

Example: To configure an external trigger

```
// *****
// Configure trigger in armed retrigger mode, set source, enable
// synchronization to external trigger, set external
// inhibit and delay.
// *****
SOURCE1:BB:BT00th:TRIGger:SEQuence ARET
SOURCE1:BB:BT00th:TRIGger:SOURce EGT1
SOURCE1:BB:BT00th:TRIGger:EXTernal:SYNChronize:OUTPut 1
SOURCE1:BB:BT00th:TRIGger:EXTernal:INHibit 100
SOURCE1:BB:BT00th:TRIGger:EXTernal:DELay 10
```

Example: To configure an internal trigger

```
// *****
// Configure trigger in single mode.
// Set source to internal, specify signal duration
// unit and duration.
// *****
SOURCE1:BB:BT00th:TRIGger:SEQuence SING
SOURCE1:BB:BT00th:TRIGger:SOURce INT
SOURCE1:BB:BT00th:TRIGger:SLUNit SEQ

SOURCE1:BB:BT00th:TRIGger:SLUNit FRAME
SOURCE1:BB:BT00th:TRIGger:SLENgth 2

// *****
// Alternatively configure trigger in armed retrigger mode.
// Set source to internal. Enable Bluetooth signal, start
// the trigger - signal generation starts.
// Stop signal generation and wait for a trigger
// event to restart signal generation.
// Query the current trigger signal generation status.
// *****
SOURCE1:BB:BT00th:TRIGger:SEQuence ARETrigger
SOURCE1:BB:BT00th:TRIGger:SOURce INT
SOURCE1:BB:BT00th:STATe 1
SOURCE1:BB:BT00th:TRIGger:EXEcute
```

<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:SEQuence</code>	291
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:SOURce</code>	291
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:RM0De</code>	292
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:TIME:DATE</code>	292
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:TIME:TIME</code>	292
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:TIME[:STATE]</code>	293
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:SLENgth</code>	293
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:SLUNit</code>	294
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:ARM:EXECute</code>	294
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:EXECute</code>	294
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTErnal]:SYNChronize:OUTPut</code>	294
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTErnal]:DELay</code>	295
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTErnal]:INHibit</code>	295

`[:SOURce<hw>]:BB:BT0oth:TRIGger:SEQuence <Sequence>`

Selects the trigger mode:

- `AUTO` = auto
- `RETRigger` = retrigger
- `AAUTO` = armed auto
- `ARETrigger` = armed retrigger
- `SINGLE` = single

Parameters:

`<Sequence>` `AUTO` | `RETRigger` | `AAUTO` | `ARETrigger` | `SINGLE`
`*RST:` `AUTO`

Example: See [Example "To configure an internal trigger"](#) on page 290.

Manual operation: See ["Mode"](#) on page 152

`[:SOURce<hw>]:BB:BT0oth:TRIGger:SOURce <Source>`

Selects the trigger signal source and determines the way the triggering is executed. Provided are the following trigger sources:

- `INTernal`: Internal manual triggering of the instrument
- External trigger signal via one of the local or global connectors:
 - `EGT1` | `EGT2`: External global trigger
 - `EGC1` | `EGC2`: External global clock
- For secondary instruments (`SCONfiguration:MULTIinstrument:MODE SEC`), triggering via the external baseband synchronization signal of the primary instrument:
`SOURce1:BB:ARB:TRIGger:SOURce BBSY`
- `OBASeband` | `BEXTErnal` | `EXTErnal`: **Setting only**
 Provided only for backward compatibility with other Rohde & Schwarz signal generators. The R&S SMM100A accepts these values and maps them automatically as follows:

OBASeband = INTA, BEXternal = EGT2, EXternal = EGT1

Parameters:

<Source> INTernal|EGT1|EGT2|EGC1|EGC2|EXternal|BBSY
*RST: INTernal

Example: See [Example "To configure an external trigger"](#) on page 290.

Example: See [Example "To configure an internal trigger"](#) on page 290.

Manual operation: See ["Source"](#) on page 154

[:SOURce<hw>]:BB:BT0oth:TRIGger:RMODe <RMode>

Queries signal generation status for all trigger modes with Bluetooth modulation on.

Parameters:

<RMode> RUN | STOP
*RST: STOP

Example: See [Example "To configure an internal trigger"](#) on page 290.

Manual operation: See ["Running/Stopped"](#) on page 153

[:SOURce<hw>]:BB:BT0oth: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> Range: 1 to 31
Increment: 1

Example: See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See ["Trigger Time"](#) on page 153

[:SOURce<hw>]:BB:BT0oth:TRIGger:TIME:TIME <Time>

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:

<Time> string

Example: See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See ["Trigger Time"](#) on page 153

[:SOURce<hw>]:BB:BTOoth:TRIGger:TIME[:STATE] <Hour>, <Minute>, <Second>

Activates time-based triggering with a fixed time reference. If activated, the R&S SMM100A 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:

<Hour> integer
Range: 0 to 23

<Minute> integer
Range: 0 to 59

<Second> integer
Range: 0 to 59

Example: See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMM100A user manual.

Manual operation: See ["Time Based Trigger"](#) on page 153

[:SOURce<hw>]:BB:BTOoth:TRIGger:SLENgth <SLength>

Defines the length of the signal sequence that is output in the SINGLE trigger mode.

Parameters:

<SLength> integer
Range: 1 to 7000
*RST: 1

Example: See [Example "To configure an internal trigger"](#) on page 290.

Manual operation: See ["Signal Duration"](#) on page 152

[[:SOURce<hw>]:BB:BT0oth:TRIGger:SLUNit <SIUnit>

Defines the unit for the entry of the signal sequence length.

Parameters:

<SIUnit> FRAME | SEQUENCE | EVENT

FRAME

A single frame is generated after a trigger event.

SEQUENCE

A single sequence is generated after a trigger event.

*RST: SEQUENCE

Example: See [Example "To configure an internal trigger"](#) on page 290.

Manual operation: See ["Signal Duration Unit"](#) on page 152

[[:SOURce<hw>]:BB:BT0oth:TRIGger:ARM:EXECute

Stops signal generation; a subsequent trigger event restarts signal generation.

Example: See [Example "To configure an internal trigger"](#) on page 290.

Usage: Event

Manual operation: See ["Arm"](#) on page 153

[[:SOURce<hw>]:BB:BT0oth:TRIGger:EXECute

Executes a trigger.

Example: See [Example "To configure an internal trigger"](#) on page 290.

Usage: Event

Manual operation: See ["Execute Trigger"](#) on page 153

[[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTernal]:SYNChronize:OUTPut <Output>

Enables signal output synchronous to the trigger event.

Parameters:

<Output> 1 | ON | 0 | OFF

*RST: 1

Example: See [Example "To configure an external trigger"](#) on page 290.

Manual operation: See ["Sync. Output to Ext. Trigger/Sync. Output to Trigger"](#) on page 154

```
[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTernal]:DELay <Delay>
```

Sets the trigger delay.

Parameters:

```
<Delay>          float
                  Range:    0 to 2147483647
                  Increment: 0.01
                  *RST:     0
```

Example: See [Example "To configure an external trigger"](#) on page 290.

Manual operation: See ["External Delay/Trigger Delay"](#) on page 155

```
[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTernal]:INHibit <Inhibit>
```

Specifies the number of samples by which a restart is to be inhibited following an external trigger event.

Parameters:

```
<Inhibit>       integer
                  Range:    0 to 21.47*symbRate
                  *RST:     0
```

Example: See [Example "To configure an external trigger"](#) on page 290.

Manual operation: See ["External Inhibit/Trigger Inhibit"](#) on page 155

8.13 Marker commands

Example: To configure a marker signal

```
// *****
// Configure marker mode: set a marker at ARB sequence start.
// *****
SOURce1:BB:BT0oth:TRIGger:OUTPut1:MODE REStart
// SOURce1:BB:BT0oth:TRIGger:OUTPut1:MODE StARt
// SOURce1:BB:BT0oth:TRIGger:OUTPut1:MODE ACTive

// *****
// Alternatively configure pulse marker. Set pulse
// divider and frequency
// *****
SOURce1:BB:BT0oth:TRIGger:OUTPut1:MODE PULSe
SOURce1:BB:BT0oth:TRIGger:OUTPut1:PULSe:DIVider 2
SOURce1:BB:BT0oth:TRIGger:OUTPut1:PULSe:FREquency?
// 500000

// *****
// Alternatively configure bit pattern marker. Specify pattern.
```

```
// *****
SOURcel:BB:BT0oth:TRIGger:OUTPut1:MODE PATtern
SOURcel:BB:BT0oth:TRIGger:OUTPut1:PATtern #H2,2
// *****
// Alternatively configure on/off ratio marker. Set on/off time.
// *****
SOURcel:BB:BT0oth:TRIGger:OUTPut1:MODE RAT
SOURcel:BB:BT0oth:TRIGger:OUTPut1:ONTime 40000
SOURcel:BB:BT0oth:TRIGger:OUTPut1:OFFTime 20000
```

Example: To configure marker delay

```
// *****
// Enable fixed marker delay. Query the limit for minimum and maximum
// marker delay. Set delay for the marker signal output.
// *****
SOURcel:BB:BT0oth:TRIGger:OUTPut1:DElay 1600
```

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay	296
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:FESHift	296
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:MODE	297
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:ONTime	298
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime	298
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PATtern	298
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PINdex	298
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:DIVider	298
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:FREQuency?	299
[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:RESHift	299

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay <Delay>

Defines the delay between the signal on the marker outputs and the start of the signals.

Parameters:

<Delay>	float
	Range: 0 to 16777215
	Increment: 1
	*RST: 0

Example: See [Example "To configure marker delay"](#) on page 296.

Manual operation: See ["Delay"](#) on page 158

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:FESHift <Shift>

Shifts the falling edge of the marker the specified number of samples.

Negative values result in a shift back of the marker edge.

Parameters:

<Shift> float
 Range: dynamic to dynamic
 Increment: 1E-6
 *RST: 0

Example:

SOURce1:BB:BTO:TRIG:OUTP1:FESH 10
 Shifts the falling edge of marker 1 by 75 samples.

Example:

See also [Example "To configure a marker signal"](#) on page 295.

Manual operation:

See ["Mode"](#) on page 156

[:SOURce<hw>]:BB:BTOoth:TRIGger:OUTPut<ch>:MODE <Mode>

Defines the signal for the selected marker output.

Parameters:

<Mode> REStArt | StARt | ACTive | PULSe | PATtern | RATio | IACTive

REStArt

A marker signal is generated at the start of each signal sequence.

StARt

A marker signal is generated at the start of each event/frame.

ACTive

The marker masks the active part of the event/frame. At the start of each burst, the marker signal changes to high. It changes back to low after the end of each burst.

PULSe

A regular marker signal is generated. The clock frequency is defined by entering a divider. The frequency is derived by dividing the symbol rate by the divider. The input box for divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below.

PATtern

A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when pattern is selected.

RATio

A regular marker signal corresponding to the "Time Off" / "Time On" specifications in the commands

SOURce1:BB:BTO:TRIGger:OUTPut:OFFTime and

SOURce1:BB:BTO:TRIGger:OUTPut:ONTime is generated.

IACTive

The marker masks the inactive part of the event/frame. At the start of each burst, the marker signal changes to low. It changes back to high after the end of each burst.

*RST: REStArt

Example:

See [Example "To configure a marker signal"](#) on page 295.

Manual operation: See ["Mode"](#) on page 156

```
[ :SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:ONTime <OnTime>
[ :SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime <OffTime>
```

Sets the duration of the ON and OFF periods.

Parameters:

<OffTime> integer
 Range: 1 to 16777215
 *RST: 1

Example: See [Example "To configure a marker signal"](#) on page 295.

Manual operation: See ["Mode"](#) on page 156

```
[ :SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PATTern <Pattern>, <BitCount>
```

Selects the data for a pattern.

Parameters:

<Pattern> numeric
 *RST: #H2
 <BitCount> integer
 Range: 1 to 64
 *RST: 2

Example: See [Example "To configure a marker signal"](#) on page 295.

Manual operation: See ["Mode"](#) on page 156

```
[ :SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PINdex <PIndex>
```

For Bluetooth LE data packets higher than one, sets the packet index. The index corresponds to the transmitted Tx event during the connection interval.

Parameters:

<PIndex> integer
 Range: 1 to depends on "No. Of Tx Packets/Event" parameter
 *RST: 1

Manual operation: See ["Mode"](#) on page 156

```
[ :SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:DIVider <Divider>
```

Sets the divider for the clock frequency.

Parameters:

<Divider> integer
 Range: 2 to 1024
 *RST: 2

Example: See [Example "To configure a marker signal"](#) on page 295.

Manual operation: See ["Mode"](#) on page 156

[:SOURce<hw>]:BB:BTOoth:TRIGger:OUTPut<ch>:PULSe:FREQUency?

Queries the marker pulse frequency.

Return values:

<Frequency> float
 Range: 2 to 1024
 Increment: 1E-3
 *RST: 2

Example: See [Example "To configure a marker signal"](#) on page 295.

Usage: Query only

Manual operation: See ["Mode"](#) on page 156

[:SOURce<hw>]:BB:BTOoth:TRIGger:OUTPut<ch>:RESHift <Shift>

Shifts the rising edge of the marker the specified number of samples.

Negative values result in a shift back of the marker edge.

Parameters:

<Shift> float
 Range: dynamic to dynamic
 Increment: 1E-6
 *RST: 0

Example: SOURce1:BB:BTO:TRIG:OUTPut2:RESH -20
 Shifts back the rising edge of marker 2 by 20 samples.

Example: See also [Example "To configure a marker signal"](#) on page 295.

Manual operation: See ["Mode"](#) on page 156

8.14 Clock commands

This section lists the remote control commands to configure the clock.

Example: To configure clock settings

```
// *****
// Select internal clock.
// *****
SOURCE1:BB:BT0oth:CLOCK:SOURce INTernal
// *****
// Alternatively select external clock. Set its mode.
// *****
SOURCE1:BB:BT0oth:CLOCK:MODE SAMP
```

[\[:SOURCE<hw>\]:BB:BT0oth:CLOCK:SOURce.....](#) 300

[:SOURCE<hw>]:BB:BT0oth:CLOCK:SOURce <Source>

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:

<Source> INTernal
 *RST: INTernal

Example: See [Example "To configure clock settings"](#) on page 300.

Manual operation: See ["Clock Source"](#) on page 159

Glossary: Specifications

Symbols

[1]: Bluetooth SIG: Bluetooth Core Specification, version 5.4
<https://www.bluetooth.com/specifications/specs/>

[2]: Bluetooth SIG: Channel Sounding, revision CR_PR
<https://www.bluetooth.com/specifications/specs/>

List of commands

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[SOURce<hw>]:BB:BT00th:BCText?.....	162
[SOURce<hw>]:BB:BT00th:BMODE.....	163
[SOURce<hw>]:BB:BT00th:CCRC:STATe.....	174
[SOURce<hw>]:BB:BT00th:CLIPping:LEVel.....	281
[SOURce<hw>]:BB:BT00th:CLIPping:MODE.....	282
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[SOURce<hw>]:BB:BT00th:CLOCK:SOURce.....	300
[SOURce<hw>]:BB:BT00th:CS:CDATa:ACI.....	254
[SOURce<hw>]:BB:BT00th:CS:CDATa:CCID:STATe.....	255
[SOURce<hw>]:BB:BT00th:CS:CDATa:CECount.....	255
[SOURce<hw>]:BB:BT00th:CS:CDATa:CID.....	255
[SOURce<hw>]:BB:BT00th:CS:CDATa:CSAThreec.....	255
[SOURce<hw>]:BB:BT00th:CS:CDATa:CSIGnal.....	256
[SOURce<hw>]:BB:BT00th:CS:CDATa:CSPCapability?.....	267
[SOURce<hw>]:BB:BT00th:CS:CDATa:ECODE.....	256
[SOURce<hw>]:BB:BT00th:CS:CDATa:EOFFset.....	256
[SOURce<hw>]:BB:BT00th:CS:CDATa:MAPath.....	256
[SOURce<hw>]:BB:BT00th:CS:CDATa:MMASSteps.....	257
[SOURce<hw>]:BB:BT00th:CS:CDATa:MMISSteps.....	257
[SOURce<hw>]:BB:BT00th:CS:CDATa:MMODE.....	257
[SOURce<hw>]:BB:BT00th:CS:CDATa:MMRepetition.....	257
[SOURce<hw>]:BB:BT00th:CS:CDATa:MPLength.....	258
[SOURce<hw>]:BB:BT00th:CS:CDATa:MPSupported.....	258
[SOURce<hw>]:BB:BT00th:CS:CDATa:MTYPe?.....	258
[SOURce<hw>]:BB:BT00th:CS:CDATa:MZSTeps.....	258
[SOURce<hw>]:BB:BT00th:CS:CDATa:NANT.....	259
[SOURce<hw>]:BB:BT00th:CS:CDATa:NCONfig.....	259
[SOURce<hw>]:BB:BT00th:CS:CDATa:NFAE.....	259
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