

R&S® FSV-K8

Firmware Option Bluetooth

Measurements

Operating Manual



1176.7610.02 – 02

This manual describes the following R&S®FSV options:

- R&S FSV-K8 (1310.8155.02)

This manual describes the following R&S®FSV models with firmware version 2.20 and higher:

- R&S®FSV 4 (1321.3008K04)
- R&S®FSV 7 (1321.3008K07)
- R&S®FSV 13 (1321.3008K13)
- R&S®FSV 30 (1321.3008K30)
- R&S®FSV 40 (1321.3008K39)
- R&S®FSV 40 (1321.3008K40)

It also applies to the following R&S®FSV models. However, note the differences described in [chapter 1.4, "Notes for Users of R&S FSV 1307.9002Kxx Models"](#), on page 9.

- R&S®FSV 3 (1307.9002K03)
- R&S®FSV 7 (1307.9002K07)
- R&S®FSV 13 (1307.9002K13)
- R&S®FSV 30 (1307.9002K30)
- R&S®FSV 40 (1307.9002K39)
- R&S®FSV 40 (1307.9002K40)

The firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" on the user documentation CD-ROM (included in delivery).

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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

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1 Preface

1.1 Documentation Overview

The user documentation for the R&S FSV is divided as follows:

- Quick Start Guide
- Operating Manuals for base unit and options
- Service Manual
- Online Help
- Release Notes

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. The manual includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Introduction, General information
Chapter 2	Front and Rear Panel
Chapter 3	Preparing for Use
Chapter 4	Firmware Update and Installation of Firmware Options
Chapter 5	Basic Operations
Chapter 6	Basic Measurement Examples
Chapter 7	Brief Introduction to Remote Control
Appendix	Printer Interface
Appendix	LAN Interface

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

The Operating Manual for the base unit provides basic information on operating the R&S FSV in general, and the "Spectrum" mode in particular. Furthermore, the software options that enhance the basic functionality for various measurement modes are described here. The set of measurement examples in the Quick Start Guide is expanded by more advanced measurement examples. In addition to the brief introduction to remote control in the Quick Start Guide, a description of the basic analyzer commands and programming examples is given. Information on maintenance, instrument interfaces and error messages is also provided.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S FSV is not included in the option manuals.

The following Operating Manuals are available for the R&S FSV:

- R&S FSV base unit; in addition:
 - R&S FSV-K9 Power Sensor Support
 - R&S FSV-K14 Spectrogram Measurement
- R&S FSV-K7 Analog Demodulation and R&S FSV-K7S FM Stereo Measurements
- R&S FSV-K10 GSM/EDGE Measurement
- R&S FSV-K30 Noise Figure Measurement
- R&S FSV-K40 Phase Noise Measurement
- R&S FSV-K70 Vector Signal Analysis Operating Manual
R&S FSV-K70 Vector Signal Analysis Getting Started (First measurements)
- R&S FSV-K72 3GPP FDD BTS Analysis
- R&S FSV-K73 3GPP FDD UE Analysis
- R&S FSV-K76/77 3GPP TD-SCDMA BTS/UE Measurement
- R&S FSV-K82/83 CDMA2000 BTS/MS Analysis
- R&S FSV-K84/85 1xEV-DO BTS/MS Analysis
- R&S FSV-K91 WLAN IEEE 802.11
- R&S FSV-K93 WiMAX IEEE 802.16 OFDM/OFDMA Analysis
- R&S FSV-K100/K104 EUTRA / LTE Downlink Measurement Application
- R&S FSV-K101/K105 EUTRA / LTE Uplink Measurement Application

These manuals are available in PDF format on the CD delivered with the instrument.

Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSV by replacing modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

Online Help

The online help contains context-specific help on operating the R&S FSV and all available options. It describes both manual and remote operation. The online help is instal-

led on the R&S FSV by default, and is also available as an executable .chm file on the CD delivered with the instrument.

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

1.3 How to Use the Help System

Calling context-sensitive and general help

- ▶ To display the general help dialog box, press the HELP key on the front panel.
The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.



For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

- ▶ If the help is already displayed, press the softkey for which you want to display help.
A topic containing information about the softkey and its function is displayed.



If a softkey opens a submenu and you press the softkey a second time, the submenu of the softkey is displayed.

Contents of the help dialog box

The help dialog box contains four tabs:

- "Contents" - contains a table of help contents
- "View" - contains a specific help topic
- "Index" - contains index entries to search for help topics
- "Zoom" - contains zoom functions for the help display

To change between these tabs, press the tab on the touchscreen.

Navigating in the table of contents

- To move through the displayed contents entries, use the UP ARROW and DOWN ARROW keys. Entries that contain further entries are marked with a plus sign.
- To display a help topic, press the ENTER key. The "View" tab with the corresponding help topic is displayed.
- To change to the next tab, press the tab on the touchscreen.

Navigating in the help topics

- To scroll through a page, use the rotary knob or the UP ARROW and DOWN ARROW keys.
- To jump to the linked topic, press the link text on the touchscreen.

Searching for a topic

1. Change to the "Index" tab.

2. Enter the first characters of the topic you are interested in. The entries starting with these characters are displayed.
3. Change the focus by pressing the ENTER key.
4. Select the suitable keyword by using the UP ARROW or DOWN ARROW keys or the rotary knob.
5. Press the ENTER key to display the help topic.
The "View" tab with the corresponding help topic is displayed.

Changing the zoom

1. Change to the "Zoom" tab.
2. Set the zoom using the rotary knob. Four settings are available: 1-4. The smallest size is selected by number 1, the largest size is selected by number 4.

Closing the help window

- ▶ Press the ESC key or a function key on the front panel.

1.4 Notes for Users of R&S FSV 1307.9002Kxx Models

Users of R&S FSV 1307.9002Kxx models should consider the following differences to the description of the newer R&S FSV 1321.3008Kxx models:

- Functions that are based on the Windows7 operating system (e.g. printing or setting up networks) may have a slightly different appearance or require different settings on the Windows XP based models. For such functions, refer to the Windows documentation or the documentation originally provided with the R&S FSV instrument.
- The R&S FSV 1307.9002K03 model is restricted to a maximum frequency of 3 GHz, whereas the 1321.3008K04 model has a maximum frequency of 4 GHz.
- The bandwidth extension option R&S FSV-B160 (1311.2015.xx) is not available for the R&S FSV 1307.9002Kxx models. The maximum usable I/Q analysis bandwidth for these models is 28 MHz, or with option R&S FSV-B70, 40 MHz.

2 Introduction to Bluetooth Measurements (K8)

Overview of Firmware Option R&S FSV-K8

This section contains all information required for operation of an R&S FSV equipped with Application Firmware R&S FSV-K8. It covers operation via menus and the remote control commands for bluetooth measurements.

This part of the documentation consists of the following chapters:

- [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10
Introduces the Bluetooth option and provides further information.
- [chapter 3, "Instrument Functions for Bluetooth Measurements \(K8\)"](#), on page 20
Shows all softkeys available in the "Bluetooth" menu. This chapter also presents the remote control commands associated with each softkey function.
- [chapter 4, "Remote Commands for Bluetooth Measurements \(K8\)"](#), on page 67
Describes all remote control commands defined for bluetooth measurements.

This part of the documentation includes only functions of the Application Firmware R&S FSV-K8. For all other descriptions, refer to the description of the base unit.

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2.1 Bluetooth Overview

This section provides the following general information on Bluetooth measurements:

- Bluetooth technical parameters
- Power classes
- Structure of a Bluetooth data packet

Bluetooth technical parameters

Table 2-1: Common Parameters

frequency bands	2402 + (0...78) MHz
channel spacing	1 MHz
symbol rate	1 Msym/s
slot length (frequency hopping)	625 (sec)
packet sizes	1, 3, 5 slot packets

Table 2-2: Modulation Parameters Basic Rate

modulation	GFSK
TX filter	Gaussian
BT /	0.5
modulation index	0.28 – 0.35 nominal 0.32
frequency deviation	160 kHz settled 141 kHz 010101 suite
bandwidth –3dB –20dB	220 kHz 1 MHz
bit rate	1 Mbps

Table 2-3: Modulation Parameters Enhanced Data Rate

modulation	$\pi/4$ -DQPSK	8DPSK
TX filter	RRC	RRC
roll-off factor	0.4	0.4
bandwidth –3dB	± 500 kHz	± 500 kHz
bit rate	2 Mbps	3 Mbps

Power classes

Power Class	Maximum (Pmax)	Nominal	Minimum (Pmin)	Power Control
1	100 mW (20 dBm)		1 mW (0 dBm)	from Pmin (< +4 dBm) to Pmax
2	2.5 mW (4dBm)	1 mW (0 dBm)	0.25 mW (–6dBm)	optional
3	1 mW (0dBm)			optional

Structure of a Bluetooth data packet

Every Bluetooth data packet is divided into 3 basic sections: access code, header and payload. The following figures show the order and bit lengths of the individual sections:

access code 72 bits				
4 bits preamble	64 bits sync word	4 bits trailer	54 bits header	240 / 1496 / 2744 bits payload*)

*) During EUT evaluation the payload contains certain bit sequences: PRBS9 (Pseudo Random Bit Sequence) or 11110000 or 10101010.

The sync word is transmitted as the major part of the access code. For this purpose, the LAP (lower address part) of the BD address is expanded to 64 bit by adding the BCH code and baker.

sync word 64 bits		
BCH code 34 bits	LAP 24 bits	Barker 6 bits

The LAP (lower address part) of the BD address serves as a basis for the sync word.

BD – address 48 bits		
NAP 16 bits	UAP 8 bits	LAP 24 bits

In case of EDR packets the payload is divided into 6 other sections:

DPSK					
guard 5µs	SYNC	payload header	user payload 0–2723Symb	CRC code	trailer

2.2 Supported Tests

The Bluetooth Measurements Option supports measurements according to the Bluetooth RF Test Specification (Bluetooth SIG) , Revision 2.0.E.3, Mar 2005, on the R&S FSV. The following tests are currently implemented according to this specification:

- Output Power
- TX Output Spectrum – Adjacent Channel Power
- Modulation Characteristics
- Initial Carrier Frequency Tolerance (ICFT)
- Carrier Frequency Drift
- EDR Relative Transmit Power
- EDR Carrier Frequency Stability and Modulation Accuracy
- EDR Differential Phase Encoding
- EDR In-band Spurious Emissions

2.3 Overview of Transmitter Tests

Table 2-4: Basic Rate Measurements

	Output Power	TX Output Spectrum – Adjacent Channel Power	Modulation Characteristics	Initial Carrier Frequency Tolerance	Carrier Frequency Drift
Hop	on	off	off	on / off	on / off
Trigger	extern	–	–	–	–
Synchronization	Yes (p0), but also possible without	no	yes (p0)	yes (p0)	yes (p0)
packet Type	longest supported	DH1	longest supported	DH1	all supported packets (DH1/3/5)
Payload	PRBS 9	PRBS 9	11110000 10101010	PRBS 9	10101010
Test Mode	loop back	loop back	loop back	loop back	loop back
Operating Mode	IQ mode	analyzer zero span	IQ mode	IQ mode	IQ mode
RBW	3 MHz	100 kHz	–	–	–
VBW	3 MHz	300 kHz	–	–	–
Power	supported maximum	supported maximum	supported maximum	supported maximum	not specified
Sweep Time	one complete packet	79s per sweep (= 100ms * 10 * 79)	one complete packet	–	one complete packet
Sweep Count	–	10	10 (extern)	10	10
Trace Mode	Maxh	Maxh	–	–	–
Detector	Peak	Aver	–	–	–
Frequency in MHz	low / middle / high	each channel	low / middle / high	low / middle / high	low / middle / high
Span	–	–	–	–	–
Test cond	norm / ext	norm / ext	norm / ext	norm / ext	norm / ext
Results	peak and average power 1) $P_{AV} < 100 \text{ mW}$ (20 dBm) 2) $P_{PK} < 200 \text{ mW}$ (23 dBm) 3) $P_{max} > P_{AV} > P_{min}$ at maximum power step $P_{AV} < 1 \text{ mW}$ (0 dBm)	channel power of all channels 1) $P_{TX}(f) \leq -20 \text{ dBm}$ for $ M-N = 2$ 2) $P_{TX}(f) \leq -40 \text{ dBm}$ for $ M-N \geq 3$	all 8 bit peak deviations and average deviations	carrier offset within the 4 preamble bits	carrier offsets of the 4 bit preamble, of all 10 bit payload sequences; maximum drift rate of all 10 bit payload sequences at 50 μs offset

	EDR Relative TX Power	EDR Carrier Frequency Stability and Modulation Accuracy	EDR Differential Phase Encoding	EDR In-band Spurious Emissions
Hop	off	off	off	off
Trigger	–	–	–	extern/ IF power
Synchronization	yes	yes	yes	yes, needed for gate adjustment
packet Type	longest supported	longest supported	longest supported	longest supported
Payload	PRBS 9	PRBS9	PRBS9	PRBS9
Test Mode	loop back	loop back	TX mode	loop back
Operating Mode	IQ mode	IQ mode	IQ mode	analyzer zero span
RBW	3 MHz	–	–	100 kHz
VBW	3 MHz	–	–	300 kHz
Power	supported minimum/ maximum	supported minimum/ maximum	supported minimum/ maximum	supported minimum/ maximum
Sweep Time	one complete packet	one complete packet	one complete packet	10*79* gate length
Sweep Count	10	200 blocks	100	10
Trace Mode	ClrWr	–	–	Maxh
Detector	Aver	–	–	Aver
Frequency in MHz	low / middle / high	low / middle / high	low / middle / high	each channel
Span	–	–	–	79 MHz
Test cond	norm / ext	norm / ext	norm / ext	norm / ext
Results	ratio of DPSK and GFSK power	carrier frequency stability and error vector magnitude	number of failed packets	channel power of all channels

2.4 Functional Description – Block Diagram

The Adjacent Channel Power and EDR In-band Spurious Emissions measurements are performed in the "Spectrum Analyzer" mode. For this test case the complete frequency band is scanned using a sequence of zero span measurements.

All other test cases are based on a digital I/Q demodulator which determines the temporal characteristics of power and frequency. The output data of the demodulator are the basis for calculation of all relevant measurement results like modulation characteristics or output power. The demodulator reaches a maximum in accuracy and tempera-

ture stability by sampling the IF signal and converting it digitally down into the base band (I/Q area).

The measurements are performed by passing the following signal processing steps:

- LAP (Lower Address Part) trigger detection
- Resampling
- Channel filtering
- Automated packet and bit pattern detection
- Limit check
- Parallel display of measurement curves and numeric results on the screen

The [figure 2-1](#) shows the R&S FSV hardware from the IF to the processor. The analog IF filter is fixed to 20MHz. The A/D converter samples the 20 MHz IF signal with a sampling frequency of 65.83 MHz.

Low pass filtering is performed after the signal has been down-converted into the complex base band and the data rate is reduced in the sequence. The amount of decimation depends on the selected oversampling factor = points / symbol. The default setting is 4, resulting in a 4 MHz sampling rate. For EDR-measurements, the oversampling factor is always fixed to 4. The resulting I/Q data are stored in a memory of 512 k words for I and Q respectively. The hardware trigger (external or IF power) controls the memory access.

Data acquisition hardware

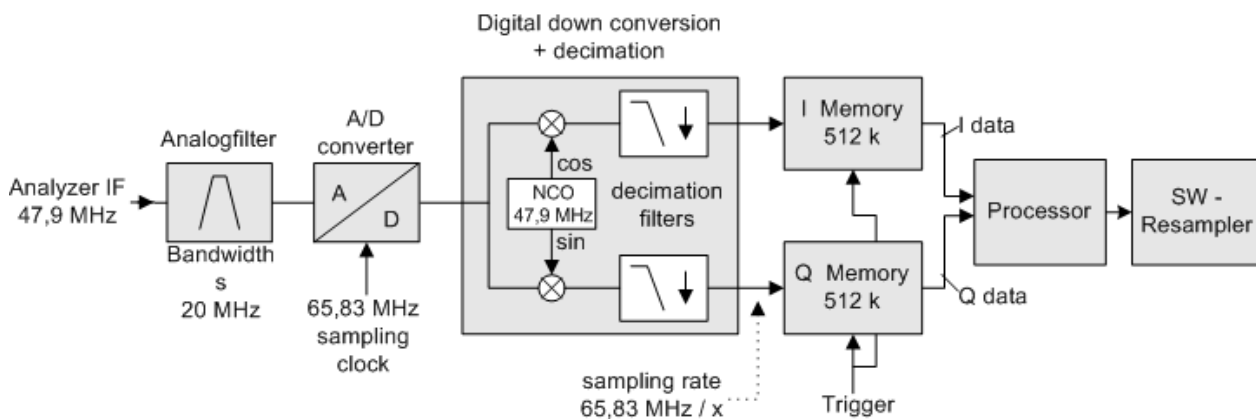


Fig. 2-1: Block diagram of the signal processing architecture of the R&S FSV

2.5 Bandwidths

The Bluetooth RF Specification defines a minimal bandwidth of 3 MHz. The digital bandwidth depends on the selected oversampling factor (= points / symbol). With the default setting of 4, the digital bandwidth is 3 MHz. This digital filter has a flat amplitude characteristics and does not affect the frequency deviation of the signal.

2.6 Measurement Filter (Meas Filter On)

The RF Specification allows high distortion power in the first adjacent channels. The 3 MHz filter does not suppress this kind of distortion, which leads to a high interference in modulation. Therefore a precise measurement of the frequency deviation is not possible.

In order to obtain correct deviation results, the spectrum analyzer supplies an optional filter with a passband only appropriate for the channel to measure. This filter is used by default. The Bluetooth spectrum has a bandwidth of 1 MHz. The filter is flat within 1.04 MHz (ripple: only 0.02 dB) and has steep edges. This measurement filter is not dependent on the selected oversampling factor. As a result the displayed deviation value is increased by 3.2%, but without the filter the displayed deviation value can increase dramatically due to interference from adjacent channels. Generally the result is more precise, if the displayed deviation is lower with filtering than without filtering. In these cases the inaccuracy caused by the adjacent channel interference is higher than the systematic inaccuracy caused by the filter.

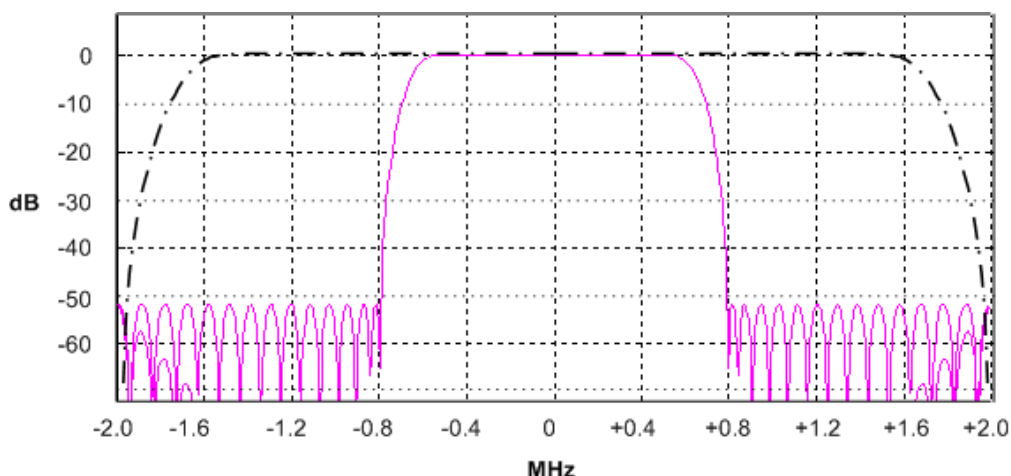


Fig. 2-2: Selection of digital filters

Dashed–dotted curve: Standard filter with 4 points / symbol

Solid curve: Optional measurement filter, independent of the points / symbol setting

2.7 Oversampling

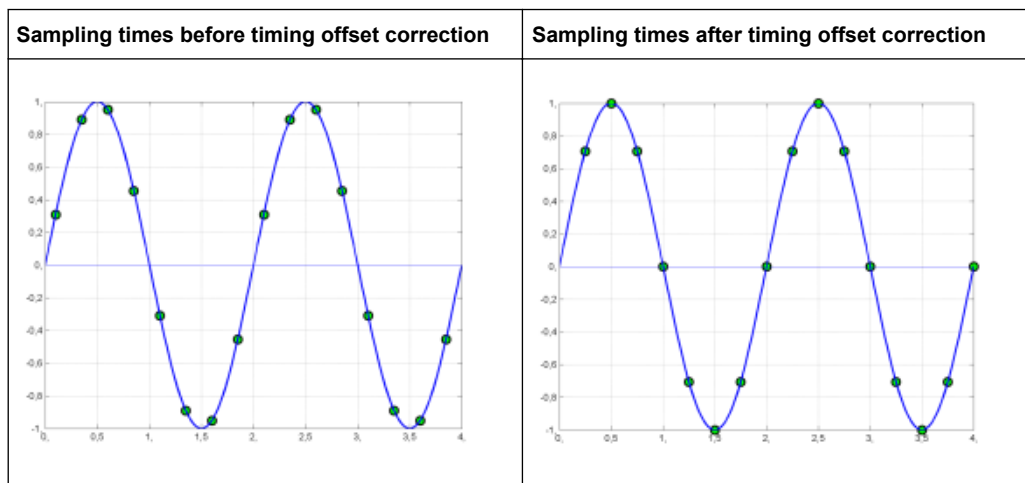
The number of samples per symbol is equivalent to the sampling rate in MHz (due to the symbol length of 1 μ s).

Digital bandwidth (flat area)	Points per Symbol	Sampling rate
10 MHz	32	32 MHz
8 MHz	16	16 MHz
5 MHz	8	8 MHz
3.0 MHz	4	4 MHz
1.6 MHz	2	2 MHz

According to the RF Test Specification an oversampling factor of 4 is required at minimum. For Basic Rate measurements, this oversampling factor can be selected as oversampling factor in a range from 2 to 32. For EDR-measurements, the oversampling factor is fixed to 4 which is also the default value.

Although possible, a value greater than 4 is not recommended. It increases the measurement time due to the extended calculation effort. Additionally, the resulting bandwidth will be larger than required, which leads to lower measurement accuracy, unless the optional measurement filter (Meas Filter On) is used as described in [chapter 2.5, "Bandwidths"](#), on page 15.

The spectrum analyzer uses a timing offset correction in order to move the samples to the zero trespassing points. As a result there is one sample per symbol time, which is especially important for a 0101 symbol sequence in order to obtain the precise value for the peak frequency deviation.



Advantages of the timing offset correction:

- No jitter with low sampling rates
- With one sample per zero, the trespassing point is always a sample in the middle of the bit length. Therefore the maximum values in the frequency deviation of 0101 bit patterns can be detected precisely also with low sampling rates.
- The immunity to interference when determining the data bits is improved.
- Higher suppression of the distortion during peak detection.

2.8 Determining Average or Max/Min Values

These functions are very useful in order to obtain more stable results or to find sporadic spurious signals not included in every burst. In many cases the RF Test Specification defines measurements over a 10 burst period.

The number of measurements can be selected using sweep count function, thus adapting the measurement to the individual requirements. In single sweep mode, the calculation of average or maximum / minimum values is performed over a well-defined number of sweeps (= sweep count). Continuous sweep mode yields continuous averaging and calculation of maximum / minimum values over the whole measurement time.

Modulation measurements

They are performed in the "Clear Write" trace mode. In continuous sweep mode, a "live" display is obtained, which allows e.g. an instant view of changes during alignment of a DUT. In single sweep mode and with the sweep count set to 10, the spectrum analyzer evaluates 10 bursts as required by the RF Test Specification. This means that a result is obtained after exactly 10 bursts.

Power measurements

They are performed in the "Maxhold" trace mode in relation with the defined measurement time. The measurement time is selected in order to make sure that always one complete burst is acquired. In this case, several sweeps are combined to one trace before this result trace is evaluated.

Impact of the sweep count on the measurement results

Trace Mode	Continuous Sweep	Single Sweep & Sweep Count
Clear Write	All measurement results (min., max., average) are updated with every sweep. The corresponding values are calculated based on the current curve.	Starts a measurement with n sweeps (n = sweep count). All measurement results (min., max., average) are calculated based on these n sweeps.
AVG, MaxHold, MinHold	All measurement results (min., max., average) are updated with every sweep. The corresponding values are calculated based on the current curve. The trace is the continuous average value (AVG) or the extreme value (MaxHold, MinHold) since the start of the measurement.	Starts a measurement with n sweeps (n = sweep count). n defines the number of sweeps that are taken into account for the trace math functions (AVG, MaxHold, MinHold). The n sweeps result in one trace and the measurement results (Min, Max, Average) are calculated based on this summarized trace.

The functions described above differ from the detector functions of the instrument:

- Detectors combine the measurement data obtained by oversampling to one measurement point on the screen. The kind of combination (Max Peak, Min Peak, Average, RMS) can be selected.

- The trace functions affect complete measurement curves: A resulting curve is calculated from several subsequent sweeps. The method of calculation (Average, Maxhold, Minhold) can be selected here as well.

Thus the detector is the arithmetic rule for how sample data collected with a high data rate are combined to a measurement point of one individual measurement curve, whereas the trace mode is the rule of how samples taken from several measurement curves are to be combined to a new resulting curve.

For the ACP measurement, the "Average" detector is set.

2.9 Trigger Concepts

As the DUT (Device Under Test) uses frequency hopping, a trigger method is necessary for two reasons:

- A measurement is only possible during the period of time, when there is a TX signal (burst) at the frequency under request.
- In order to determine the modulation characteristics correctly, a synchronization with the preamble of the signal must be supplied.

If the "Find Sync" softkey is activated, the synchronization is supplied towards the 64 bit sync word. For this purpose, in a first step a burst is searched automatically within the RF signal, or, if selected, the external trigger or the IF power trigger are used to determine the burst position.

In a second step the sync word position is searched by correlation of the signal with the sync word defined in the initialization phase. The correlation is performed directly with the FM signal, not with the data bits, which are only available after the phase shifter has been processed. The find burst process is continued as long as no sync word is found.

After the position of the sync word has been determined, the position of the p0 bit is calculated from the average value of all zero trespassing points, as defined in the RF test specification. Finally the samples are moved in a way that each sample matches one zero trespassing point (phase shifting).

The only measurement possible without synchronization is the Output Power measurement. The specified measurement time is 20% to 80% of the burst length. Without synchronization the burst length is defined via the -3dB points of the power curve. With synchronization the burst starts with the p0 bit. Therefore varying measurement results is possible if the power of the EUT is not constant within the burst.

In order to supply stable synchronization the EUT must be operated in reduced hopping mode. The EUT is only allowed to toggle between two frequencies, because otherwise the repetition time for the same frequency would become higher than the record length. If the test environment supplies an external trigger that marks the channel to be measured a synchronization is also possible with normal hopping operation.

3 Instrument Functions for Bluetooth Measurements (K8)

This option provides measurements to test the conformity of signal sources to the Bluetooth RF Test Specification (Bluetooth SIG).

For background information on Bluetooth measurements refer to [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10.

To open the Bluetooth menu

- If the "Bluetooth" mode is not the active measurement mode, press the MODE key and activate the "Bluetooth" option.
If the "Bluetooth" mode is already active, press the MENU key.
The "Bluetooth" menu is displayed.

Menu and softkey description

The following softkey menus are specific to the R&S FSV-K8 option and are described here:

- [chapter 3.3, "Softkeys of the Bluetooth Menu"](#), on page 34
- [chapter 3.4, "Softkeys of the MEAS CONFIG menu"](#), on page 49
- [chapter 3.7, "Softkeys of the Frequency Menu \(option R&S FSV-K8\)"](#), on page 55
- [chapter 3.5, "Softkeys of the Amplitude Menu \(Bluetooth Mode\)"](#), on page 49
- [chapter 3.6, "Softkeys of the Bandwidth Menu \(option R&S FSV-K8\)"](#), on page 53
- [chapter 3.8, "Softkeys of the Sweep Menu \(Bluetooth mode\)"](#), on page 56
- [chapter 3.9, "Softkeys of the Trigger Menu \(Option R&S FSV-K8\)"](#), on page 60

The span menu is not available in the "Bluetooth" mode. All other menus are provided as described for the base unit. For details refer to the corresponding menu descriptions.

To display help to a softkey, press the HELP key and then the softkey for which you want to display help. To close the help window, press the ESC key. For further information refer to [chapter 1.3, "How to Use the Help System"](#), on page 8.

Tasks

- [chapter 3.2, "Adapting the settings to the characteristics of the DUT"](#), on page 33

Measurement settings

Various measurement types are available with the Bluetooth option, see [chapter 3.1, "Measurement Types and Result Display"](#), on page 22.

The basic parameter settings are described in [chapter 3.2, "Adapting the settings to the characteristics of the DUT"](#), on page 33. The settings that can be configured individually for each measurement are the following:

- RBW (the IF bandwidth set up for modulation measurements is valid for all measurements)
- VBW
- RBW auto mode
- VBW auto mode
- trace mode
- detector
- sweep count
- sweep time auto mode
- sweep time

They are available in the corresponding menus as soon as the corresponding measurement is selected. Changes to these settings are always related to the selected measurement. The settings defined in the RF Test Specification can thus be modified individually for development or production. By using the start recall function, the individual configuration of the various tests can be preserved over a preset.

Position of a Bluetooth burst

The RF Test Specification allows different methods to determine the position of a Bluetooth burst:

- The burst is defined by the p0 bit and the automatically determined packet length ("Find Sync On").
- The burst is defined by the two 3dB points ("Find Sync Off" and "Find Burst On"). The search of the 3dB points is defined in the RF Test Specification as the alternative method compared with the p0 bit method.

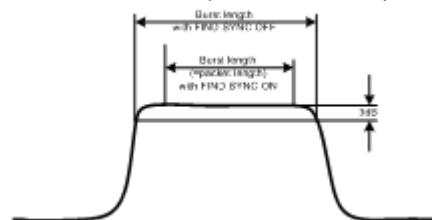


Fig. 3-1: Definition of a Bluetooth burst

Labels used in the measurement displays

- Enhancement label "TDF"

Offset values, set with the "Antenna Gain" softkey, that are larger or smaller than 0 dB activate the enhancement label "TDF" at the right diagram border.

3.1 Measurement Types and Result Display

The Bluetooth Measurements option provides various measurement types. The measurements and the corresponding result display are described in the following chapters. Generally, a diagram and a table with the main results are displayed.

For each measurement, the results are compared to the selected standard. If the results match the standard, the status is indicated as "Passed". If one of the results does not match the standard, that value is displayed in red, and the status of the measurement is indicated as "Failed".

3.1.1	Output Power Measurement.....	22
3.1.2	Adjacent Channel Power Measurement.....	24
3.1.3	Modulation Characteristics Measurement.....	25
3.1.4	Initial Carrier Frequency Tolerance Measurement.....	26
3.1.5	Carrier Frequency Drift Measurement.....	27
3.1.6	Relative Transmit Power (EDR) Measurement.....	28
3.1.7	In-band Spurious Emissions (EDR) measurement.....	29
3.1.8	Carrier Frequency Stability and Modulation Accuracy (EDR) measurement.....	31
3.1.9	Differential Phase Encoding (EDR) measurement.....	32

3.1.1 Output Power Measurement

The Output Power measurement ([Output Power](#) softkey) determines the maximum and average output power during a burst of the equipment under test (EUT). For this purpose a complete packet is recorded in the time domain.

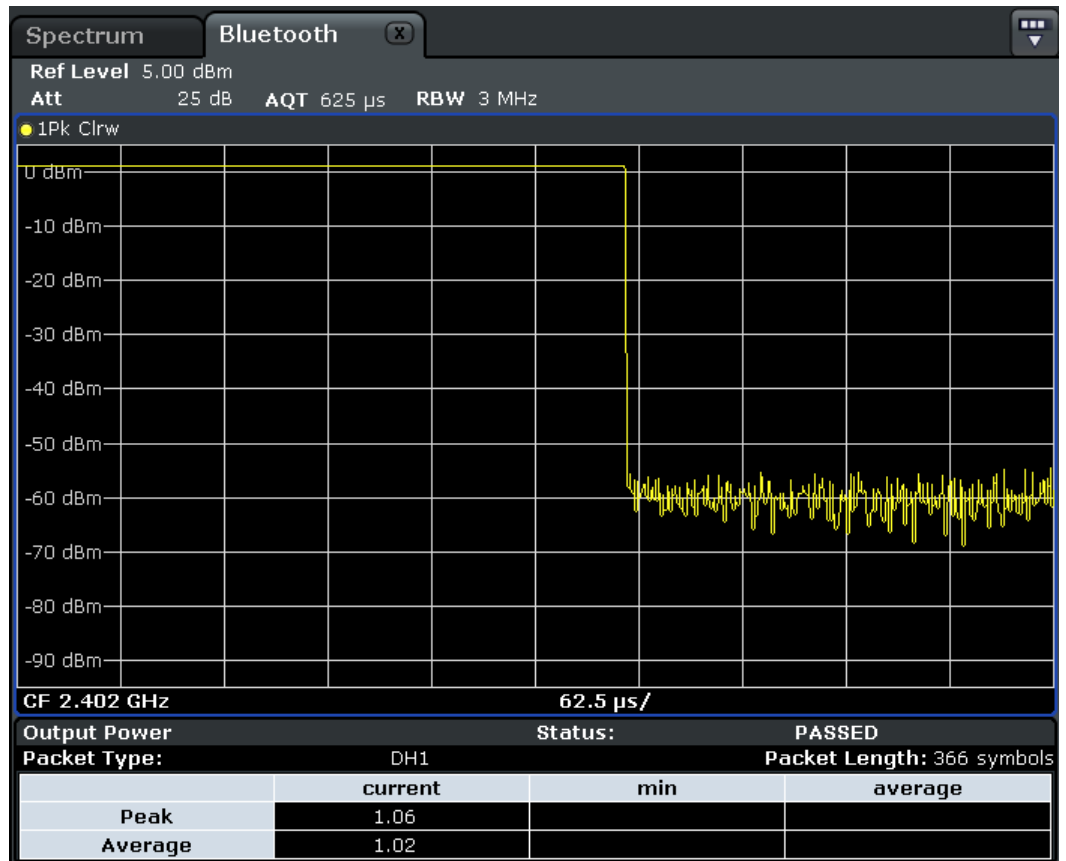


Fig. 3-2: Output power measurement

The peak value is determined from the complete contents of the measurement trace, whereas the average power is calculated from an area of at least 20% to 80% of the burst.

During the Output Power measurement the Bluetooth demodulator is active in order to determine the sync word within the signal, which is used as the trigger basis later. The Bluetooth demodulator is placed in a signal path without video filter. This is why the video filter cannot be activated with the Output Power measurement.

The EUT (equipment under test) must not exceed the following limits according to the RF Test Specification:

- $P_{AV} < 100 \text{ mW}$ (20 dBm) EIRP
- $P_{PK} < 200 \text{ mW}$ (23 dBm) EIRP
- If the EUT conforms to power class 1: $P_{AV} > 1 \text{ mW}$ (0 dBm)
- If the EUT conforms to power class 2: 0.25 mW (-6 dBm) $< P_{AV} < 2.5 \text{ mW}$ (4 dBm)
- If the EUT conforms to power class 3: $P_{AV} < 1 \text{ mW}$ (0 dBm)

A violation of these limits is marked on the screen in red color.

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Packet type
- Packet length
- Peak power (current packet value, minimum and average values of all previous and current packets)
- Average power (current packet value, minimum and average values of all previous and current packets)

3.1.2 Adjacent Channel Power Measurement

The measurement of the TX Output Spectrum – Adjacent Channel Power measurement (TX Spec ACLR softkey) measures the power of all adjacent channels.

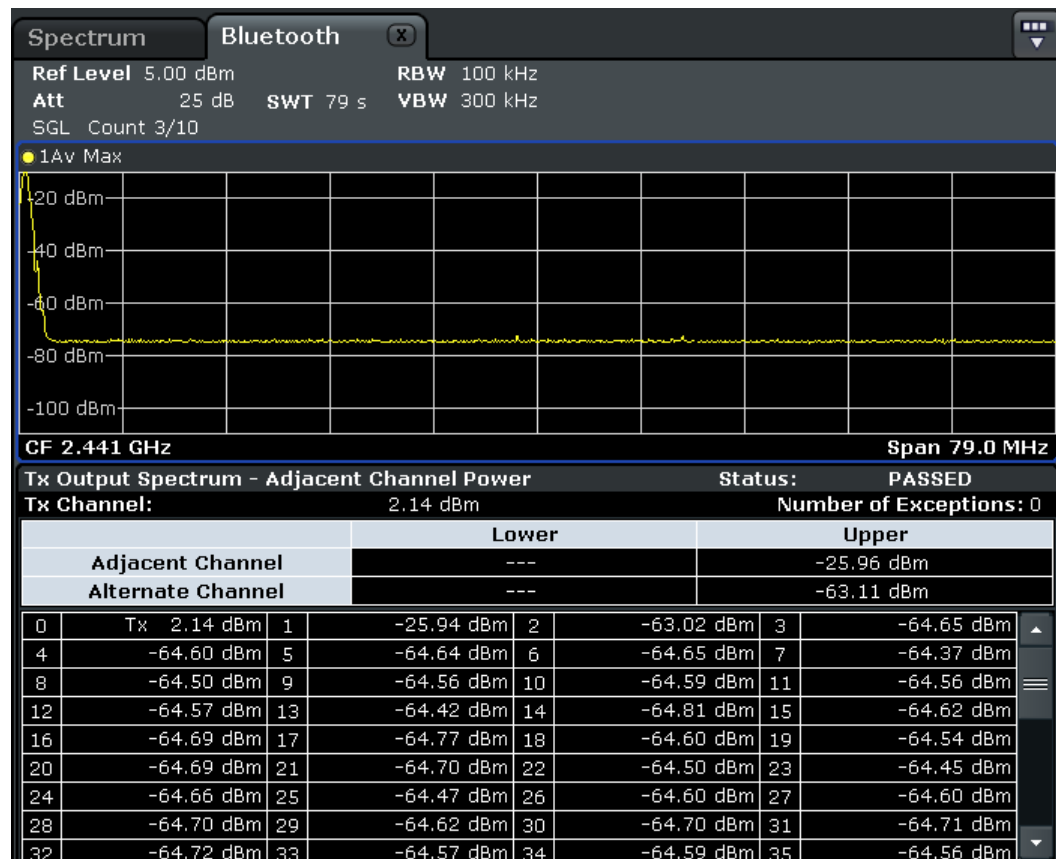


Fig. 3-3: TX Spectrum ACP measurement

The following limits are given by the RF Test Specification:

- $P_{TX}(f) \leq -20$ dBm for $|M-N| = 2$
- $P_{TX}(f) \leq -40$ dBm for $|M-N| \geq 3$

with M = Transmit channel of the equipment under test, N = adjacent channel to be measured. A violation of these limits is indicated on the screen by red color and an asterisk (*).

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Tx channel
- Number of Exceptions
- Lower and upper adjacent channel
- Lower and upper alternate channel
- Channel power for each channel

3.1.3 Modulation Characteristics Measurement

The measurement of the modulation characteristics ([Modulation Char](#) softkey) determines the maximum frequency deviation of all 8 bit sequences of the payload.

Additionally the average value of the maximum frequency deviation of a packet is calculated. Thus, the equipment under test is configured such that packets with bit patterns "11110000" and "10101010" are transmitted alternately. According to the RF Test Specification this sequence has to be repeated 10 times.

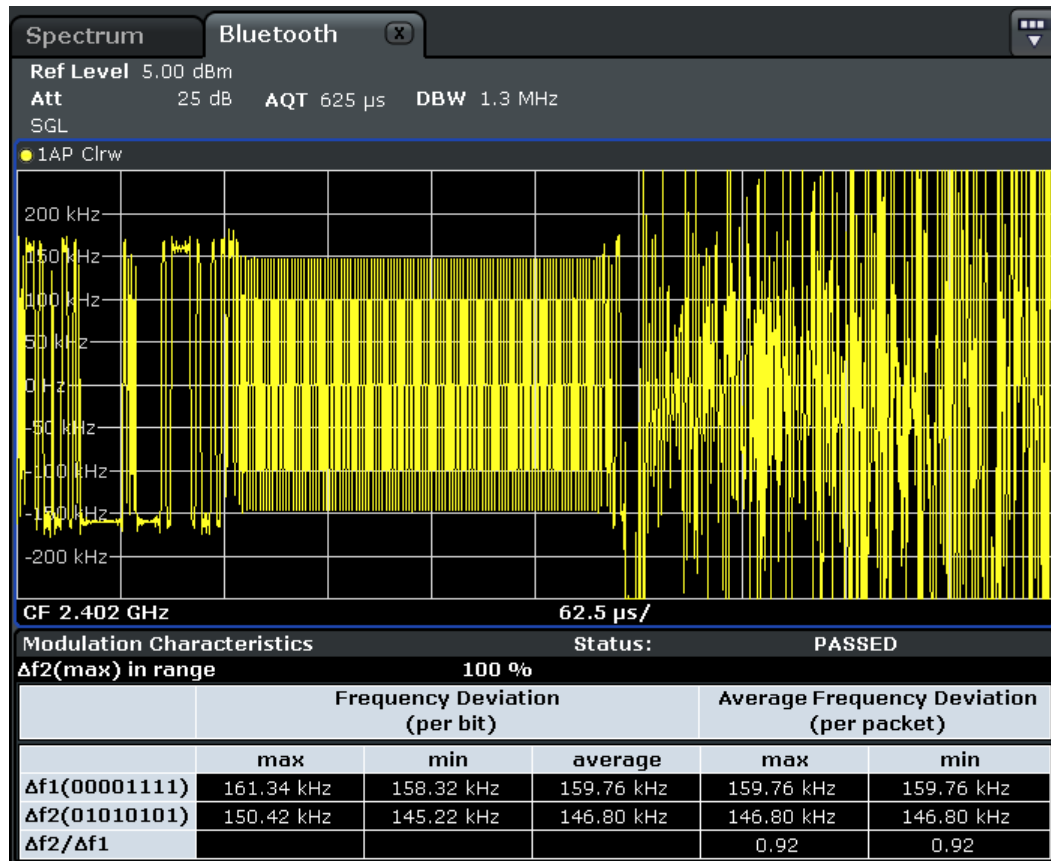


Fig. 3-4: Modulation Characteristics measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

Label	Description
$\Delta f_2(\text{max})$ in range	Maximum frequency deviation in range
Frequency Deviation (per bit)	Maximum, minimum and average frequency deviation per bit
Average Frequency Deviation (per packet)	Minimum and maximum average frequency deviation per packet
$\Delta f_1(00001111)$	Frequency deviation for bit pattern "00001111"
$\Delta f_2(01010101)$	Frequency deviation for bit pattern "01010101"
$\Delta f_2/\Delta f_1$	Ratio of the frequency deviations of both patterns

3.1.4 Initial Carrier Frequency Tolerance Measurement

The measurement of the Initial Carrier Frequency Tolerance ([Init Carr Freq Tol](#) softkey) determines the carrier offset of the four preamble bits. According to the RF Test Speci-

fication the calculation of the carrier offset is performed from the middle of the first preamble bit to the middle of the bit following the preamble.

With "Clear/Write" trace mode and single sweep operation the selected number of sweeps is processed and, according to the RF Test Specification, the results of all sweeps are compared with the defined tolerance. If a different trace mode is selected, alternatively, the analyzer can combine several traces and determine the measurement results from the resulting trace.

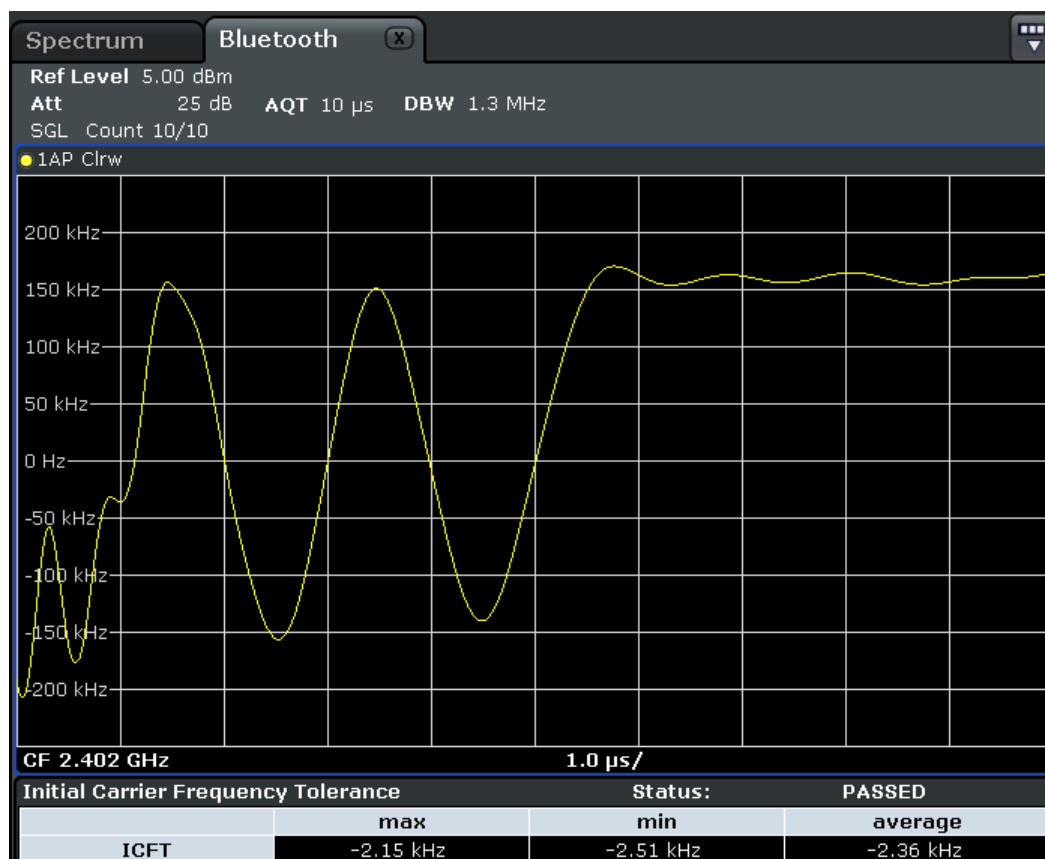


Fig. 3-5: Initial Carrier Frequency Tolerance measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Maximum, minimum and average initial carrier frequency tolerance

3.1.5 Carrier Frequency Drift Measurement

The measurement of the Carrier Frequency Drift ([Carr Freq Drift](#) softkey) determines the maximum frequency drift between the average value of the preamble bits and any 10 bit group of the payload. Additionally, the maximum drift rate between all 10 bit groups in the payload is determined every 50μs.

With "Clear/Write" trace mode and single sweep operation the selected number of sweeps is processed and, according to the RF Test Specification, the results of all sweeps are compared with the defined tolerance. If a different trace mode is selected, alternatively, the analyzer can combine several traces and determine the measurement results from the resulting trace.

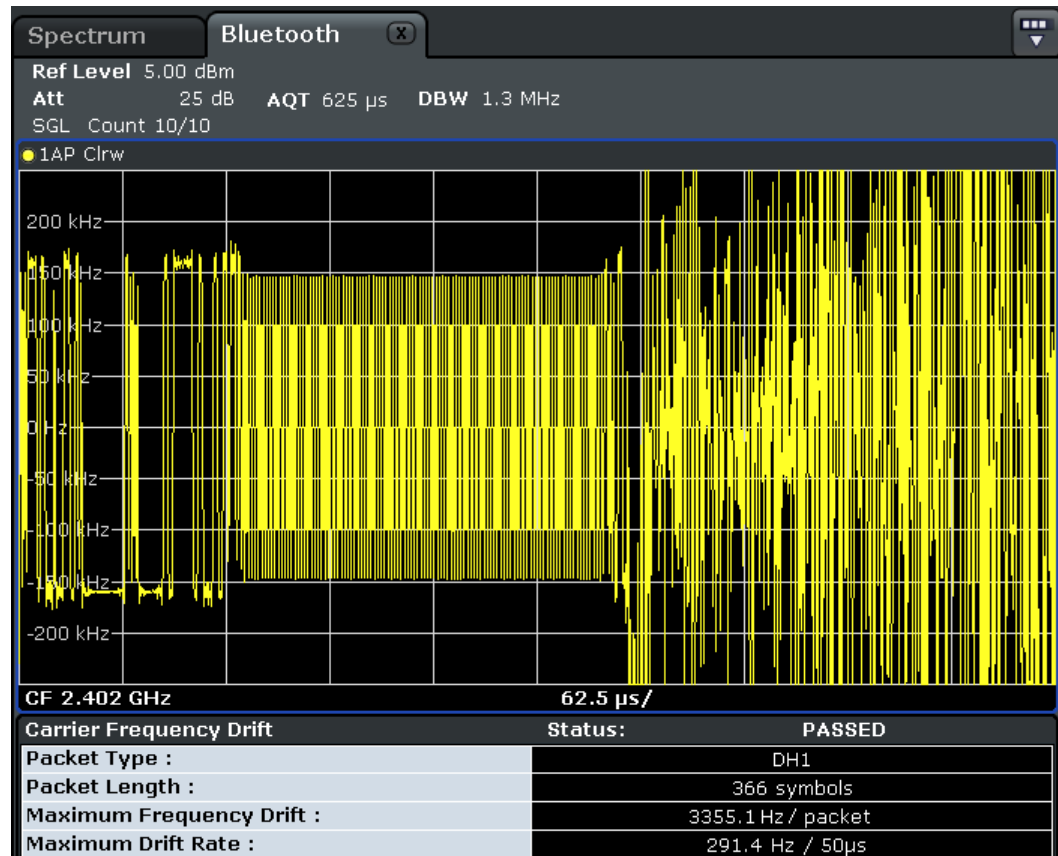


Fig. 3-6: Carrier Frequency Drift measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Packet type
- Packet length in symbols
- Maximum frequency drift per packet
- Maximum drift rate per 50 µs interval

3.1.6 Relative Transmit Power (EDR) Measurement

The measurement of the Relative Transmit Power ([Rel TX Power](#) softkey) is an enhanced data rate measurement (EDR). It determines the average transmission

power of the GFSK and DPSK modulated parts of the signal and calculates the ratio of those values.

The measurement results must conform to the requirement:

- $(P_{\text{GFSK}} - 4\text{dB}) < P_{\text{DPSK}} < (P_{\text{GFSK}} + 1\text{dB})$

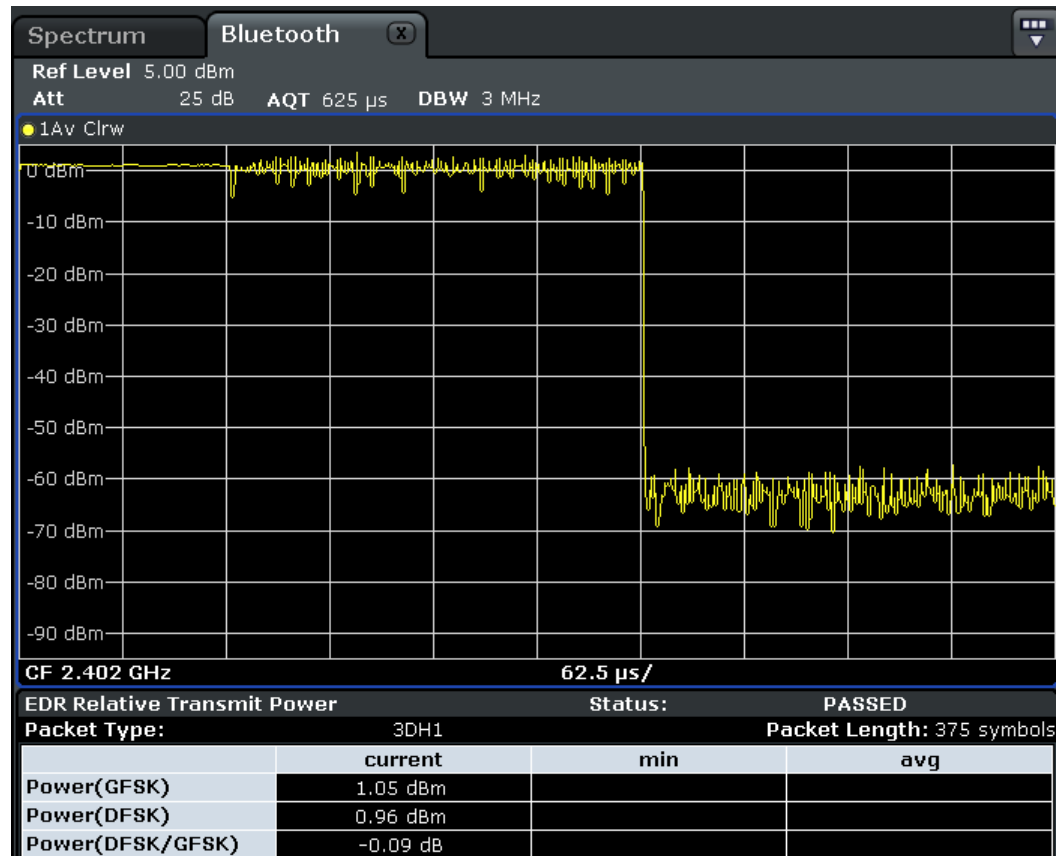


Fig. 3-7: Relative Transmit Power (EDR) measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Packet type
- Packet length in symbols
- Maximum, minimum and average power of the GFSK modulated part
- Maximum, minimum and average power of the DFSK modulated part
- Maximum, minimum and average ratio of the two powers

3.1.7 In-band Spurious Emissions (EDR) measurement

The measurement of the In-band Spurious Emissions ([Spurious Emissions](#) softkey) is an enhanced data rate measurement (EDR). It verifies whether the level of unwanted

signals within the used frequency band lies below the required level. The analyzer records the signal only in those parts of the signal in which the instrument transmits DPSK-modulated data.

The signal must meet the following conditions:

- $P_{TX}(f) \leq -20 \text{ dBm}$ for $|M-N| = 2$
- $P_{TX}(f) \leq -40 \text{ dBm}$ for $|M-N| \geq 3$
with $M =$ transmit channel of the equipment under test, $N =$ adjacent channel to be measured
- The adjacent channel power between 1 MHz and 1.5 MHz from the carrier (Adj500kHz Low/Up) shall be at least 26 dB below the maximum power of the carrier (TX Channel (Ref)).

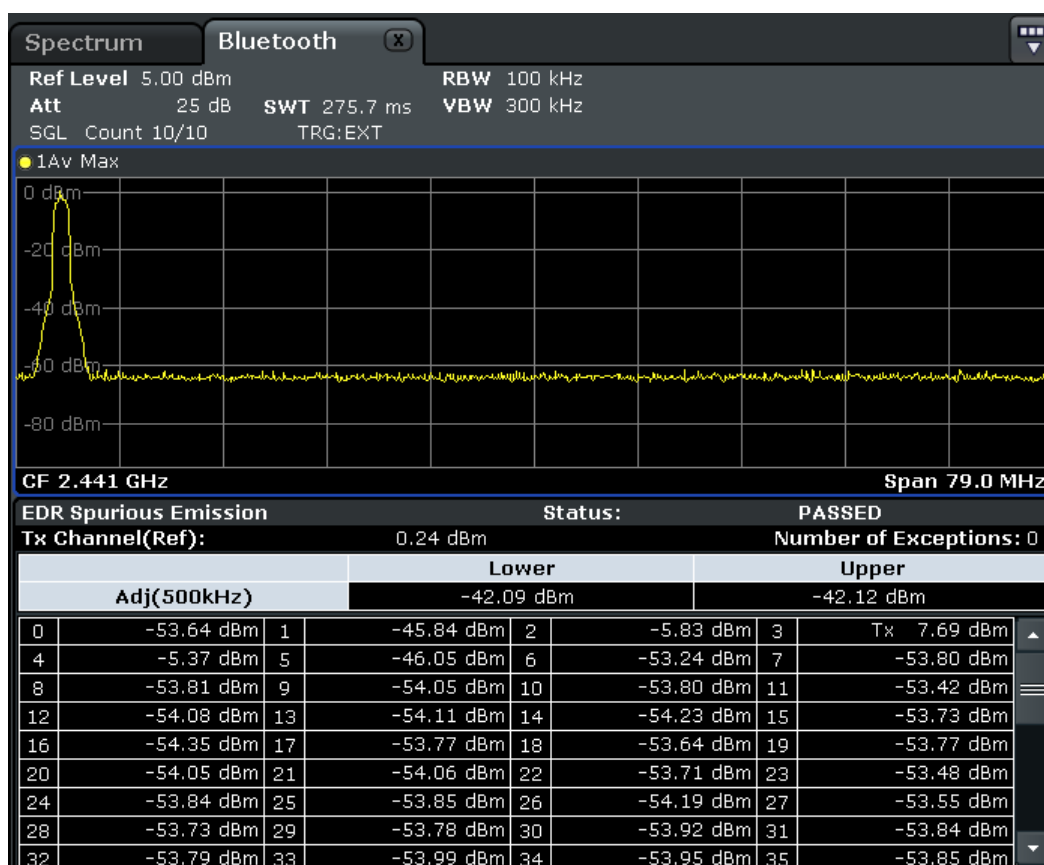


Fig. 3-8: In-band Spurious Emissions (EDR) measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Upper and lower adjacent channels (500 kHz from the carrier)
- Power level for each channel

3.1.8 Carrier Frequency Stability and Modulation Accuracy (EDR) measurement

The measurement of the Carrier Frequency Stability and Modulation Accuracy (**Carr Freq Stability** softkey) is an enhanced data rate measurement (EDR). It verifies that the modulation accuracy and the frequency stability are within the required limits. According to the RF Test Specification, the software records 200 blocks, each with a length of 50 μs for the evaluation. The number of blocks to be recorded can be changed using the **Block Count (Carr Freq Stability)** softkey.

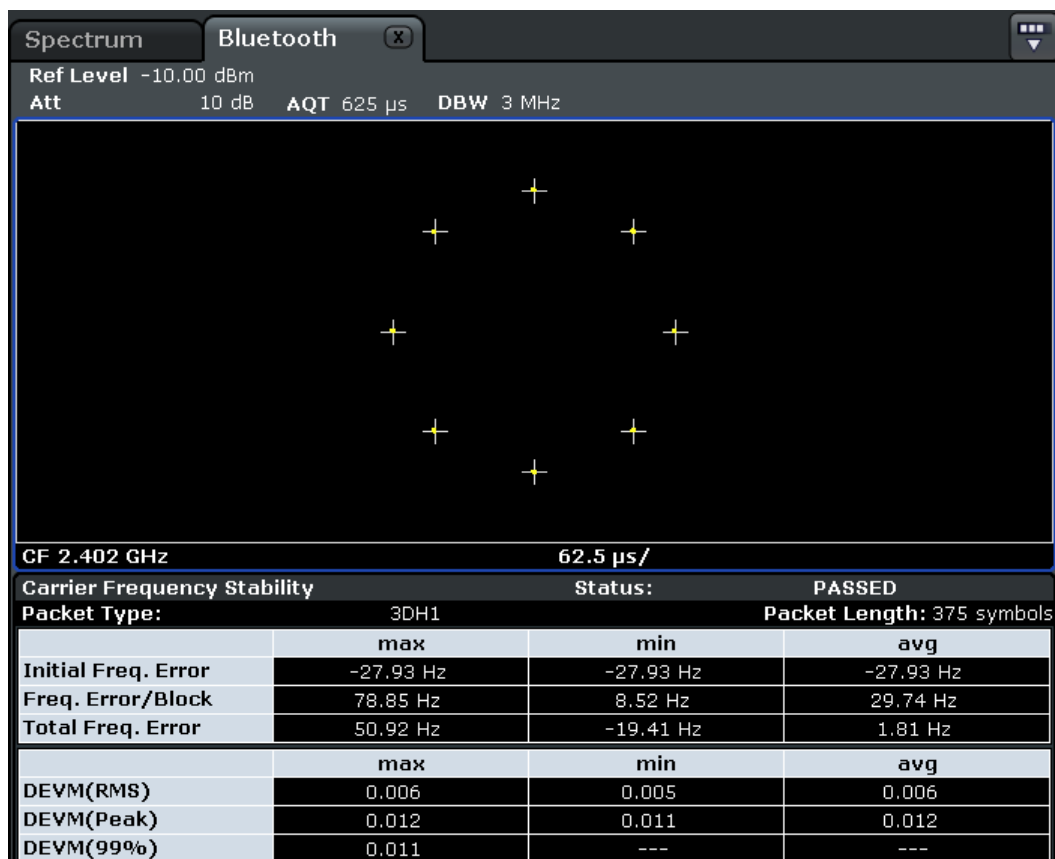


Fig. 3-9: Carrier Frequency Stability and Modulation Accuracy (EDR) measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

Label	Description
Packet Type	Packet type
Packet Length	Packet length in symbols
Initial Freq. Error	Minimum, maximum and average error in the initial frequency

Label	Description
Freq.Error/Block	Minimum, maximum and average frequency error per block
Total Freq. Error	Minimum, maximum and average frequency error per block + initial frequency error
DEVm (RMS)	Differential error vector magnitude as RMS value
DEVm (Peak)	Peak differential error vector magnitude
DEVm (99%)	99-percentile of differential error vector magnitude

3.1.9 Differential Phase Encoding (EDR) measurement

The measurement of the Differential Phase Encoding (**Diff Phase** softkey) is an enhanced data rate measurement (EDR). It checks whether the instrument modulates the data correctly in the time range of the DPSK modulation. Correct modulation is assumed if a specific bit pattern (PRBS9) is received from the sender. For each packet, this pattern is checked and each positive test result is counted.

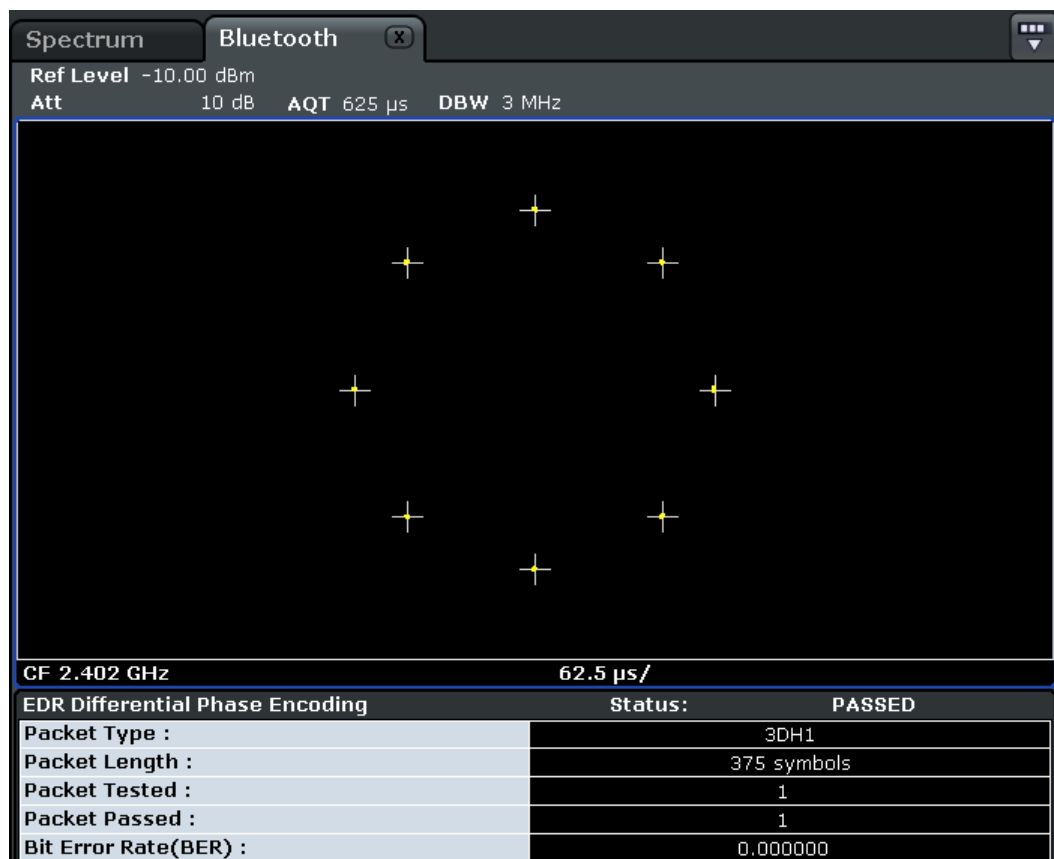


Fig. 3-10: Differential Phase Encoding (EDR) measurement

Result Summary

The results of the measurement are summarized in a table beneath the diagram. The summary contains the following results:

- Packet type
- Packet length in symbols
- Packet tested (Number of tested packets)
- Packet passed (Number of successful tests, i.e. correctly modulated packets)
- Bit error rate

3.2 Adapting the settings to the characteristics of the DUT

1. Set the spectrum analyzer to its default state.
 - a) Press "PRESET".
The R&S FSV is set to its default state.
2. Select the Bluetooth operating mode.
 - a) Press "MODE" key.
 - b) In the "Measurement Modes" dialog box, select "Bluetooth".
The "Bluetooth" mode is activated and the main menu of the option is displayed.
3. Select the required measurement type to be performed.
 - a) Press "Standard" and select the required standard.
 - b) Press the softkey for the required measurement type.
The measurement configuration menu is displayed.
4. Select the transmit channel.
 - a) Press "Channel" softkey and enter the desired channel number.
5. Select the packet type and power class.
 - a) Press "Meas Setup".
The "Meas Setup Settings" dialog box is displayed.
 - b) Select the desired packet type.
 - c) Select the power class of the DUT.
 - d) Press "Close".
6. Configure the sync settings (LAP).
 - a) Press "Find Sync" softkey.
The "Find Sync" dialog box is displayed.
 - b) Enter the "LAP (lower address part)" of the Bluetooth device address of the DUT. The sync word used for the sync search is calculated.

7. Configure measurement time, measurement control and the number of measurement cycles by pressing the corresponding softkeys. For further information refer to [chapter 3.8, "Softkeys of the Sweep Menu \(Bluetooth mode\)"](#), on page 56.

3.3 Softkeys of the Bluetooth Menu

The following softkeys and settings are available in the main "Bluetooth" menu which is displayed when you select the "Bluetooth" mode. The same menu is also displayed when "Bluetooth" mode is selected and you press the MEAS or HOME key.

Standard.....	35
Output Power.....	35
L Channel.....	36
L Meas Setup.....	36
L Packet Type.....	36
L Packet Bytes SCO.....	37
L Power Class.....	37
L Points / Symbol.....	37
L Antenna Gain.....	37
L Selected Trace.....	37
L Find Sync.....	37
L LAP.....	37
L Find Sync On/Off.....	38
L Sync Offset.....	38
L Find Burst On/Off (Output Power).....	38
L Burst Offset.....	39
L Search Len Auto.....	39
L Search Len Manual.....	40
L Power Avg Start (Output Power).....	40
L Power Avg Stop (Output Power).....	40
TX Spec ACLR.....	40
L Channel.....	41
L Meas Setup.....	41
L Find Sync.....	41
L No. of ACP Chan (TX Spec ACLR, Spurious Emissions).....	41
Modulation Char.....	41
L Channel.....	42
L Meas Setup.....	42
L Find Sync.....	42
L Start Test (Modulation Char).....	42
L Continue Test (Modulation Char).....	42
L Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift).....	42
Init Carr Freq Tol.....	43
L Channel.....	43
L Meas Setup.....	43
L Find Sync.....	43
L Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift).....	43
Carr Freq Drift.....	43

L Channel.....	43
L Meas Setup.....	44
L Find Sync.....	44
L Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift).....	44
Rel TX Power.....	44
L Channel.....	44
L Meas Setup.....	44
L Find Sync.....	45
L Settings.....	45
L GFSK Start.....	45
L GFSK Stop.....	45
L DPSK Start.....	45
L DPSK Stop.....	45
Spurious Emissions.....	46
L Channel.....	46
L Meas Setup.....	46
L Find Sync.....	46
L No. of ACP Chan (TX Spec ACLR, Spurious Emissions).....	46
L Gate Delay (Spurious Emissions).....	47
L Gate Length (Spurious Emissions).....	47
L Adjust Gate.....	47
Carr Freq Stability.....	47
L Channel.....	47
L Meas Setup.....	48
L Find Sync.....	48
L Block Count (Carr Freq Stability).....	48
Diff Phase.....	48
L Channel.....	48
L Meas Setup.....	48
L Find Sync.....	48

Standard

Opens a dialog box to select the standard by which the Bluetooth measurements are performed.

Currently, the following standards are supported:

- Bluetooth 2.1 - Base Rate
- Bluetooth 2.1 - EDR

Depending on the selected standard, different measurement types are available via softkeys.

Output Power

Opens a submenu to configure the Output Power measurement. For further details refer to [chapter 3.1.1, "Output Power Measurement"](#), on page 22.

Remote command:

CONF:BT0:MEAS OPOW, see [CONFigure:BT0oth:MEASurement](#) on page 96

CALCulate<n>:BT0oth:OPOWer[:PEAK]? on page 83

CALCulate<n>:BT0oth:OPOWer:AVERAge? on page 83

Channel ← Output Power

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

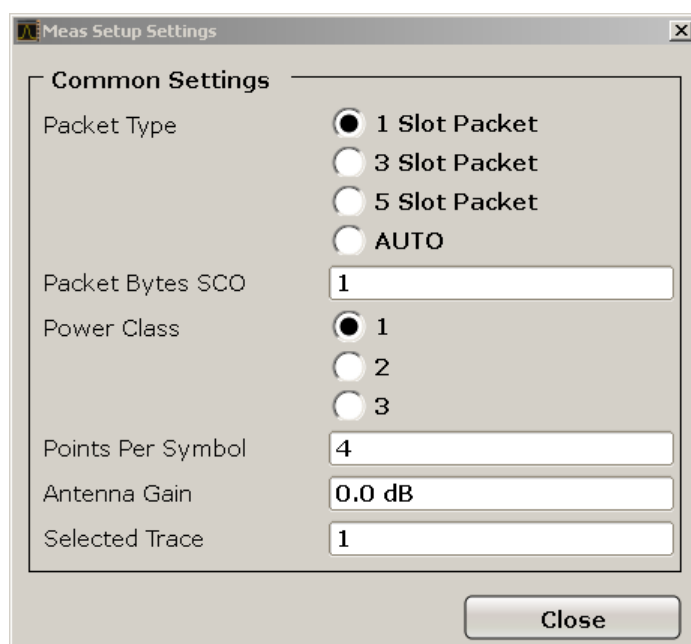
Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Output Power

Opens a dialog box for common measurement settings.

**Packet Type ← Meas Setup ← Output Power**

Defines the number of occupied slots in the sent packet.

The number of occupied slots is used for the automatic calculation of the sweep time ([Sweptime Auto \(TX Spec ACLR\)](#) softkey) and the search length of the sync word ([Search Len Auto](#) setting).

The currently transmitted packet type is determined automatically by the Bluetooth demodulator (which means that the selected packet type need not necessarily correspond to the actually transmitted packet type; it will only affect the settings for sweep time and search length as described above).

"DH 1" 1 slot packet (default)
 "DH 3" 3 slot packet
 "DH 5 | AUTO" 5 slot packet

Remote command:

[CONFigure:BT0oth:PTYPe](#) on page 100

Packet Bytes SCO ← Meas Setup ← Output Power

Defines the number of payload bytes that are transmitted in a packet. For SCO packets, the payload length must be adjusted because those packets have no payload header.

Remote command:

`CONFigure:BT0oth:PBSCo` on page 98

Power Class ← Meas Setup ← Output Power

Selects one of the Bluetooth power classes (1 to 3). The selection of the power class determines the limits. The default setting is power class 1 (100 mW).

Remote command:

`CONFigure:BT0oth:PCLass` on page 98

Points / Symbol ← Meas Setup ← Output Power

Defines the number of measurement samples per symbol. For Basic Rate measurements, the possible values are 2, 4, 8, 16, 32. The default value is 4. For EDR measurements, the default value is set and cannot be changed.

The RF Test Specification requests an oversampling factor of at least 4. With this oversampling factor a 5 Slot Packet corresponds to 12500 measurement samples (= 2500 samples / slot).

Remote command:

`CONFigure:BT0oth:PRATe` on page 99

Antenna Gain ← Meas Setup ← Output Power

Defines a level offset in order to take the gain of an antenna into account for displaying power values. The default setting is 0 dB. Offset values that are larger or smaller than 0 dB activate the enhancement label "TDF" at the right diagram border.

Remote command:

`[SENSe:]CORRection:EGain:INPut[:MAGNitude]` on page 115

Selected Trace ← Meas Setup ← Output Power

Selects the measurement trace whose numeric results are displayed in the table below the diagram. By default, trace 1 is selected.

Remote command:

`CONFigure:BT0oth:TRACe<t>:SElect` on page 104

Find Sync ← Output Power

Opens a dialog box to set the signal processing functions of the analyzer. They are necessary to determine the position of the first preamble bit p_0 by correlation with the sync word. Thus, a sufficient record length of the FM demodulated signal is necessary.

For further information refer to "Position of a Bluetooth burst" in [chapter 3, "Instrument Functions for Bluetooth Measurements \(K8\)"](#), on page 20.

LAP ← Find Sync ← Output Power

Defines the lower 24 bit Lower Address Part (LAP) of the Bluetooth Device Address (BD_ADDR) of the equipment under test (EUT).

The LAP is used to calculate the 64-bit sync word. The sync word in return is used to determine the start of a packet by correlation and to determine the position of the first preamble bit p_0 using the method described in the RF Test Specification.

The values for the lower address part range from 000000h to FFFFFFFh. The default setting is 000000h.

Remote command:

[SENSe:] DDEMod:SEARCh:SYNC:LAP on page 122

Find Sync On/Off ← Find Sync ← Output Power

Activates or deactivates the search of the sync word. The default setting is activated.

The results of the modulation measurements Modulation Characteristics, Initial Carrier Frequency Tolerance, Carrier Frequency Drift can only be calculated if the softkey is activated. The measurement of the Output Power can be performed with either this softkey or the Find Burst On/Off softkey activated. If both softkeys are activated, the search area for the sync word will be limited to the area of the detected burst. If the Find Burst On/Off softkey is not activated or no burst is identified, the total record length (search length) is investigated.

Remote command:

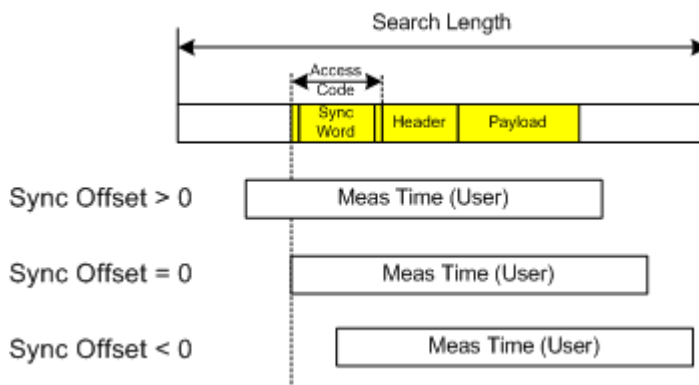
[SENSe:] DDEMod:SEARCh:SYNC:STATe on page 121

Sync Offset ← Find Sync ← Output Power

Defines the number of bits to be displayed in front of the of the first preamble bit p_0 . If the sync word is identified, but the selected measurement time cannot be displayed due to the selected sync offset, the message "SYNC OFFSET INVALID" is displayed.

The value range depends on the search length and the upper limit of symbols (400001 points / symbol). The default setting for the sync offset is 0.

This softkey is only available if the [Find Sync On/Off](#) softkey is activated.



Remote command:

[SENSe:] DDEMod:SEARCh:SYNC:OFFSet on page 122

Find Burst On/Off (Output Power) ← Find Sync ← Output Power

Activates the burst search if the [Find Sync On/Off](#) softkey is deactivated. Beside the synchronization on the sync word, the Output Power measurement can perform a burst search to evaluate the signal according to the standard.

If the **Find Sync On/Off** softkey is not activated and no burst is identified, the message "BURST NOT FOUND" is displayed, and the corresponding bit in the `STATUS:QUESTIONABLE:SYNC` register is set during remote operation.

Remote command:

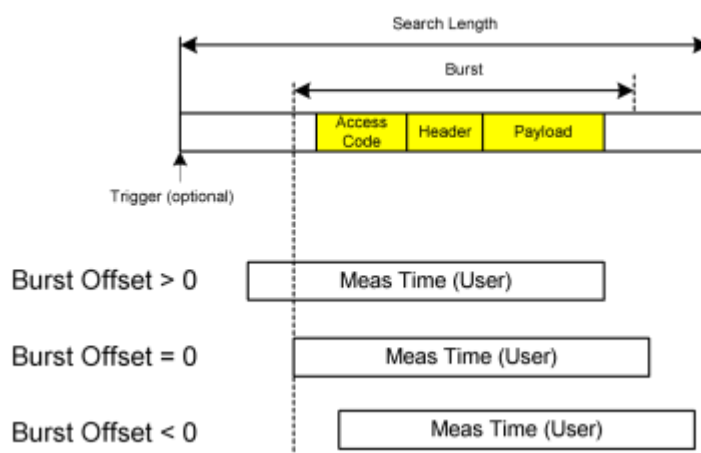
`[SENSe:] DDEMod:SEARCH:PULSe[:STATe]` on page 121

Burst Offset ← Find Sync ← Output Power

Opens an edit dialog box to define the time to be displayed before the identified burst. The values range from -10 ms to +10 ms, with negative values moving the burst to the left, positive values to the right. The default setting for the burst offset is 0.

If the burst is identified, but the selected measurement time cannot be displayed due to the selected burst offset, the message "BURST OFFSET INVALID" is displayed.

This softkey is only available if the **Find Sync On/Off** is deactivated and the **Find Burst On/Off (Output Power)** softkey is activated.



Remote command:

`[SENSe:] DDEMod:SEARCH:PULSe:OFFSet` on page 121

Search Len Auto ← Find Sync ← Output Power

Activates or deactivates the automatic selection of the search length for the search of the sync word or the burst, depending on the selected packet type. The automatic search length is determined as follows:

Trigger free run:

$$\text{search length} = 3 * \text{packet length} + |\text{sync offset or burst offset}|$$

All other trigger modes:

$$\text{search length} = 1 * \text{packet length} + 1 \text{ Slot} + |\text{sync offset or burst offset}|$$

If the selected measurement time is higher than the packet length, the following difference is added to the search length:

$$\text{measurement time} - \text{packet length}$$

In the default setting, the automatic calculation of the search length is activated.

Remote command:

`[SENSe:] DDEMod:SEARCH:TIME:AUTO` on page 123

Search Len Manual ← Find Sync ← Output Power

Opens an edit dialog box to enter the search length used for determining the sync word or the burst. The unit of the search length is seconds; the values range from 100 μ s to (400001 / points per symbol) μ s. The default setting is 1825 μ s.

The selected number of points per symbol and the maximum search length is listed in the table below.

Points per symbol	Max. search length (number of slots)
2	104.4
4	52.2
8	26.1
16	13.1
32	6.5

For information on the correlation of trigger and record length refer to the [Search Len Auto](#) softkey.

Remote command:

[\[SENSe:\]DDEMod:SEARch:TIME](#) on page 122

Power Avg Start (Output Power) ← Output Power

Opens an edit dialog box to enter the start position of the evaluation area for the average burst power. The values range is from 0 to 100%, the default setting is 20%.

For further information refer to [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10.

Remote command:

[CONFigure:BT0oth:POWer:AVERAge:START](#) on page 98

Power Avg Stop (Output Power) ← Output Power

Opens an edit dialog box to enter the stop position of the evaluation area for the average burst power. The values range from 0 to 100%, the default setting is 80%.

For further information refer to [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10.

Remote command:

[CONFigure:BT0oth:POWer:AVERAge:STOP](#) on page 99

TX Spec ACLR

Opens a submenu to configure the TX Spec ACLR measurement. For further details refer to [chapter 3.1.2, "Adjacent Channel Power Measurement"](#), on page 24.

Remote command:

[CONF:BT0:MEAS ACLR](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:ACLR\[:LIST\]?](#) on page 68

[CALCulate<n>:BT0oth:ACLR:EXceptions?](#) on page 69

Channel ← TX Spec ACLR

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← TX Spec ACLR

Opens a dialog box for common measurement settings, see ["Meas Setup"](#) on page 36.

Find Sync ← TX Spec ACLR

Opens a dialog box to set the signal processing functions of the analyzer, see ["Find Sync"](#) on page 37.

No. of ACP Chan (TX Spec ACLR, Spurious Emissions) ← TX Spec ACLR

Opens an edit dialog box to enter the number of adjacent channels, for which the power is to be measured. The values range from 0 to 78. A minimum value of 3 is recommended. The default setting is 78 (all channels).

As with the ACP measurement of the basic instrument firmware this value refers to the number of adjacent channels on one side of the TX channel. This means that with a selected value of 10 the analyzer will measure in total 21 channels (10 lower channels + TX channel + 10 upper channels).

The frequency range required for the measurement is set up automatically. The center frequency will also be adapted automatically dependent on the selected TX channel.

The measurement of the adjacent channels is limited to the available Bluetooth frequency band, which means that at maximum 79 channels (23 channels in France) will be measured.

Remote command:

[CONFigure:BT0oth:ACLR:ACPairs](#) on page 91

[CONFigure:BT0oth:IBSEmissions:ACPairs](#) on page 95

Modulation Char

Opens a submenu to configure the Modulation Char measurement. For further details refer to [chapter 3.1.3, "Modulation Characteristics Measurement"](#), on page 25.

Remote command:

[CONF:BT0:MEAS MCH](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:MCHar:DF<Delta>:AVERage?](#) on page 79

[CALCulate<n>:BT0oth:MCHar:DF<Delta>:MAXimum?](#) on page 80

[CALCulate<n>:BT0oth:MCHar:DF2:PERCent?](#) on page 81

[CALCulate<n>:BT0oth:MCHar:RATio?](#) on page 82

Channel ← Modulation Char

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Modulation Char

Opens a dialog box for common measurement settings, see ["Meas Setup"](#) on page 36.

Find Sync ← Modulation Char

Opens a dialog box to set the signal processing functions of the analyzer, see ["Find Sync"](#) on page 37.

Start Test (Modulation Char) ← Modulation Char

Initiates a new measurement. All frequency deviation values obtained earlier are discarded.

The bit pattern in the payload is detected automatically. The frequency deviation of a packet is determined according to the procedure defined in the RF Test Specification.

Remote command:

INIT;*WAI

Continue Test (Modulation Char) ← Modulation Char

Measures the frequency deviation of further packets after the bit pattern has been changed at the EUT, just like the "Start Test" softkey did for the first bit pattern type. The results of the preceding measurement are preserved and are taken into account for the new measurements.

Remote command:

INIT:CONM;*WAI

Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift) ← Modulation Char

Activates or deactivates the zoom function. Opens an edit dialog box to enter the zoom start position. The valid value range for the zoom start position is 0 to (measurement time – 500 / sampling rate). The default setting for the zoom function is 0s (off).

With active zoom function, an area of only 501 samples is displayed.

Remote command:

[\[SENSe:\]ADEMod:ZOOM\[:STATe\]](#) on page 119

[\[SENSe:\]ADEMod:ZOOM:START](#) on page 120

Init Carr Freq Tol

Opens a submenu to configure the Init Carr Freq Tol measurement. For further details refer to [chapter 3.1.4, "Initial Carrier Frequency Tolerance Measurement"](#), on page 26.

Remote command:

`CONF:BT0:MEAS IFCT`, see [CONFigure:BT0oth:MEASurement](#) on page 96
[CALCulate<n>:BT0oth:ICFTolerance?](#) on page 79

Channel ← Init Carr Freq Tol

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Init Carr Freq Tol

Opens a dialog box for common measurement settings, see ["Meas Setup"](#) on page 36.

Find Sync ← Init Carr Freq Tol

Opens a dialog box to set the signal processing functions of the analyzer, see ["Find Sync"](#) on page 37.

Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift) ← Init Carr Freq Tol

Activates or deactivates the zoom function. Opens an edit dialog box to enter the zoom start position. The valid value range for the zoom start position is 0 to (measurement time – 500 / sampling rate). The default setting for the zoom function is 0s (off).

With active zoom function, an area of only 501 samples is displayed.

Remote command:

[\[SENSe:\]ADEMod:ZOOM\[:STATe\]](#) on page 119
[\[SENSe:\]ADEMod:ZOOM:START](#) on page 120

Carr Freq Drift

Opens a submenu to configure the Carr Freq Drift measurement. For further details refer to [chapter 3.1.5, "Carrier Frequency Drift Measurement"](#), on page 27.

Remote command:

`CONF:BT0:MEAS CFDR`, see [CONFigure:BT0oth:MEASurement](#) on page 96
[CALCulate<n>:BT0oth:CFDRift\[:MAXimum\]?](#) on page 70
[CALCulate<n>:BT0oth:CFDRift:RATE?](#) on page 70

Channel ← Carr Freq Drift

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Carr Freq Drift

Opens a dialog box for common measurement settings, see "[Meas Setup](#)" on page 36.

Find Sync ← Carr Freq Drift

Opens a dialog box to set the signal processing functions of the analyzer, see "[Find Sync](#)" on page 37.

Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift) ← Carr Freq Drift

Activates or deactivates the zoom function. Opens an edit dialog box to enter the zoom start position. The valid value range for the zoom start position is 0 to (measurement time – 500 / sampling rate). The default setting for the zoom function is 0s (off).

With active zoom function, an area of only 501 samples is displayed.

Remote command:

[\[SENSe:\]ADEMod:ZOOM\[:STATe\]](#) on page 119

[\[SENSe:\]ADEMod:ZOOM:START](#) on page 120

Rel TX Power

Opens a submenu to configure the Rel TX Power measurement. For further details refer to [chapter 3.1.6, "Relative Transmit Power \(EDR\) Measurement"](#), on page 28.

Remote command:

[CONF:BT0:MEAS RTP](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:RTPower:\[DPSK\]?](#) on page 85

[CALCulate<n>:BT0oth:RTPower:GFSK?](#) on page 86

[CALCulate<n>:BT0oth:RTPower:RATio?](#) on page 87

Channel ← Rel TX Power

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Rel TX Power

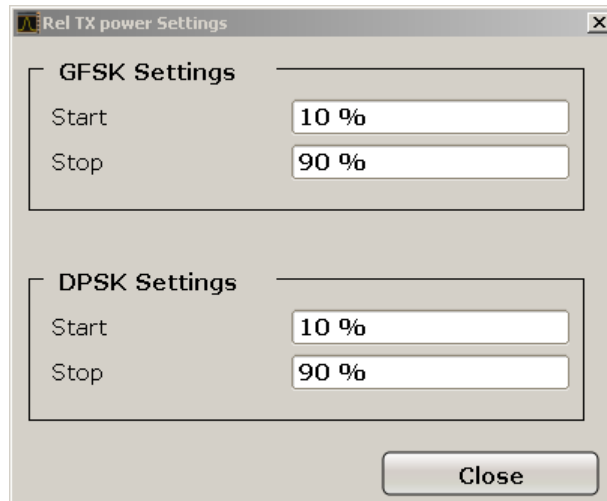
Opens a dialog box for common measurement settings, see "[Meas Setup](#)" on page 36.

Find Sync ← Rel TX Power

Opens a dialog box to set the signal processing functions of the analyzer, see "[Find Sync](#)" on page 37.

Settings ← Rel TX Power

Opens a dialog box to define the start and stop times for power measurements.

**GFSK Start ← Settings ← Rel TX Power**

Defines the start time for the power measurement of the GFSK sections of the packet. The default value is 10%.

The abbreviation GFSK stands for "Gaussian Frequency Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:GAverage:START](#) on page 101

GFSK Stop ← Settings ← Rel TX Power

Defines the stop time for the power measurement of the GFSK sections of the packet. The default value is 90%.

The abbreviation GFSK stands for "Gaussian Frequency Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:GAverage:STOP](#) on page 101

DPSK Start ← Settings ← Rel TX Power

Defines the start time for the power measurement of the DPSK sections of the packet. The default value is 10%.

The abbreviation DPSK stands for "Differential Phase Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:DAverage:START](#) on page 100

DPSK Stop ← Settings ← Rel TX Power

Defines the stop time for the power measurement of the DPSK sections of the packet. The default value is 90%.

The abbreviation DPSK stands for "Differential Phase Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:DAverage:STOP](#) on page 100

Spurious Emissions

Opens a submenu to configure the Spurious Emissions measurement. For further details refer to [chapter 3.1.7, "In-band Spurious Emissions \(EDR\) measurement"](#), on page 29.

Remote command:

[CONF:BT0:MEAS_IBS](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:IBSEmissions:\[List\]?](#) on page 76

[CALCulate<n>:BT0oth:IBSEmissions:EXCeptions?](#) on page 77

[CALCulate<n>:BT0oth:IBSEmissions:HADJacent?](#) on page 78

Channel ← Spurious Emissions

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Spurious Emissions

Opens a dialog box for common measurement settings, see ["Meas Setup"](#) on page 36.

Find Sync ← Spurious Emissions

Opens a dialog box to set the signal processing functions of the analyzer, see ["Find Sync"](#) on page 37.

No. of ACP Chan (TX Spec ACLR, Spurious Emissions) ← Spurious Emissions

Opens an edit dialog box to enter the number of adjacent channels, for which the power is to be measured. The values range from 0 to 78. A minimum value of 3 is recommended. The default setting is 78 (all channels).

As with the ACP measurement of the basic instrument firmware this value refers to the number of adjacent channels on one side of the TX channel. This means that with a selected value of 10 the analyzer will measure in total 21 channels (10 lower channels + TX channel + 10 upper channels).

The frequency range required for the measurement is set up automatically. The center frequency will also be adapted automatically dependent on the selected TX channel.

The measurement of the adjacent channels is limited to the available Bluetooth frequency band, which means that at maximum 79 channels (23 channels in France) will be measured.

Remote command:

[CONFigure:BT0oth:ACLR:ACPairs](#) on page 91

[CONFigure:BT0oth:IBSEmissions:ACPairs](#) on page 95

Gate Delay (Spurious Emissions) ← Spurious Emissions

Opens an edit dialog box to enter the time between trigger event and start of the DPSK packet. That is the measurement start time.

Remote command:

[\[SENSe:\]SWEep:EGATE:HOLOff](#) on page 116

Gate Length (Spurious Emissions) ← Spurious Emissions

Opens an edit dialog box to enter the sweep time in seconds. Usually, this is the length of the DPSK section.

Remote command:

[\[SENSe:\]SWEep:EGATE:LENGth](#) on page 117

Adjust Gate ← Spurious Emissions

Adjusts the gate settings according to the pre-measurement results.

Remote command:

[CONFigure:BT0oth:IBSEmissions:GATE:AUTO ONCE](#) on page 96

Carr Freq Stability

Opens a submenu to configure the Carr Freq Stability measurement. For further details refer to [chapter 3.1.8, "Carrier Frequency Stability and Modulation Accuracy \(EDR\) measurement"](#), on page 31.

Remote command:

[CONF:BT0:MEAS CFST](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:CFSTability:FERRor:\[TOTal\]?](#) on page 73

[CALCulate<n>:BT0oth:CFSTability:FERRor:BLOCK?](#) on page 74

[CALCulate<n>:BT0oth:CFSTability:FERRor:INITial?](#) on page 74

[CALCulate<n>:BT0oth:CFSTability:DEVM:\[RMS\]?](#) on page 71

[CALCulate<n>:BT0oth:CFSTability:DEVM:PEAK?](#) on page 72

[CALCulate<n>:BT0oth:CFSTability:DEVM:D99Pct?](#) on page 72

[CALCulate<n>:BT0oth:CFSTability:COUNT?](#) on page 71

Channel ← Carr Freq Stability

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Carr Freq Stability

Opens a dialog box for common measurement settings, see "[Meas Setup](#)" on page 36.

Find Sync ← Carr Freq Stability

Opens a dialog box to set the signal processing functions of the analyzer, see "[Find Sync](#)" on page 37.

Block Count (Carr Freq Stability) ← Carr Freq Stability

Opens an edit dialog box to enter the number of blocks to be measured. Every block has the length of 50 μ s. The default value is 200 blocks.

This softkey is only available in single sweep operation.

Remote command:

[CONFigure:BT0oth:CFSTability:BCOunt](#) on page 94

Diff Phase

Opens a submenu to configure the Diff Phase measurement. For further details refer to [chapter 3.1.9, "Differential Phase Encoding \(EDR\) measurement"](#), on page 32.

Remote command:

[CONF:BT0:MEAS DPEN](#), see [CONFigure:BT0oth:MEASurement](#) on page 96

[CALCulate<n>:BT0oth:DPENcoding:NERRor?](#) on page 76

[CALCulate<n>:BT0oth:DPENcoding:\[TOTal\]?](#) on page 75

[CALCulate<n>:BT0oth:DPENcoding:BER?](#) on page 75

Channel ← Diff Phase

Opens an edit dialog box to enter the transmission channel number. From the number of the channel the center frequency is calculated in accordance to the RF Test Specification. The default setting is channel number 0.

Principally, setting the channel number has the same effect as changing the center frequency. The major difference is that the center frequency is not limited to available frequency band values, i.e. values outside the frequency band and between the discrete channels can be selected (see also [Center](#) softkey in the "Frequency" menu).

Remote command:

[CONFigure:BT0oth:CHANnel](#) on page 94

Meas Setup ← Diff Phase

Opens a dialog box for common measurement settings, see "[Meas Setup](#)" on page 36.

Find Sync ← Diff Phase

Opens a dialog box to set the signal processing functions of the analyzer, see "[Find Sync](#)" on page 37.

3.4 Softkeys of the MEAS CONFIG menu

The MEAS CONFIG key provides direct access to the submenu of the currently selected measurement type. For a description of the submenus, see the corresponding keys in [chapter 3.3, "Softkeys of the Bluetooth Menu"](#), on page 34.

3.5 Softkeys of the Amplitude Menu (Bluetooth Mode)

The following table shows all softkeys available in the amplitude menu in Bluetooth mode (AMPT key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Ref Level

Opens an edit dialog box to enter the reference level in the current unit (dBm, dBμV, etc).

The reference level is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IFOVL" status display.

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:RLEVel](#) on page 107

Range Log Manual

Opens an edit dialog box to define the display range of a logarithmic level axis manually.

Remote command:

Logarithmic scaling:

[DISP:WIND:TRAC:Y:SPAC LOG](#), see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Not available for Carr Freq Drift, Init Carr Freq Tol, and Modulation Char measurements.

Display range:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range

Opens a submenu to define the display range of the level axis.

Range Log 100 dB ← Range

Sets the level display range to 100 dB.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Display range:

DISP:WIND:TRAC:Y 100DB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Log 50 dB ← Range

Sets the level display range to 50 dB.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Display range:

DISP:WIND:TRAC:Y 50DB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Log 10 dB ← Range

Sets the level display range to 10 dB.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Display range:

DISP:WIND:TRAC:Y 10DB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Log 5 dB ← Range

Sets the level display range to 5 dB.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Display range:

DISP:WIND:TRAC:Y 5DB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Log 1 dB ← Range

Sets the level display range to 1 dB.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Display range:

DISP:WIND:TRAC:Y 1DB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Log Manual ← Range

Opens an edit dialog box to define the display range of a logarithmic level axis manually.

Remote command:

Logarithmic scaling:

DISP:WIND:TRAC:Y:SPAC LOG, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Not available for Carr Freq Drift, Init Carr Freq Tol, and Modulation Char measurements.

Display range:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]](#) on page 105

Range Linear % ← Range

Selects linear scaling for the level axis in %.

The grid is divided into decadal sections.

Markers are displayed in the selected unit ("Unit" softkey). Delta markers are displayed in % referenced to the voltage value at the position of marker 1. This is the default setting for linear scaling.

Remote command:

DISP:TRAC:Y:SPAC LIN, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Range Lin. Unit ← Range

Selects linear scaling in dB for the level display range, i.e. the horizontal lines are labeled in dB.

Markers are displayed in the selected unit ("Unit" softkey). Delta markers are displayed in dB referenced to the power value at the position of marker 1.

Remote command:

DISP:TRAC:Y:SPAC LDB, see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108

Preamp On/Off

Switches the preamplifier on and off.

If option R&S FSV-B22 is installed, the preamplifier is only active below 7 GHz.

If option R&S FSV-B24 is installed, the preamplifier is active for all frequencies.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:

`INPut:GAIN:STATe` on page 111

RF Atten Manual/Mech Att Manual

Opens an edit dialog box to enter the attenuation, irrespective of the reference level. If electronic attenuation is activated (option R&S FSV-B25 only; "EI Atten Mode Auto" softkey), this setting defines the mechanical attenuation.

The mechanical attenuation can be set in 10 dB steps.

The RF attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). The range is specified in the data sheet. If the current reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

The RF attenuation defines the level at the input mixer according to the formula:

$$\text{level}_{\text{mixer}} = \text{level}_{\text{input}} - \text{RF attenuation}$$

Note: As of firmware version 1.61, the maximum mixer level allowed is **0 dBm**. Mixer levels above this value may lead to incorrect measurement results, which are indicated by the "OVLd" status display. The increased mixer level allows for an improved signal, but also increases the risk of overloading the instrument!

Remote command:

`INPut:ATTenuation` on page 110

RF Atten Auto/Mech Att Auto

Sets the RF attenuation automatically as a function of the selected reference level. This ensures that the optimum RF attenuation is always used. It is the default setting.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:

`INPut:ATTenuation:AUTO` on page 111

Ref Level Offset

Opens an edit dialog box to enter the arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly. The setting range is ± 200 dB in 0.1 dB steps.

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:RLEVel:OFFSet` on page 107

Ref Level Position

Opens an edit dialog box to enter the reference level position, i.e. the position of the maximum AD converter value on the level axis. The setting range is from -200 to +200 %, 0 % corresponding to the lower and 100 % to the upper limit of the diagram.

Not available for Carr Freq Drift, Init Carr Freq Tol, and Modulation Char measurements.

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition` on page 107

Grid Abs/Rel

Switches between absolute and relative scaling of the level axis (not available with "Linear" range).

Not available for Carr Freq Drift, Init Carr Freq Tol, and Modulation Char measurements.

"Abs" Absolute scaling: The labeling of the level lines refers to the absolute value of the reference level. Absolute scaling is the default setting.

"Rel" Relative scaling: The upper line of the grid is always at 0 dB. The scaling is in dB whereas the reference level is always in the set unit (for details on unit settings see the "Unit" softkey).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE` on page 106

Input 50 Ω/75 Ω

Uses 50 Ω or 75 Ω as reference impedance for the measured levels. Default setting is 50 Ω.

The setting 75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75 Ω/50 Ω).

All levels specified in this Operating Manual refer to the default setting of the instrument (50 Ω).

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:

`INPut:IMPedance` on page 112

3.6 Softkeys of the Bandwidth Menu (option R&S FSV-K8)

The following section describes all softkeys available in the "Bandwidth" menu in Bluetooth mode (BW key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Sweptime Manual (TX Spec ACLR)	54
Sweptime Auto (TX Spec ACLR)	54
Meas Time Manual	54
Meas Time Auto	54
Res BW Manual (Output Power, Rel TX Power)	54
Res BW Auto (Output Power, TX Spec ACLR, Rel TX Power, Spurious Emissions) ...	54

Video BW Manual (TX Spec ACLR).....	54
Video BW Auto (TX Spec ACLR, Spurious Emissions).....	55
Filter Type (Output Power, TX Spec ACLR, Spurious Emissions, Rel TX Power).....	55
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Sweeptime Manual (TX Spec ACLR)

Opens an edit dialog box to enter the sweep time. The valid value range is 10 μ s (minimum measurement time for one channel) to 16000 s. The default setting is 79 s.

Remote command:

`CONFigure:BT0oth:SWEep:TIME` on page 103

Sweeptime Auto (TX Spec ACLR)

Activates the automatic calculation of the sweep time. The automatic sweep time corresponds to the settings defined in the RF Test Specification. By default, it is activated.

Remote command:

`CONFigure:BT0oth:SWEep:TIME:AUTO` on page 103

Meas Time Manual

Opens an edit dialog box to enter the measurement time. The valid value range is 1 μ s to (400001 / points per symbol) μ s.

This function is not available for Spurious Emissions measurements.

Remote command:

`CONFigure:BT0oth:SWEep:TIME` on page 103

Meas Time Auto

Activates the automatic calculation of the measurement time. The automatic sweep time corresponds to the settings defined in the RF Test Specification. By default, the automatic sweep time calculation is activated.

This function is not available for Spurious Emissions measurements.

Remote command:

`CONFigure:BT0oth:SWEep:TIME:AUTO` on page 103

Res BW Manual (Output Power, Rel TX Power)

Opens an edit dialog box to enter the resolution bandwidth. The values range from 1 MHz to 3 MHz. The default value is 3 MHz.

Remote command:

`CONFigure:BT0oth:BANDwidth|BWIDth[:RESolution]` on page 92

Res BW Auto (Output Power, TX Spec ACLR, Rel TX Power, Spurious Emissions)

Sets the bandwidth according to the values defined in the RF Test Specification.

Remote command:

`CONFigure:BT0oth:BANDwidth|BWIDth[:RESolution]:AUTO` on page 92

Video BW Manual (TX Spec ACLR)

The default value is 300 kHz, according to the values defined in the RF Test Specification.

For further details refer to the "Video BW Manual" softkey in the bandwidth menu of the base unit.

Remote command:

[CONFigure:BT0oth:Bandwidth|BWIDth:VIDeo](#) on page 93

Video BW Auto (TX Spec ACLR, Spurious Emissions)

Sets the video bandwidth according to the values defined in the RF Test Specification.

In the In-band Spurious Emissions measurement, the video bandwidth is always adjusted automatically. Therefore the softkey is activated by default and its state cannot be changed.

Remote command:

[CONFigure:BT0oth:Bandwidth|BWIDth:VIDeo:AUTO](#) on page 93

Filter Type (Output Power, TX Spec ACLR, Spurious Emissions, Rel TX Power)

Opens the "Filter Type" dialog box to select the filter type. For the measurements Output Power and Rel TX Power, a Gaussian or a channel filter can be selected. For the measurements TX Spec ACLR and Spurious Emissions, the filter type is a Gaussian filter.

Remote command:

[\[SENSe:\]Bandwidth|BWIDth\[:RESolution\]:TYPE](#) on page 114

Meas Filter (Modulation Char, Init Carr Freq Tol, Carr Freq Drift)

Activates or deactivates a filter that limits the bandwidth for the modulation measurements. Since the RF Test Specification Rev 2.0.E.3 it is required to use this filter and therefore it is activated by default.

The filter is flat within 1.04 MHz (ripple: only 0.02 dB) and has steep slopes outside this area. The filter has the following characteristics:

- passband ripple up to 550 kHz < 0.5 dB (peak to peak)
- minimum attenuation in the transition band

+/- 650 kHz:	>=3 dB
+/-1 MHz:	>= 14 dB
+/- 2 MHz:	>= 44 dB

Remote command:

[\[SENSe:\]DDEMod:FILTER:MEASurement](#) on page 120

3.7 Softkeys of the Frequency Menu (option R&S FSV-K8)

The following table shows all softkeys available in the "Frequency" menu in Bluetooth mode (FREQ key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Center

Opens an edit dialog box to change the center frequency.

If the frequency channel was set via the "Channel" softkey (see "Channel" on page 36), you can change the center frequency, but the relation to the frequency channel will be lost, which means that the value range for the center frequency is not limited to frequencies within valid frequency channels.

The fixed relation between center frequency and Bluetooth frequency channels is restored when you press the "Channel" softkey or select another measurement. The center frequency is rounded to the nearest frequency channel.

Remote command:

[SENSe:] FREQuency:CENTer on page 115

CF–Stepsize

Opens a submenu to set the step size of the center frequency.

0.1*Chan Spacing ← CF–Stepsize

Sets the step size of the center frequency to 1/10 of the channel spacing.

= Chan Spacing ← CF–Stepsize

Sets the step size of the center frequency to the size of the channel spacing.

3.8 Softkeys of the Sweep Menu (Bluetooth mode)

The following table shows all softkeys available in the sweep menu in Bluetooth mode (SWEEP key). In the Bluetooth mode, the sweep menu is used for direct entry into the measurement menu of the currently selected measurement. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Continuous Sweep

Sets the continuous sweep mode: the sweep takes place continuously according to the trigger settings. This is the default setting.

The trace averaging is determined by the sweep count value (see the "Sweep Count" softkey, "Sweep Count" on page 57).

Remote command:

INIT:CONT ON, see INITiate<n>:CONTInuous on page 109

Single Sweep

Sets the single sweep mode: after triggering, starts the number of sweeps that are defined by using the Sweep Count softkey. The measurement stops after the defined number of sweeps has been performed.

Remote command:

INIT:CONT OFF, see INITiate<n>:CONTInuous on page 109

Meas Time Manual

Opens an edit dialog box to enter the measurement time. The valid value range is 1 μ s to (400001 / points per symbol) μ s.

This function is not available for Spurious Emissions measurements.

Remote command:

[CONFigure:BT0oth:SWEEp:TIME](#) on page 103

Meas Time Auto

Activates the automatic calculation of the measurement time. The automatic sweep time corresponds to the settings defined in the RF Test Specification. By default, the automatic sweep time calculation is activated.

This function is not available for Spurious Emissions measurements.

Remote command:

[CONFigure:BT0oth:SWEEp:TIME:AUTO](#) on page 103

Sweep Count

Opens an edit dialog box to enter the number of sweeps to be performed in the single sweep mode. Values from 0 to 32767 are allowed. If the values 0 or 1 are set, one sweep is performed. The sweep count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the sweep count value also determines the number of averaging or maximum search procedures.

In continuous sweep mode, if sweep count = 0 (default), averaging is performed over 10 sweeps. For sweep count = 1, no averaging, maxhold or minhold operations are performed.

Remote command:

[CONFigure:BT0oth:SWEEp:COUNT](#) on page 102

Power Avg Start (Output Power)

Opens an edit dialog box to enter the start position of the evaluation area for the average burst power. The values range is from 0 to 100%, the default setting is 20%.

For further information refer to [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10.

Remote command:

[CONFigure:BT0oth:POWer:AVERAge:START](#) on page 98

Power Avg Stop (Output Power)

Opens an edit dialog box to enter the stop position of the evaluation area for the average burst power. The values range from 0 to 100%, the default setting is 80%.

For further information refer to [chapter 2, "Introduction to Bluetooth Measurements \(K8\)"](#), on page 10.

Remote command:

[CONFigure:BT0oth:POWer:AVERAge:STOP](#) on page 99

No. of ACP Chan (TX Spec ACLR, Spurious Emissions)

Opens an edit dialog box to enter the number of adjacent channels, for which the power is to be measured. The values range from 0 to 78. A minimum value of 3 is recommended. The default setting is 78 (all channels).

As with the ACP measurement of the basic instrument firmware this value refers to the number of adjacent channels on one side of the TX channel. This means that with a selected value of 10 the analyzer will measure in total 21 channels (10 lower channels + TX channel + 10 upper channels).

The frequency range required for the measurement is set up automatically. The center frequency will also be adapted automatically dependent on the selected TX channel.

The measurement of the adjacent channels is limited to the available Bluetooth frequency band, which means that at maximum 79 channels (23 channels in France) will be measured.

Remote command:

[CONFigure:BT0oth:ACLR:ACPairs](#) on page 91

[CONFigure:BT0oth:IBSemiissions:ACPairs](#) on page 95

Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift)

Activates or deactivates the zoom function. Opens an edit dialog box to enter the zoom start position. The valid value range for the zoom start position is 0 to (measurement time – 500 / sampling rate). The default setting for the zoom function is 0s (off).

With active zoom function, an area of only 501 samples is displayed.

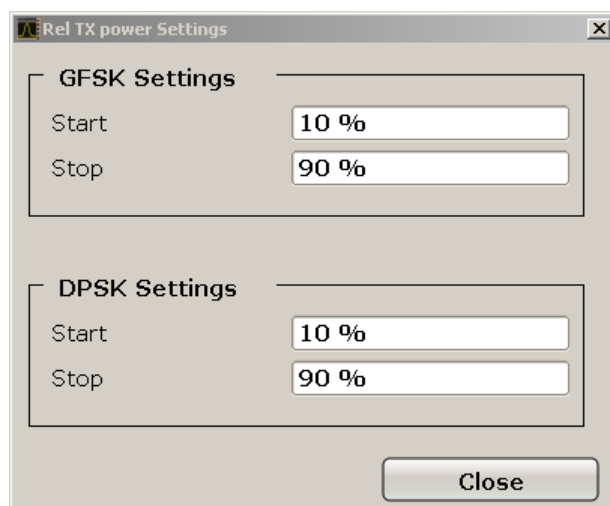
Remote command:

[\[SENSe:\]ADEMod:ZOOM\[:STATe\]](#) on page 119

[\[SENSe:\]ADEMod:ZOOM:START](#) on page 120

Settings

Opens a dialog box to define the start and stop times for power measurements.

**GFSK Start ← Settings**

Defines the start time for the power measurement of the GFSK sections of the packet. The default value is 10%.

The abbreviation GFSK stands for "Gaussian Frequency Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:GAverage:START](#) on page 101

GFSK Stop ← Settings

Defines the stop time for the power measurement of the GFSK sections of the packet. The default value is 90%.

The abbreviation GFSK stands for "Gaussian Frequency Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:GAverage:STOP](#) on page 101

DPSK Start ← Settings

Defines the start time for the power measurement of the DPSK sections of the packet. The default value is 10%.

The abbreviation DPSK stands for "Differential Phase Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:DAverage:START](#) on page 100

DPSK Stop ← Settings

Defines the stop time for the power measurement of the DPSK sections of the packet. The default value is 90%.

The abbreviation DPSK stands for "Differential Phase Shift Keying".

Remote command:

[CONFigure:BT0oth:RTPower:DAverage:STOP](#) on page 100

Gate Delay (Spurious Emissions)

Opens an edit dialog box to enter the time between trigger event and start of the DPSK packet. That is the measurement start time.

Remote command:

[\[SENSe:\]SWEep:EGATe:HOLDoff](#) on page 116

Gate Length (Spurious Emissions)

Opens an edit dialog box to enter the sweep time in seconds. Usually, this is the length of the DPSK section.

Remote command:

[\[SENSe:\]SWEep:EGATe:LENGth](#) on page 117

Block Count (Carr Freq Stability)

Opens an edit dialog box to enter the number of blocks to be measured. Every block has the length of 50 μ s. The default value is 200 blocks.

This softkey is only available in single sweep operation.

Remote command:

[CONFigure:BT0oth:CFStability:BCount](#) on page 94

3.9 Softkeys of the Trigger Menu (Option R&S FSV-K8)

The following table shows all softkeys available in the "Trigger" menu in Bluetooth mode (TRIG key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Trg/Gate Source

Opens the "Trigger/Gate Source" dialog box to select the trigger/gate mode.

The default setting is "Free Run". If a trigger mode other than "Free Run" has been set, the enhancement label "TRG" is displayed and the trigger source is indicated.

Remote command:

[TRIGger<n>\[:SEquence\]:SOURce](#) on page 126

Free Run ← Trg/Gate Source

The start of a sweep is not triggered. Once a measurement is completed, another is started immediately.

Remote command:

TRIG:SOUR IMM, see [TRIGger<n>\[:SEquence\]:SOURce](#) on page 126

External ← Trg/Gate Source

Defines triggering via a TTL signal at the "EXT TRIG/GATE IN" input connector on the rear panel.

Remote command:

TRIG:SOUR EXT, see [TRIGger<n>\[:SEquence\]:SOURce](#) on page 126

Video ← Trg/Gate Source

Defines triggering by the displayed voltage.

A horizontal trigger line is shown in the diagram. It is used to set the trigger threshold from 0 % to 100 % of the diagram height.

Video mode is only available in the time domain.

Remote command:

TRIG:SOUR VID, see [TRIGger<n>\[:SEquence\]:SOURce](#) on page 126

RF Power ← Trg/Gate Source

Defines triggering of the measurement via signals which are outside the measurement channel.

This trigger mode is available with detector board 1307.9554.02 Rev 05.00 or higher. It is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17). If RF Power trigger mode is selected and digital baseband input is activated, the trigger mode is automatically switched to "Free Run".

In RF Power trigger mode the instrument uses a level detector at the first intermediate frequency. The detector threshold can be selected in a range between - 50 dBm and -10 dBm at the input mixer. The resulting trigger level at the RF input lies within the following range:

$(-24\text{dBm} + \text{RF Att}) \leq \text{Triggerlevel} \leq (+5\text{dBm} + \text{RF Att})$, max. 30 dBm, for Preamp = OFF

$(-40\text{dBm} + \text{RF Att}) \leq \text{Triggerlevel} \leq (-11\text{dBm} + \text{RF Att})$, max. 30 dBm, for Preamp = ON

with

$500 \text{ MHz} \leq \text{InputSignal} \leq 7 \text{ GHz}$

Note: If input values outside of this range occur (e.g. for fullspan measurements), the sweep may be aborted and a message indicating the allowed input values is displayed in the status bar.

Remote command:

TRIG:SOUR RFP, see TRIGger<n>[:SEQuence]:SOURce on page 126

IF Power/BB Power ← Trg/Gate Source

For this purpose, the R&S FSV uses a level detector at the second intermediate frequency.

The available trigger levels depend on the RF attenuation and preamplification. A reference level offset, if defined, is also considered.

For details on available trigger levels and trigger bandwidths see the data sheet.

The bandwidth at the intermediate frequency depends on the RBW and sweep type:

Sweep mode:

- RBW > 500 kHz: 40 MHz, nominal
- RBW ≤ 500 kHz: 6 MHz, nominal

FFT mode:

- RBW > 20 kHz: 40 MHz, nominal
- RBW ≤ 20 kHz: 6 MHz, nominal

Note: Be aware that in auto sweep type mode, due to a possible change in sweep types, the bandwidth may vary considerably for the same RBW setting.

The R&S FSV is triggered as soon as the trigger level is exceeded around the selected frequency (= start frequency in the frequency sweep).

Thus, the measurement of spurious emissions, e.g. for pulsed carriers, is possible even if the carrier lies outside the selected frequency span.

Remote command:

TRIG:SOUR IFP, see TRIGger<n>[:SEQuence]:SOURce on page 126

Power Sensor ← Trg/Gate Source

Uses an external power sensor as a trigger function. This option is only available if the R&S FSV-K9 Power Sensor option is installed and a power sensor is connected and configured.

Power sensors are configured in the "Input/Output" menu, see "Configuring an External Power Trigger" in the base unit description.

If a power sensor is selected as the trigger mode, the following softkeys are not available; these settings are configured in the "Power Sensor Configuration" dialog box (see the base unit description).

- [Trg/Gate Level](#)

- [Trg/Gate Polarity](#)
- [Trigger Hysteresis](#)
- [Trigger Holdoff](#)

Note: For R&S power sensors, the "Gate Mode" *Lvl* is not supported. The signal sent by these sensors merely reflects the instant the level is first exceeded, rather than a time period. However, only time periods can be used for gating in level mode. Thus, the trigger impulse from the sensors is not long enough for a fully gated measurement; the measurement cannot be completed.

Remote command:

TRIG:SOUR PSE, see [TRIGger<n>\[:SEQuence\]:SOURce](#) on page 126

Time ← Trg/Gate Source

Opens an edit dialog box to define a repetition interval in which the measurement is triggered. The shortest interval is 2 ms.

Remote command:

TRIG:SOUR TIMETRIGger<n>[:SEQuence]:SOURce on page 126

Digital IQ ← Trg/Gate Source

For I/Q Analyzer or AnalogDemod mode only:

Defines triggering of the measurement directly via the LVDS connector. In the sub-menu you must specify which general purpose bit (GP0 to GP5) will provide the trigger data.

This trigger mode is available for input from the R&S Digital I/Q Interface (option R&S FSV-B17) only.

The following table describes the assignment of the general purpose bits to the LVDS connector pins.

Table 3-1: Assignment of general purpose bits to LVDS connector pins

Bit	LVDS pin
GP0	SDATA4_P - Trigger1
GP1	SDATA4_P - Trigger2
GP2	SDATA0_P - Reserve1
GP3	SDATA4_P - Reserve2
GP4	SDATA0_P - Marker1
GP5	SDATA4_P - Marker2

Remote command:

TRIG:SOUR GP0, see [TRIGger<n>\[:SEQuence\]:SOURce](#) on page 126

Trg/Gate Level

Opens an edit dialog box to enter the trigger/gate level.

In the trigger modes "Time" and "Power Sensor", this softkey is not available.

Remote command:

[TRIGger<n>\[:SEQuence\]:LEVel:IFPower](#) on page 126

Trg/Gate Polarity

Sets the polarity of the trigger/gate source.

The sweep starts after a positive or negative edge of the trigger signal. The default setting is "Pos". The setting applies to all trigger modes with the exception of the "Free Run", "Power Sensor" and "Time" mode.

"Pos" Level triggering: the sweep is stopped by the logic "0" signal and restarted by the logical "1" signal after the gate delay time has elapsed.

"Neg" Edge triggering: the sweep is continued on a "0" to "1" transition for the gate length duration after the gate delay time has elapsed.

Remote command:

[TRIGger<n>\[:SEquence\]:SLOPe](#) on page 126

Trigger Offset

Opens an edit dialog box to enter the time offset between the trigger signal and the start of the sweep.

offset > 0:	Start of the sweep is delayed
offset < 0:	<p>Sweep starts earlier (pre-trigger)</p> <p>Only possible for span = 0 (e.g. I/Q Analyzer mode) and gated trigger switched off</p> <p>Maximum allowed range limited by the sweep time: $\text{pretrigger}_{\text{max}} = \text{sweep time}$</p> <p>When using the R&S Digital I/Q Interface (R&S FSV-B17) with I/Q Analyzer mode, the maximum range is limited by the number of pretrigger samples.</p>

In the "External" or "IF Power" trigger mode, a common input signal is used for both trigger and gate. Therefore, changes to the gate delay will affect the trigger delay (trigger offset) as well.

Remote command:

[TRIGger<n>\[:SEquence\]:HOLDoff\[:TIME\]](#) on page 125

Trigger Hysteresis

Defines the value for the trigger hysteresis for "IF power" or "RF Power" trigger sources. The hysteresis in dB is the value the input signal must stay below the power trigger level in order to allow a trigger to start the measurement. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

Remote command:

[TRIGger<n>\[:SEquence\]:IFPower:HYSteresis](#) on page 125

Trigger Holdoff

Defines the value for the trigger holdoff. The holdoff value in s is the time which must pass before triggering, in case another trigger event happens.

This softkey is only available if "IFPower", "RF Power" or "BBPower" is the selected trigger source.

Remote command:

[TRIGger<n>\[:SEquence\]:IFPower:HOLDoFF](#) on page 125

3.10 Further Information

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3.10.1 Selecting the Appropriate Filter Type

All resolution bandwidths are realized with digital filters.

The video filters are responsible for smoothing the displayed trace. Using video bandwidths that are small compared to the resolution bandwidth, only the signal average is displayed and noise peaks and pulsed signals are repressed. If pulsed signals are to be measured, it is advisable to use a video bandwidth that is large compared to the resolution bandwidth ($VBW * 10 \times RBW$) for the amplitudes of pulses to be measured correctly.

The following filter types are available:

- Normal (3dB) (Gaussian) filters
The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.
- CISPR (6 dB) filters
- MIL Std (6 dB) filters
Note that the 6 dB bandwidths are available only with option R&S FSV-K54.
- Channel filters
For details see [chapter 3.10.2, "List of Available RRC and Channel Filters"](#), on page 64 .
Channel filters do not support FFT mode.
- RRC filters
For details see [chapter 3.10.2, "List of Available RRC and Channel Filters"](#), on page 64 .
RRC filters do not support FFT mode.
- 5-Pole filters
The available bandwidths are specified in the data sheet.
5-Pole filters do not support FFT mode.

3.10.2 List of Available RRC and Channel Filters

For power measurement a number of especially steep-edged channel filters are available (see the following table). The indicated filter bandwidth is the 3 dB bandwidth. For RRC filters, the fixed roll-off factor (a) is also indicated.

Table 3-2: Filter types

Filter Bandwidth	Filter Type	Application
100 Hz	CFILter	
200 Hz	CFILter	A0
300 Hz	CFILter	
500 Hz	CFILter	
1 kHz	CFILter	
1.5 kHz	CFILter	
2 kHz	CFILter	
2.4 kHz	CFILter	SSB
2.7 kHz	CFILter	
3 kHz	CFILter	
3.4 kHz	CFILter	
4 kHz	CFILter	DAB, Satellite
4.5 kHz	CFILter	
5 kHz	CFILter	
6 kHz	CFILter	
6 kHz, a=0.2	RRC	APCO
8.5 kHz	CFILter	ETS300 113 (12.5 kHz channels)
9 kHz	CFILter	AM Radio
10 kHz	CFILter	
12.5 kHz	CFILter	CDMAone
14 kHz	CFILter	ETS300 113 (20 kHz channels)
15 kHz	CFILter	
16 kHz	CFILter	ETS300 113 (25 kHz channels)
18 kHz, a=0.35	RRC	TETRA
20 kHz	CFILter	
21 kHz	CFILter	PDC
24.3 kHz, a=0.35	RRC	IS 136
25 kHz	CFILter	
30 kHz	CFILter	CDPD, CDMAone
50 kHz	CFILter	

Filter Bandwidth	Filter Type	Application
100 kHz	CFILter	
150 kHz	CFILter	FM Radio
192 kHz	CFILter	PHS
200 kHz	CFILter	
300 kHz	CFILter	
500 kHz	CFILter	J.83 (8-VSB DVB, USA)
1 MHz	CFILter	CDMAone
1.228 MHz	CFILter	CDMAone
1.28 MHz, a=0.22	RRC	
1.5 MHz	CFILter	DAB
2 MHz	CFILter	
3 MHz	CFILter	
3.75 MHz	CFILter	
3.84 MHz, a=0.22	RRC	W-CDMA 3GPP
4.096 MHz, a=0.22	RRC	W-CDMA NTT DOCoMo
5 MHz	CFILter	
20 MHz	CFILter	
28 MHz	CFILter	
40 MHz	CFILter	

4 Remote Commands for Bluetooth Measurements (K8)

This chapter describes the remote commands specific to Bluetooth measurements and those required for the described programming examples.

For a description of the basic settings commands, see the base unit description.

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4.1 CALCulate subsystem

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4.1.1 CALCulate:BT0oth Subsystem (BLUETOOTH, K8)

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CALCulate<n>:BT0oth:CFSTability:DEVM:PEAK?	72
CALCulate<n>:BT0oth:CFSTability:FERRor:[TOTal]?	73
CALCulate<n>:BT0oth:CFSTability:FERRor:BLOCK?	74
CALCulate<n>:BT0oth:CFSTability:FERRor:INITial?	74
CALCulate<n>:BT0oth:DPENcoding:[TOTal]?	75
CALCulate<n>:BT0oth:DPENcoding:BER?	75
CALCulate<n>:BT0oth:DPENcoding:NERRor?	76
CALCulate<n>:BT0oth:IBSemiissions:[List]?	76
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CALCulate<n>:BT0oth:IBSemiissions:HADJacent?	78
CALCulate<n>:BT0oth:IBSemiissions:TXReference?	78
CALCulate<n>:BT0oth:ICFTolerance?	79
CALCulate<n>:BT0oth:MCHar:DF<Delta>:AVERage?	79
CALCulate<n>:BT0oth:MCHar:DF<Delta>:MAXimum?	80
CALCulate<n>:BT0oth:MCHar:DF2:PERCent?	81
CALCulate<n>:BT0oth:MCHar:RATio?	82
CALCulate<n>:BT0oth:OPOWer[:PEAK]?	83
CALCulate<n>:BT0oth:OPOWer:AVERage?	83
CALCulate<n>:BT0oth:PLENght?	84
CALCulate<n>:BT0oth:PTYPE?	85
CALCulate<n>:BT0oth:RTPower:[DPSK]?	85
CALCulate<n>:BT0oth:RTPower:GFSK?	86
CALCulate<n>:BT0oth:RTPower:RATio?	87
CALCulate<n>:BT0oth:STATus?	87

CALCulate<n>:BT0oth:ACLR[:LIST]?

This command determines the power of the selected adjacent channels. The number of adjacent channel pairs is defined with the `CONFigure:BT0oth:ACLR:ACPairs` command.

This command is only available with active "Adjacent Channel Power" measurement (see `CONFigure:BT0oth:MEASurement` on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Return values:

<Result> <TX channel – n>...<TX channel – 1> <TX channel> <TX channel + 1>...<TX channel + n>

The results are returned as a list of power values.
The number of adjacent channels is limited by the Bluetooth band limits.

Example:

```
INST:SEL BTO
```

Activates the Bluetooth Measurements option.

```
INIT:CONT OFF
```

Selects single sweep operation.

```
CONF:BTO:MEAS ACLR
```

Activates the Adjacent Channel Power measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:ACLR?
```

Queries the power list.

Usage:

Query only

Mode:

BT

Manual operation: See "[TX Spec ACLR](#)" on page 40

CALCulate<n>:BTOoth:ACLR:EXceptions?

This command determines the number of exceptions which occurred during the adjacent channel power measurement according to the Bluetooth specification.

Note:

This command is only available with active Adjacent Channel Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

```
INST:SEL BTO
```

Activates the Bluetooth Measurements option.

```
INIT:CONT OFF
```

Selects single sweep operation.

```
CONF:BTO:MEAS ACLR
```

Activates the Adjacent Channel Power measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:ACLR?
```

Queries the power list.

```
CALC:BTO:ACLR:EXC?
```

Queries the number of exceptions.

Usage:

Query only

Mode:

BT

Manual operation: See "TX Spec ACLR" on page 40

CALCulate<n>:BTOoth:CFDRift[:MAXimum]?

This command determines the maximum Carrier Frequency Drift.

Note:

This command is only available with active Carrier Frequency Drift measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS CFDR
```

Activates the Carrier Frequency Drift measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:CFDR?
```

Queries the result.

Usage: Query only

Mode: BT

Manual operation: See "Carr Freq Drift" on page 43

CALCulate<n>:BTOoth:CFDRift:RATE?

This command determines the maximum Carrier Frequency Drift per 50 (s).

Note:

This command is only available with active Carrier Frequency Drift measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS CFDR
```

Activates the Carrier Frequency Drift measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:CFDR:RATE?
```

Queries the result.

Usage: Query only

Mode: BT

Manual operation: See "Carr Freq Drift" on page 43

CALCulate<n>:BTOoth:CFStability:COUNT?

This command reads the number of measured blocks during or after a measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS CFST
```

Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:CFST:COUNT?
```

Reads the number of measured blocks.

Usage: Query only

Mode: BT

Manual operation: See "Carr Freq Stability" on page 47

CALCulate<n>:BTOoth:CFStability:DEVM:[RMS]? <Mode>

This command reads the root mean square (RMS) of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**

*RST: -

Example:	<p>For the first steps refer to chapter 4.14, "Programming Example", on page 127</p> <pre>CONF:BTO:MEAS CFST</pre> <p>Activates the Carrier Frequency Stability and Modulation Accuracy measurement.</p> <pre>INIT;*WAI</pre> <p>Starts the measurement with synchronization.</p> <pre>CALC:BTO:CFST:DEVM? AVER</pre> <p>Reads the root mean square of the average differential error vector magnitude.</p>
Usage:	Query only
Mode:	BT
Manual operation:	See " Carr Freq Stability " on page 47

CALCulate<n>:BTOoth:CFStability:DEVM:DPCT
CALCulate<n>:BTOoth:CFStability:DEVM:D99Pct?

This command reads 99% of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:	<p>For the first steps refer to chapter 4.14, "Programming Example", on page 127</p> <pre>CONF:BTO:MEAS CFST</pre> <p>Activates the Carrier Frequency Stability and Modulation Accuracy measurement.</p> <pre>INIT;*WAI</pre> <p>Starts the measurement with synchronization.</p> <pre>CALC:BTO:CFST:DEVM:D99Pct?</pre> <p>Reads 99% of the differential error vector magnitude.</p>
Usage:	Query only
Mode:	BT
Manual operation:	See " Carr Freq Stability " on page 47

CALCulate<n>:BTOoth:CFStability:DEVM:PEAK?

This command reads the peak of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).
With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF: BTO: MEAS CFST
```

Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT; *WAI
```

Starts the measurement with synchronization.

```
CALC: BTO: CFST: DEVM: PEAK?
```

Reads the peak of the differential error vector magnitude.

Usage:

Query only

Mode:

BT

Manual operation: See "[Carr Freq Stability](#)" on page 47

CALCulate<n>:BT0oth:CFSTability:FERRor:[TOTal]? <Mode>

This command reads the carrier frequency deviation of all packets in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).
With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode>

MINimum | MAXimum | AVERage

*RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF: BTO: MEAS CFST
```

Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT; *WAI
```

Starts the measurement with synchronization.

```
CALC: BTO: CFST: FERR? MIN
```

Reads the minimum carrier frequency deviation of all packets.

Usage:

Query only

Mode:

BT

Manual operation: See "[Carr Freq Stability](#)" on page 47

CALCulate<n>:BTOoth:CFSTability:FERRor:BLOCK? <Mode>

This command reads the maximum frequency deviation of all blocks in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**
*RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS CFST
```

Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:CFST:FERR:BLOC? AVER
```

Reads the maximum average frequency deviation of all blocks.

Usage: Query only

Mode: BT

Manual operation: See "[Carr Freq Stability](#)" on page 47

CALCulate<n>:BTOoth:CFSTability:FERRor:INITial? <Mode>

This command reads the combined frequency deviation of all packets and all blocks in the Carrier Frequency Stability and Modulation Accuracy measurement.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**
*RST: -

Example:	<p>For the first steps refer to chapter 4.14, "Programming Example", on page 127</p> <pre>CONF:BTO:MEAS CFST</pre> <p>Activates the Carrier Frequency Stability and Modulation Accuracy measurement.</p> <pre>INIT;*WAI</pre> <p>Starts the measurement with synchronization.</p> <pre>CALC:BTO:CFST:FERR:INIT? MAX</pre> <p>Reads the combined maximum frequency deviation of all packets and all blocks.</p>
Usage:	Query only
Mode:	BT
Manual operation:	See " Carr Freq Stability " on page 47

CALCulate<n>:BTOoth:DPENcoding:[TOTAl]?

This command reads the number of tested packets in the Differential Phase Encoding measurement.

Note:

This command is only available with active Differential Phase Encoding measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:	<p>For the first steps refer to chapter 4.14, "Programming Example", on page 127</p> <pre>CONF:BTO:MEAS DPEN</pre> <p>Activates the Differential Phase Encoding measurement.</p> <pre>INIT;*WAI</pre> <p>Starts the measurement with synchronization.</p> <pre>CALC:BTO:DPEN?</pre> <p>Reads the number of tested packets.</p>
Usage:	Query only
Mode:	BT
Manual operation:	See " Diff Phase " on page 48

CALCulate<n>:BTOoth:DPENcoding:BER?

This command reads the bit error rate (BER) in the Differential Phase Encoding measurement.

Note:

This command is only available with active Differential Phase Encoding measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF: BTO: MEAS DPEN
```

Activates the Differential Phase Encoding measurement.

```
INIT; *WAI
```

Starts the measurement with synchronization.

```
CALC: BTO: DPEN: BER?
```

Reads the bit error rate.

Usage:

Query only

Mode:

BT

Manual operation:

See ["Diff Phase"](#) on page 48

CALCulate<n>:BT0oth:DPENcoding:NERRor?

This command reads the number of passed packets in the Differential Phase Encoding measurement.

Note:

This command is only available with active Differential Phase Encoding measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF: BTO: MEAS DPEN
```

Activates the Differential Phase Encoding measurement.

```
INIT; *WAI
```

Starts the measurement with synchronization.

```
CALC: BTO: DPEN: NERR?
```

Reads the number of passed packets.

Usage:

Query only

Mode:

BT

Manual operation:

See ["Diff Phase"](#) on page 48

CALCulate<n>:BT0oth:IBSemiissions:[List]?

This command reads the power of all adjacent channels in the In-band Spurious Emissions measurement.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS IBS
```

Activates the In-band Spurious Emissions measurement.

```
CONF:BTO:CHAN 7
```

Adjust the TX channel number.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:IBS?
```

Reads the results of the In-band Spurious Emissions measurement.

Usage:

Query only

Mode:

BT

Manual operation:

See "[Spurious Emissions](#)" on page 46

CALCulate<n>:BT0oth:IBSEmissions:EXCEPTIONS?

This command reads the number of results that exceeded the specified limits in the In-band Spurious Emissions measurement.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS IBS
```

Activates the In-band Spurious Emissions measurement.

```
CONF:BTO:CHAN 7
```

Adjust the TX channel number.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:IBS:EXC?
```

Reads the number of results that exceeded the specified limits.

Usage:

Query only

Mode:

BT

Manual operation: See "[Spurious Emissions](#)" on page 46

CALCulate<n>:BTOoth:IBSemiissions:HADJacent? <Band>

This command reads the maximum power of the upper or lower frequency band (500 kHz) of the TX channel in the In-band Spurious Emissions measurement.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Band> **UPPer | LOWer**
*RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS IBS
```

Activates the In-band Spurious Emissions measurement.

```
CONF:BTO:CHAN 7
```

Adjust the TX channel number.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:IBS:HADJ? LOW
```

Reads the maximum power of the lower frequency band.

Usage: Query only

Mode: BT

Manual operation: See "[Spurious Emissions](#)" on page 46

CALCulate<n>:BTOoth:IBSemiissions:TXReference?

This command reads the TX channel reference power.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:	For the first steps refer to chapter 4.14, "Programming Example" , on page 127 <code>CONF:BTO:MEAS IBS</code> Activates the In-band Spurious Emissions measurement. <code>CONF:BTO:CHAN 7</code> Adjust the TX channel number. <code>INIT;*WAI</code> Starts the measurement with synchronization. <code>CALC:BTO:IBS:TXR?</code> Reads the TX channel reference power.
Usage:	Query only
Mode:	BT

CALCulate<n>:BTOoth:ICFTolerance? <Mode>

This command determines the Initial Carrier Frequency Tolerance.

Note:

This command is only available with active Modulation Characteristics measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**
 *RST: -

Example:	For the first steps refer to chapter 4.14, "Programming Example" , on page 127 <code>CONF:BTO:MEAS ICFT</code> Activates the Initial Carrier Frequency Tolerance measurement. <code>CONF:BTO:SWE:COUN 20</code> Initiates the sweep counter with 20. <code>INIT;*WAI</code> Starts the measurement with synchronization. <code>CALC:BTO:ICFT? AVER</code> Queries the average value.
Usage:	Query only
Mode:	BT
Manual operation:	See " Init Carr Freq Tol " on page 43

CALCulate<n>:BTOoth:MChar:DF<Delta>:AVERage? <Type>

This command determines the average frequency deviation for varying bit patterns of the payload.

Note:

This command is only available with active Modulation Characteristics measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

<Delta> 1 | 2
the frequency deviation and the bit pattern:
1 = $\Delta f_{1_{avg}}$: 11110000
2 = $\Delta f_{2_{avg}}$: 10101010

Parameters:

<Type> **MINimum | MAXimum**

*RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF: BTO: MEAS MCH
```

Activates the Modulation Characteristics measurement.

```
CONF: BTO: SWE: COUN 20
```

Initiates the sweep counter with 20.

... EUT emits bit pattern 11110000

```
INIT: IMM; *WAI
```

Starts the measurement with synchronization and erase previous measurement results.

```
CALC: BTO: MCH: DF1: AVER? MIN
```

Queries minimum value "11110000".

Usage: Query only

Mode: BT

Manual operation: See "[Modulation Char](#)" on page 41

CALCulate<n>:BT0oth:MCHar:DF<Delta>:MAXimum? <Mode>

This command determines the maximum frequency deviation for different bit patterns of the payload.

Note:

This command is only available with active Modulation Characteristics measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

<Delta>	1 2 the frequency deviation and the bit pattern: 1 = $\Delta f_{1_{avg}}$: 11110000 2 = $\Delta f_{2_{avg}}$: 10101010
Parameters:	
<Mode>	MINimum MAXimum AVERage *RST: -
Example:	For the first steps refer to chapter 4.14, "Programming Example" , on page 127 CONF:BTO:MEAS MCH Activates the Modulation Characteristics measurement. CONF:BTO:SWE:COUN 20 Initiates the sweep counter with 20. ... EUT emits bit pattern 11110000 INIT:IMM;*WAI Starts the measurement with synchronization and erase previous measurement results. CALC:BTO:MCH:DF1:MAX? MIN Queries minimum value "11110000".
Usage:	Query only
Mode:	BT
Manual operation:	See " Modulation Char " on page 41

CALCulate<n>:BTOoth:MCHar:DF2:PERCent?

This command determines the percentage of measurements of the frequency deviation, for which the value of $f_{2_{max}}$ is within the allowed range. Therefore only the numeric suffix 2 is allowed for DF.

Note:

This command is only available with active Modulation Characteristics measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Example:	For the first steps refer to chapter 4.14, "Programming Example" , on page 127 CONF:BTO:MEAS MCH Activates the Modulation Characteristics measurement. CONF:BTO:SWE:COUN 20 Initiates the sweep counter with 20. ... EUT emits bit pattern 10101010 INIT;*WAI Starts the measurement with synchronization. CALC:BTO:MCH:DF2:PERC? Queries the percentage of "in range" measurements.
Usage:	Query only
Mode:	BT
Manual operation:	See " Modulation Char " on page 41

CALCulate<n>:BTOoth:MCHar:RATio? <Mode>

This command determines the ratio of the average frequency deviations for varying bit patterns of the payload.

Note:

This command is only available with active Modulation Characteristics measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**

*RST: -

Example:	For the first steps refer to chapter 4.14, "Programming Example" , on page 127 CONF:BTO:MEAS MCH Activates the Modulation Characteristics measurement. CONF:BTO:SWE:COUN 20 Initiates the sweep counter with 20. ... EUT emits bit pattern 1111000 INIT:IMM;*WAI Starts the measurement with synchronization and erase previous measurement results. ... EUT emits bit pattern 10101010 INIT:CONM;*WAI Starts additional measurement with synchronization. CALC:BTO:MCH:RAT? MIN Queries the minimum value.
Usage:	Query only

Mode: BT

Manual operation: See "[Modulation Char](#)" on page 41

CALCulate<n>:BTOoth:OPOWER[:PEAK]?

This command reads the peak value of the Output Power measurement according to the BLUETOOTH standard.

Note:

This command is only available with active Output Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements it causes a query error.

Suffix:

<n> irrelevant

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BT0:MEAS OPOW
```

Activates the Output Power measurement.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BT0:OPOW?
```

Queries the output power result.

Usage: Query only

Mode: BT

Manual operation: See "[Output Power](#)" on page 35

CALCulate<n>:BTOoth:OPOWER:AVERAge? <Mode>

This command reads the average value of the Output Power measurement according to the Bluetooth standard.

With a sweep count value of ≥ 1 ([CONFigure:BT0oth:SWEep:COUNT](#)) and trace mode "Clear/Write" ([DISPlay\[:WINDow<n>\]:TRACe<t>:MODE](#)) the selected number of measurements is performed when a single sweep is started ([INITiate<n>\[:IMMediate\]](#)). During these measurements the minimum and maximum values are determined. If only a single measurement is performed, the minimum and maximum value are identical.

Note:

This command is only available with active Output Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements it causes a query error.

Suffix:

<n> irrelevant

Parameters:<Mode> **MINimum | MAXimum | AVERage**

*RST: -

Example:For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

CONF:BTO:MEAS OPOW

Activates the Output Power measurement.

CONF:BTO:SWE:COUN 20

Activates measurement over 20 sweeps.

INIT;*WAI

Activates measurement over 20 sweeps.

CALC:BTO:OPOW:AVER? MAX

Queries the maximum average value of the Output Power measurement.

Usage:

Query only

Mode:

BT

Manual operation:See ["Output Power"](#) on page 35**CALCulate<n>:BTOoth:PLENght?**

This command reads the length of the packet analyzed by the preceding measurement.

Note:

This command is only available if a measurement was started via [INITiate<n>\[:IMMEDIATE\]](#) before and if this measurement is completed. With a missing or incomplete measurement the command causes a query error. This command is only available with the measurements Output Power, Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift (see [CONFIGure:BT0oth:MEASurement](#) on page 96).

Suffix:

<n> irrelevant

Example:

INST:SEL BTO

Activates the Bluetooth Measurements option

INIT:CONT OFF

Selects single sweep operation

CONF:BTO:MEAS OPOW

Activates the Output Power measurement

INIT;*WAI

Starts the measurement with synchronization

CALC:BTO:PLEN?

Queries the packet length

Usage:

Query only

Mode:

BT

CALCulate<n>:BTOoth:PTYPe?

This command determines the type of the packet analyzed by a preceding measurement.

Note:

This command is only available if a measurement was started via [INITiate<n>\[:IMMEDIATE\]](#) before and if this measurement is completed. With a missing or incomplete measurement the command causes a query error. This command is only available with the measurements Output Power, Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Suffix:

<n> irrelevant

Parameters:

Result AUX1 | DH1 | DH3 | DH5 | DM1 | DM3 | DM5 | FHS | HV1 | HV2 | HV3 | DV | NULL | POLL | UNDEF

These packet types are recognized and returned as character data.

*RST: -

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option
INIT:CONT OFF
Selects single sweep operation
CONF:BTO:MEAS OPOW
Activates the Output Power measurement
INIT;*WAI
Starts the measurement with synchronization
CALC:BTO:PTYP?
Queries the packet type
```

Usage: Query only

Mode: BT

CALCulate<n>:BTOoth:RTPower:[DPSK]? <Mode>

This command reads the average transmission power for the DPSK sections of the packet in the Relative Transmission Power measurement. With a sweep count 1, the command returns the current value, irrespective of the parameter.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**
 *RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS RTP
```

Activates the Relative Transmit Power measurement.

```
CONF:BTO:SWE:COUN 10
```

Initiates the sweep counter with 10.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:RTP? MIN
```

Reads the lowest recorded average power of the DPSK section of all packets.

Usage:

Query only

Mode:

BT

Manual operation:

See "[Rel TX Power](#)" on page 44

CALCulate<n>:BTOoth:RTPower:GFSK? <Mode>

This command reads the transmission power for the GFSK sections of the packet in the Relative Transmission Power measurement. With a sweep count 1, the command returns the current value, irrespective of the parameter.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**
 *RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS RTP
```

Activates the Relative Transmit Power measurement.

```
CONF:BTO:SWE:COUN 10
```

Initiates the sweep counter with 10.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:RTP:GFSK? MIN
```

Reads the highest recorded average power of the GFSK section of all packets.

Usage:

Query only

Mode: BT

Manual operation: See "Rel TX Power" on page 44

CALCulate<n>:BTOoth:RTPower:RATio? <Mode>

This command reads the ratio of the transmission power for the GFSK and DPSK modulation in the Relative Transmission Power measurement (PDPSK/PGFSK). With a sweep count 1, the command returns the current value, irrespective of the parameter.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). With all other measurements this command causes a query error.

Suffix:

<n> irrelevant

Parameters:

<Mode> **MINimum | MAXimum | AVERage**

*RST: -

Example:

For the first steps refer to [chapter 4.14, "Programming Example"](#), on page 127

```
CONF:BTO:MEAS RTP
```

Activates the Relative Transmit Power measurement.

```
CONF:BTO:SWE:COUN 10
```

Initiates the sweep counter with 10.

```
INIT;*WAI
```

Starts the measurement with synchronization.

```
CALC:BTO:RTP:RAT? MIN
```

Queries the minimum value.

Usage: Query only

Mode: BT

Manual operation: See "Rel TX Power" on page 44

CALCulate<n>:BTOoth:STATus?

This command queries the status of a preceding measurement.

Note:

This command is only available, if a measurement was started via [INITiate<n>\[:IMMEDIATE\]](#) before and if this measurement is completed. With a missing or incomplete measurement the command causes a query error.

Suffix:

<n> irrelevant

Return values:

<Result> **0**
 PASS
 1
 FAIL

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option
INIT:CONT OFF
Selects single sweep operation
CONF:BTO:MEAS OPOW
Activates Output Power measurement
INIT;*WAI
Starts the measurement with synchronization
CALC:BTO:STAT?
Queries the status
```

Usage: Query only

Mode: BT

4.1.2 CALCulate:DELTamarker Subsystem (BLUETOOTH, K8)

CALCulate<n>:DELTamarker<m>:Y?.....88

CALCulate<n>:DELTamarker<m>:Y?

This command queries the measured value of a delta marker. The corresponding delta marker is activated, if necessary. The output is always a relative value referred to marker 1 or to the reference position (reference fixed active).

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Depending on the unit defined with `CALC:UNIT:POW` or on the activated measuring functions, the query result is output in the units below:

Table 4-1: Bluetooth measurements

Parameter, measuring function or result display	Output unit
OUTPUT POWER result display (R&S FSV-K8)	dB
TX SPECTRUM ACP result display (R&S FSV-K8)	dB
MODULATION CHARACTERISTICS result display (R&S FSV-K8)	Hz
INITIAL CARR FREQ TOL result display (R&S FSV-K8)	Hz
CARRIER FREQ DRIFT result display (R&S FSV-K8)	Hz
RELATIVE TX POWER (R&S FSV-K8)	dB
IN-BAND SPURIOUS EMISSIONS (R&S FSV-K8)	dB

Parameter, measuring function or result display	Output unit
CARRIER FREQUENCY STABILITY (R&S FSV-K8)	–
DIFF PHASE ENCODING (R&S FSV-K8)	–

Suffix:

<n> Selects the measurement window.

<m> Selects the marker.

Example:

```
INIT:CONT OFF
Switches to single sweep mode.
INIT;*WAI
Starts a sweep and waits for its end.
CALC:DELT2 ON
Switches on delta marker 2.
CALC:DELT2:Y?
Outputs measurement value of delta marker 2.
```

Usage: Query only

4.1.3 CALCulate:MARKer Subsystem (BLUETOOTH, K8)

CALCulate<n>:MARKer<m>:PEXCursion.....	89
CALCulate<n>:MARKer<m>:Y?.....	90

CALCulate<n>:MARKer<m>:PEXCursion <Excursion>

This command defines the peak excursion

The peak excursion sets the requirements for a peak to be detected during a peak search.

The unit depends on the selected operating mode and measurement.

Mode/Display mode	Unit
Spectrum	dB
ADEMOD, RF display	dB
ADEMOD, AM display	PCT
ADEMOD, FM display	kHz
ADEMOD, PM display	RAD

Suffix:

<n> Selects the measurement window.

<m> irrelevant

Parameters:

<Excursion>

The peak excursion is the distance to a trace maximum that must be attained before a new maximum is recognized, or the distance to a trace minimum that must be attained before a new minimum is recognized

*RST: 6dB in "Spectrum" mode and RF displays; 5 PCT in AM displays, 50 kHz in FM displays, (0.5 RAD in PM displays

Example:

```
CALC:MARK:PEXC 10dB
```

Defines peak excursion 10 dB.

CALCulate<n>:MARKer<m>:Y?

This command queries the measured value of a marker.

The corresponding marker is activated before or switched to marker mode, if necessary.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps.

Suffix:

<n>

Selects the measurement window.

<m>

Selects the marker.

Return values:

<Result>

The measured value of the selected marker is returned.

Example:

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK2 ON
```

Switches marker 2.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK2:Y?
```

Outputs the measured value of marker 2.

Usage:

Query only

4.1.4 Other Commands in the CALCulate subsystem**CALCulate<n>:UNIT:POWER <Unit>**

This command selects the unit of the y-axis.

The unit applies to all measurement windows.

Suffix:

<n>

irrelevant

Parameters:

<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT |
 DBUA | AMPere
 *RST: dBm

Example:

CALC:UNIT:POW DBM
 Sets the power unit to dBm.

4.2 CONFigure:BT0oth Subsystem (BLUETOOTH, K8)

This subsystem contains commands to configure Bluetooth measurements.

CONFigure:BT0oth:ACLR:ACPairs.....	91
CONFigure:BT0oth:BANDwidth BWIDth[:RESolution].....	92
CONFigure:BT0oth:BANDwidth BWIDth[:RESolution]:AUTO.....	92
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CONFigure:BT0oth:PBSCo.....	98
CONFigure:BT0oth:PCLass.....	98
CONFigure:BT0oth:POWer:AVERage:START.....	98
CONFigure:BT0oth:POWer:AVERage:STOP.....	99
CONFigure:BT0oth:PRATe.....	99
CONFigure:BT0oth:PTYPE.....	100
CONFigure:BT0oth:RTPower:DAVerage:START.....	100
CONFigure:BT0oth:RTPower:DAVerage:STOP.....	100
CONFigure:BT0oth:RTPower:GAVerage:START.....	101
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CONFigure:BT0oth:SWEEp:COUNT.....	102
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CONFigure:BT0oth:TRACe<t>:MODE.....	103
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CONFigure:BT0oth:ACLR:ACPairs <NoChannels>

This command selects the number of adjacent channel pairs during the Adjacent Channel Power measurement. The number of adjacent channels is limited as soon as the border of the Bluetooth frequency band is reached.

Note:

This command is only available with active "Adjacent Channel Power" measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:<NoChannels> **1 to 78**

*RST: 78

Example:

CONF: BTO: ACLR: ACP 10

Selects 10 adjacent channel pairs.

Mode:

BT

Manual operation:See "[No. of ACP Chan \(TX Spec ACLR, Spurious Emissions\)](#)" on page 41**CONFigure:BT0oth:BANDwidth|BWIDth[:RESolution] <Bandwidth>**

This command sets the resolution bandwidth of the analyzer for the currently selected Bluetooth measurement (see [[SENSe:\]BANDwidth|BWIDth\[:RESolution\]](#) on page 113).

For the measurements of modulation characteristics, initial carrier frequency tolerance, and carrier frequency drift (see [CONFigure:BT0oth:MEASurement](#) on page 96), the resolution bandwidth corresponds to the IF bandwidth of the signal. If the resolution bandwidth is changed, its coupling to the settings according to the RF Test Specification is cancelled.

Note:

The settings for the measurements are valid for all three measurements. For all other Bluetooth measurements the setting is only valid for the currently active measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96). This command is not available with active Adjacent Channel Power measurement.

Parameters:<Bandwidth> **300kHz to 10MHz**

*RST: AUTO is set to ON

Example:

INST: SEL BTO

Activates the Bluetooth Measurements option.

CONF: BTO: MEAS OPOW

Activates the Output Power measurement.

CONF: BTO: BAND 1KHZ

Sets the resolution bandwidth to 1kHz.

Mode:

BT

Manual operation:See "[Res BW Manual \(Output Power, Rel TX Power\)](#)" on page 54**CONFigure:BT0oth:BANDwidth|BWIDth[:RESolution]:AUTO <Mode>**

This command couples the resolution bandwidth to the settings according to the RF Test Specification.

Note:

The settings for the measurements of Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift are common to all three measurements. For all other Bluetooth measurements the setting is only valid for the currently active measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<Mode> **ON | OFF**
*RST: ON

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS MCH
Activates the Modulation Characteristics measurement.
CONF:BTO:BAND:AUTO ON
Activates the RBW coupling.
```

Mode: BT

Manual operation: See "[Res BW Auto \(Output Power, TX Spec ACLR, Rel TX Power, Spurious Emissions\)](#)" on page 54

CONFigure:BT0oth:BANDwidth|BWIDth:VIDeo <Bandwidth>

This command sets the video bandwidth for the Adjacent Channel Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

The available filters have a bandwidth range of 1 Hz to 10 MHz. On a change in video bandwidth its link according to the RF Test Specification is switched off.

Note:

This setting is only available for Output Power measurements.

Parameters:

<Bandwidth> **1 Hz to 10 MHz**
*RST: AUTO is set to ON

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS ACLR
Activates the Adjacent Channel Power measurement.
CONF:BTO:BAND:VID 100HZ
Sets the video bandwidth to 100 Hz.
```

Mode: BT

Manual operation: See "[Video BW Manual \(TX Spec ACLR\)](#)" on page 54

CONFigure:BT0oth:BANDwidth|BWIDth:VIDeo:AUTO <Mode>

This command links the video bandwidth to the settings according to the RF Test Specification. It is only available for the Adjacent Channel Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Note:

This setting is only valid for the currently active measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96) and it is independent of the other Bluetooth measurements.

Parameters:

<Mode> **ON | OFF**
*RST: ON

Example:

INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS ACLR
Activates the Adjacent Channel Power measurement.
CONF:BTO:BAND:VID:AUTO ON
Switches the VBW coupling on.

Mode: BT

Manual operation: See "[Video BW Auto \(TX Spec ACLR, Spurious Emissions\)](#)" on page 55

CONFigure:BT0oth:CFSTability:BCOunt <NoBlocks>

This command sets the number of blocks to be measured.

Note:

This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<NoBlocks> **0 to 1,000,000**
*RST: 200

Example:

CONF:BTO:CFST:BCO 1000
Selects 1000 blocks to be measured.

Mode: BT

Manual operation: See "[Block Count \(Carr Freq Stability\)](#)" on page 48

CONFigure:BT0oth:CHANnel <Channel>

This command selects the frequency channel for the measurements according to the Bluetooth standard.

Parameters:

<Channel> **0 to 78**
*RST: 0

Example:

CONF:BTO:CHAN 20
Selects channel 20

Mode: BT

Manual operation: See "Channel" on page 36

CONFigure:BT0oth:DETEctor<1...4>[:FUNCTion] <Detector>

This command selects the detector for the currently selected Bluetooth measurement. The numeric suffix assigns the detector to a trace (1 to 4).

Note:

The RMS detector is not available for the measurements Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift (see [CONFigure:BT0oth:MEASurement](#) on page 96). The setting is valid for the currently selected measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96) and independent of other Bluetooth measurements.

Parameters:

<Detector> APEak | NEGative | POSitive | SAMPlE | RMS | AVERAge
 *RST: see table below

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS OPOW
Activates the Output Power measurement.
CONF:BTO:DET2 RMS
Sets the detector for trace 2 to RMS.
```

Mode: BT

Table 4-2: RST value depending on measurement type

Measurement type	RST value
Output Power	PEAK
Adjacent Channel Power EDR Rel TX Power EDR In-band Spurious Emissions	AVER
Modulation Characteristics Initial Carrier Frequency Tolerance Carrier Frequency Drift EDR Differential Phase Encoding EDR Carrier Frequency Stability and Modulation Accuracy	APEAK

CONFigure:BT0oth:IBSemissions:ACPairs <NoChannels>

This command selects the number of adjacent channel pairs during the In-band Spurious Emissions measurement. The number of adjacent channels will be limited as soon as the border of the Bluetooth frequency band is reached.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

CONFigure:BT0oth Subsystem (BLUETOOTH, K8)

Parameters:<NoChannels> **1 to 78**

*RST: 78

Example:

CONF: BTO: IBS: ACP 20

Selects 20 adjacent channel pairs.

Mode:

BT

Manual operation:See "[No. of ACP Chan \(TX Spec ACLR, Spurious Emissions\)](#)" on page 41

CONFigure:BT0oth:IBSEmissions:GATE:AUTO ONCE

This command adjusts the gate settings for the In-band Spurious Emissions automatically.

Note:

This command is only available with active In-band Spurious Emissions measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Example:

CONF: BTO: IBS: GATE: AUTO ONCE

Adjusts the gate automatically once.

Mode:

BT

Manual operation:See "[Adjust Gate](#)" on page 47

CONFigure:BT0oth:MEASurement <MeasType>

This command selects the current measurement according to the Bluetooth standard.

Parameters:

<MeasType>

OPOWEROutput Power measurement, see [chapter 3.1.1, "Output Power Measurement"](#), on page 22**ACLR**Adjacent Channel Power measurement, see [chapter 3.1.2, "Adjacent Channel Power Measurement"](#), on page 24**MChar**Modulation Characteristics measurement, see [chapter 3.1.3, "Modulation Characteristics Measurement"](#), on page 25**ICFTolerance**Initial Carrier Frequency Tolerance measurement, see [chapter 3.1.4, "Initial Carrier Frequency Tolerance Measurement"](#), on page 26**CFDRift**Carrier Frequency Drift measurement, see [chapter 3.1.5, "Carrier Frequency Drift Measurement"](#), on page 27**RTPower**Relative Transmit Power (EDR) measurement, see [chapter 3.1.6, "Relative Transmit Power \(EDR\) Measurement"](#), on page 28**IBSemissions**Spurious Emissions (EDR) measurement, see [chapter 3.1.7, "In-band Spurious Emissions \(EDR\) measurement"](#), on page 29**DPENcoding**Differential Phase Encoding (EDR) measurement, see [chapter 3.1.9, "Differential Phase Encoding \(EDR\) measurement"](#), on page 32**CFSTability**Carrier Frequency Stability and Modulation Accuracy (EDR) measurement, see [chapter 3.1.8, "Carrier Frequency Stability and Modulation Accuracy \(EDR\) measurement"](#), on page 31

*RST: OPOWER

Example:

CONF:BT0:MEAS ACLR

Selects the measurement of the adjacent channel power.

Mode:

BT

Manual operation:

See ["Output Power"](#) on page 35
 See ["TX Spec ACLR"](#) on page 40
 See ["Modulation Char"](#) on page 41
 See ["Init Carr Freq Tol"](#) on page 43
 See ["Carr Freq Drift"](#) on page 43
 See ["Rel TX Power"](#) on page 44
 See ["Spurious Emissions"](#) on page 46
 See ["Carr Freq Stability"](#) on page 47
 See ["Diff Phase"](#) on page 48

CONFigure:BT0oth:PBSCo <NoBytes>

This command selects the number of payload bytes that are transmitted in a packet.

Parameters:

<NoBytes> **1 – 1000**
 *RST: 1

Example: CONF:BT0:PBSC 50
 Selects the number of payload bytes.

Mode: BT

Manual operation: See "[Packet Bytes SCO](#)" on page 37

CONFigure:BT0oth:PClass <Class>

This command selects the power class for the Output Power measurement. The power class defines the limits for the output power measurement.

Parameters:

<Class> **1 to 3**
 *RST: 1

Example: CONF:BT0:PCL 3
 Selects power class 3

Mode: BT

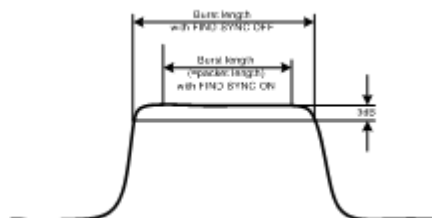
Manual operation: See "[Power Class](#)" on page 37

CONFigure:BT0oth:POWER:AVERage:START <Position>

This command defines the start position for the calculation of the average power of a burst.

Note:

Depending on the setting `FIND SYNC ON` or `OFF` (see [[SENSe](#)] : [DDEMod:SEARCH:SYNC:STATE](#) on page 121) the burst is either defined by the p0 bit and the packet length or the 3 dB points according to the RF Test Specification. As a result there are different areas within the burst for calculating the average power:

**Parameters:**

<Position> **0 to 100PCT**
 *RST: 20%

Example: `CONF:BTO:POW:AVER:STAR 10PCT`
Sets the starting point for the calculation to 10% of the burst length.

Mode: BT

Manual operation: See ["Power Avg Start \(Output Power\)"](#) on page 40

CONFigure:BT0oth:POWer:AVERAge:STOP <Position>

This command defines the end position for the calculation of the average power of a burst.

Note:

Depending on the setting FIND SYNC ON or OFF (see [\[SENSe\]:DDEMod:SEARCh:SYNC:STATe](#) on page 121) the burst is either defined by the p0 bit and the packet length or the 3 dB points according to the RF Test Specification. As a result there are different areas within the burst for calculating the average power (see [CONFigure:BT0oth:POWer:AVERAge:STARt](#) on page 98).

Parameters:

<Position> **0 to 100PCT**
*RST: 80%

Example: `CONF:BTO:POW:AVER:STAR 90PCT`
Sets the end point for the calculation to 90% of the burst length.

Mode: BT

Manual operation: See ["Power Avg Stop \(Output Power\)"](#) on page 40

CONFigure:BT0oth:PRATe <NoSamples>

This command selects the number of measurement samples (points) per symbol for the measurement. This command is not available for EDR measurements. For EDR measurements, this parameter is set to 4 points/symbol and cannot be changed.

Note:

The RF Test Specification specifies an oversampling factor of at least 4.

Parameters:

<NoSamples> **2 | 4 | 8 | 16 | 32**
*RST: 4

Example: `CONF:BTO:PRAT 16`
Selects 16 points/symbol.

Mode: BT

Manual operation: See ["Points / Symbol"](#) on page 37

CONFigure:BT0oth:PTYPe <Type>

This command selects the packet type to be measured.

Parameters:

<Type>	DH1 1 slot packet
	DH3 3 slot packet
	DH5 5 slot packet
	AUTO automatic selection of the packet type
*RST:	DH1

Example: CONF:BT0:PTYP DH5
Selects type "5 slot packet".

Mode: BT

Manual operation: See "[Packet Type](#)" on page 36

CONFigure:BT0oth:RTPower:DAverage:STARt <Time>

This command sets the start time for the power measurement of the DPSK sections of the packet.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<Time>	0 to 100%
*RST:	10%

Example: CONF:BT0:RTP:DAV:STAR 20
Sets the start time for the power measurement of the DPSK sections of the packet.

Mode: BT

Manual operation: See "[DPSK Start](#)" on page 45

CONFigure:BT0oth:RTPower:DAverage:STOP <Time>

This command sets the stop time for the power measurement of the DPSK sections of the packet.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<Time> **0 to 100%**
 *RST: 90%

Example:

CONF: BTO: RTP: DAV: STOP 80

Sets the stop time for the power measurement of the DPSK sections of the packet.

Mode: BT

Manual operation: See "DPSK Stop" on page 45

CONFigure:BT0oth:RTPower:GAverage:START <Time>

This command sets the start time for the power measurement of the GFSK sections of the packet.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<Time> **0 to 100%**
 *RST: 10%

Example:

CONF: BTO: RTP: GAV: STAR 20

Sets the start time for the power measurement of the GFSK sections of the packet.

Mode: BT

Manual operation: See "GFSK Start" on page 45

CONFigure:BT0oth:RTPower:GAverage:STOP <Time>

This command sets the stop time for the power measurement of the GFSK sections of the packet.

Note:

This command is only available with active Relative Transmit Power measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96).

Parameters:

<Time> **0 to 100%**
 *RST: 90%

Example:

CONF: BTO: RTP: GAV: STOP 80

Sets the stop time for the power measurement of the GFSK sections of the packet.

Mode: BT

Manual operation: See "GFSK Stop" on page 45

CONFigure:BT0oth:SWEep:COUNT <NoSweeps>

This command defines the number of sweeps for the currently selected Bluetooth measurement. This number will be started as a "single sweep". With trace mode setting clear/write (see [CONFigure:BT0oth:TRACe<t>:MODE](#) on page 103) the measurement results will be calculated for each sweep and taken into account for the calculation of minimum, maximum and average values. For the remaining trace settings (AVER, MAXH, MINH) the measurement results will be calculated from the resulting trace. In average mode the value 0 defines the sliding average of the measurement data over 10 sweeps.

Note:

The setting is valid only for the currently active measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96) and independent of the other Bluetooth measurements.

Parameters:

<NoSweeps>

0 to 32767

*RST: see table below

Example:

INST:SEL BTO

Activates the Bluetooth Measurements option.

CONF:BTO:MEAS OPOW

Activates the Output Power measurement.

INIT:CONT OFF

Selects single sweep operation.

CONF:BTO:SWE:COUN 20

Sets the number of sweeps to 20.

INIT;*OPC

Starts a sweep with synchronization.

Mode:

BT

Manual operation: See "[Sweep Count](#)" on page 57**Table 4-3: RST value depending on measurement type**

Measurement type	RST value
Output Power	0
Adjacent Channel Power Modulation Characteristics Initial Carrier Frequency Tolerance Carrier Frequency Drift EDR Relative TX Power EDR In-band Spurious Emissions	10
Differential Phase Encoding	100

CONFigure:BT0oth:SWEep:TIME <Duration>

This command defines the duration of a sweep sequence for the active Bluetooth measurement.

Parameters:

<Duration> **1us to [130560us / (points per symbol)]**
 *RST: AUTO is set to ON

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS OPOW
Activates the Output Power measurement.
CONF:BTO:SWE:TIME 10MS
Sets a sweep time of 10 ms.
```

Mode: BT

Manual operation: See "[Sweeptime Manual \(TX Spec ACLR\)](#)" on page 54
 See "[Meas Time Manual](#)" on page 54

CONFigure:BT0oth:SWEep:TIME:AUTO <Mode>

This command couples the sweep time to the settings according to the RF Test Specification.

Note:

The setting is valid only for the currently active measurement (see [CONFigure:BT0oth:MEASurement](#) on page 96) and independent of the other Bluetooth measurements.

Parameters:

<Mode> **ON | OFF**
 *RST: ON

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BTO:MEAS OPOW
Activates the Output Power measurement.
CONF:BTO:SWE:TIME:AUTO ON
Switches the sweep time coupling on.
```

Mode: BT

Manual operation: See "[Sweeptime Auto \(TX Spec ACLR\)](#)" on page 54
 See "[Meas Time Auto](#)" on page 54

CONFigure:BT0oth:TRACe<t>:MODE <Mode>

This command defines the way of displaying and evaluating the measurement curves for the selected Bluetooth measurement. WRITE corresponds to manual operating mode Clr/Write.

The number of measurement to be executed for AVERage, MAXHold and MINHold is defined with the `CONFigure:BT0oth:SWEep:COUNT` on page 102 command. Please note that a synchronization to the end of the indicated number of measurements is only possible during single sweep operation.

Note:

The setting is valid only for the currently active measurement (see `CONFigure:BT0oth:MEASurement` on page 96) and independent of the other Bluetooth measurements.

Suffix:

<t> the trace related to this setting

Parameters:

<Mode> **WRITE | VIEW | AVERage | MAXHold | MINHold | BLANK**
*RST: WRITE

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BT0:MEAS OPOW
Activates the Output Power measurement.
INIT:CONT OFF
Selects single sweep operation.
CONF:BT0:SWE:COUN 10
Sets the sweep count to 10.
CONF:BT0:TRAC2:MODE AVER
Switches averaging for trace 2 on.
INIT;*OPC
Starts a measurement with synchronization.
```

Mode: BT

CONFigure:BT0oth:TRACe<t>:SElect

This command selects the measurement curve for evaluation of the modulation characteristics.

Suffix:

<t> the trace related to this setting

Example:

```
INST:SEL BTO
Activates the Bluetooth Measurements option.
CONF:BT0:MEAS ACLR
Activates the Adjacent Channel Power measurement.
INIT:CONT OFF
Selects single sweep operation.
CONF:BT0:TRAC2:SEL
Selects trace 2 for measurement result queries.
```

Mode: BT

Manual operation: See "[Selected Trace](#)" on page 37

4.3 DISPlay Subsystem (BLUETOOTH, K8)

DISPlay[:WINDow<n>]:TRACe<t>[:STATe].....	105
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe].....	105
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE.....	106
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision.....	106
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel.....	107
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	107
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition.....	107
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue.....	108
DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing.....	108

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command switches on or off the display of the corresponding trace. The other measurements are not aborted but continue running in the background.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t> trace

Parameters:

<State> ON | OFF

*RST: ON for TRACe1, OFF for TRACe2 to 6

Example: DISP:TRAC3 ON

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] <Range>

This command defines the display range of the y-axis with logarithmic scaling.

The command works only for a logarithmic scaling. You can select the scaling with [DISPlay\[:WINDow<n>\]:TRACe<t>:Y:SPACing](#) on page 108.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t> irrelevant

Parameters:

<Range> Range: 10 to 200

*RST: 100

Default unit: dB

Example: DISP:TRAC:Y 110dB

Manual operation: See "Range Log Manual" on page 49
 See "Range Log 100 dB" on page 50
 See "Range Log 50 dB" on page 50
 See "Range Log 10 dB" on page 50
 See "Range Log 5 dB" on page 50
 See "Range Log 1 dB" on page 51

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

This command selects the type of scaling of the y-axis.

When `SYSTem:DISPlay:UPDate` is turned off, this command has no immediate effect on the screen.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t> irrelevant

Parameters:

<Mode> **ABSolute**
absolute scaling of the y-axis

RELative
relative scaling of the y-axis

*RST: ABS

Example: `DISP:TRAC:Y:MODE REL`

Manual operation: See "Grid Abs/Rel " on page 53

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y axis for all diagrams, where possible.

Suffix:

<n> irrelevant

<t> irrelevant

Parameters:

<Value> numeric value; the unit depends on the result display

*RST: depends on the result display

Example: `DISP:TRAC:Y:PDIV 10`
Sets the grid spacing to 10 units (for example 10 dB in the Code Domain Power result display).

Mode: CDMA, BT, EVDO, TDS, WCDMA

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level.

With the reference level offset $\neq 0$, the value range of the reference level is modified by the offset.

Suffix:

<n> irrelevant.

<t> irrelevant

Parameters:

<ReferenceLevel> The unit is variable.

Range: see datasheet

*RST: -10dBm

Example: `DISP:TRAC:Y:RLEV -60dBm`

Manual operation: See "[Ref Level](#)" on page 49

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>

This command defines a reference level offset.

Suffix:

<n> irrelevant.

<t> irrelevant

Parameters:

<Value> Range: -200 to 200

*RST: 0

Default unit: dB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Manual operation: See "[Ref Level Offset](#)" on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSITion <Position>

This command defines the position of the reference level on the display grid..

When using a tracking generator (only with option R&S FSV-B9 or -B10, requires active normalization), and in Bluetooth mode (option R&S FSV-K8) this command defines the position of the reference value for all windows.

Suffix:

<n> Selects the measurement window.

<t> irrelevant

Parameters:

<Position> 0 PCT corresponds to the lower display border, 100% corresponds to the upper display border.
 Range: 0 to 100
 *RST: Spectrum mode: 100 PCT, with tracking generator or time display: 50 PCT
 Default unit: PCT

Example:

```
DISP:TRAC:Y:RPOS 50PCT
```

Manual operation: See "[Ref Level Position](#)" on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

The command defines the power value assigned to the reference position in the grid. When using a tracking generator, this command requires active normalization.

Suffix:

<n> irrelevant
 <t> irrelevant

Parameters:

<Value> *RST: 0 dB, coupled to reference level

Example:

```
DISP:TRAC:Y:RVAL -20dBm
```

Defines a reference position of -20 dBm.

DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing <ScalingType>

This command selects the scaling of the y-axis.

Suffix:

<n> Selects the measurement window.
 <t> irrelevant

Parameters:

<ScalingType> **LOGarithmic**
 Logarithmic scaling.
LINear
 Linear scaling in %.
LDB
 Linear scaling in dB.
 *RST: LOGarithmic

Example:

```
DISP:TRAC:Y:SPAC LIN
```

Select a linear scale.

Manual operation: See "Range Log Manual" on page 49
 See "Range Log 100 dB" on page 50
 See "Range Log 50 dB" on page 50
 See "Range Log 10 dB" on page 50
 See "Range Log 5 dB" on page 50
 See "Range Log 1 dB" on page 51
 See "Range Linear %" on page 51
 See "Range Lin. Unit" on page 51

4.4 FORMat subsystem

FORMat[:DATA] <Format>

This command selects the data format for the data transmitted from the R&S FSV to the controlling computer. It is used for the transmission of trace data. The data format of trace data received by the instrument is automatically recognized, regardless of the format which is programmed.

Parameters:

<Format>

ASCII

ASCII data are transmitted in plain text, separated by commas.

REAL

REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block format".

*RST: ASCII

Example:

```
FORM REAL, 32
FORM ASC
```

4.5 INITiate subsystem

INITiate<n>:CONTInuous.....	109
INITiate<n>[:IMMEDIATE].....	110

INITiate<n>:CONTInuous <State>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

The sweep is started immediately.

Suffix:

<n> irrelevant

Parameters:

<State> ON | OFF

*RST: ON

Example:	INIT:CONT OFF Switches the sequence to single sweep. INIT:CONT ON Switches the sequence to continuous sweep.
Mode:	all
Manual operation:	See "Continuous Sweep" on page 56 See "Single Sweep" on page 56

INITiate<n>[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous sweep mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous sweep mode in remote control, as results like trace data or markers are only valid after a single sweep end synchronization.

Suffix:
<n> irrelevant

Example:	INIT:CONT OFF Switches to single sweep mode. DISP:WIND:TRAC:MODE AVER Switches on trace averaging. SWE:COUN 20 Setting the sweep counter to 20 sweeps. INIT;*WAI Starts the measurement and waits for the end of the 20 sweeps.
-----------------	--

Mode: all

4.6 INPut subsystem

INPut:ATTenuation.....	110
INPut:ATTenuation:AUTO.....	111
INPut:GAIN:STATe	111
INPut:IMPedance.....	112

INPut:ATTenuation <Value>

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the DOWN command.

The attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

In the default state with "Spectrum" mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<Value> *RST: 10 dB (AUTO is set to ON)

Example:

INP:ATT 30dB

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Mode: all

Manual operation: See "[RF Atten Manual/Mech Att Manual](#)" on page 52

INPut:ATTenuation:AUTO <State>

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<State> ON | OFF

*RST: ON

Example:

INP:ATT:AUTO ON

Couples the attenuation set on the attenuator to the reference level.

Manual operation: See "[RF Atten Auto/Mech Att Auto](#)" on page 52

INPut:GAIN:STATe <State>

This command turns the 20 dB preamplifier on and off.

With option R&S FSV-B22, the preamplifier only has an effect below 7 GHz.

With option R&S FSV-B24, the amplifier applies to the entire frequency range.

This command is not available when using R&S Digital I/Q Interface (R&S FSV-B17).

Parameters:

<State> ON | OFF

*RST: OFF

Example:

INP:GAIN:STAT ON

Turns the preamplifier on.

Manual operation: See "[Preamp On/Off](#)" on page 51

INPut:IMPedance <Impedance>

This command selects the nominal input impedance.

75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75 Ω /50 Ω).

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<Impedance> 50 | 75
 *RST: 50 Ω

Example: INP:IMP 75

Manual operation: See "Input 50 Ω /75 Ω " on page 53

4.7 INSTrument Subsystem (BLUETOOTH, K8)

INSTrument[:SElect].....	112
INSTrument:NSElect.....	112

INSTrument[:SElect]**Parameters:**

Parameter **BTOoth**
 Bluetooth mode (option Bluetooth Measurements)

INSTrument:NSElect**Parameters:**

Parameter **12**
 Bluetooth mode (option Bluetooth Measurements)

4.8 SENSE Subsystem (BLUETOOTH, K8)

[SENSe:]AVERage<n>:COUNT <NoMeasurements>

This command defines the number of measurements which contribute to the average value.

Note that continuous averaging is performed after the indicated number has been reached in continuous sweep mode.

In single sweep mode, the sweep is stopped as soon as the indicated number of measurements (sweeps) is reached. Synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

This command has the same effect as the `[SENSe<source>:]SWEep:COUNT` command. In both cases, the number of measurements is defined whether the average calculation is active or not.

The number of measurements applies to all traces in the window.

Suffix:

<n> Selects the measurement window.

Parameters:

<NoMeasurements> 0 to 32767

*RST: 0

Example:

SWE:CONT OFF

Switching to single sweep mode.

AVER:COUN 16

Sets the number of measurements to 16.

AVER:STAT ON

Switches on the calculation of average.

INIT;*WAI

Starts the measurement and waits for the end of the 16 sweeps.

[SENSe:]AVERage<n>:TYPE <FunctionType>

This command selects the type of average function.

Suffix:

<n> Selects the measurement window.

Parameters:

<FunctionType> VIDEo | LINear | POWer

VIDeo

The logarithmic power values are averaged.

LINear

The power values are averaged before they are converted to logarithmic values.

POWer

The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

*RST: VIDEo

Example:

AVER:TYPE LIN

Switches to linear average calculation.

[SENSe:]BANDwidth|BWIDth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth.

The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to [chapter 3.10.1, "Selecting the Appropriate Filter Type"](#), on page 64.

Parameters:

<Bandwidth> refer to data sheet
 *RST: (AUTO is set to ON)

Example:

BAND 1 MHz
 Sets the resolution bandwidth to 1 MHz

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO <State>

This command couples and decouples the resolution bandwidth to the span.

The automatic coupling adapts the resolution bandwidth to the current frequency span according to the relationship between frequency span and resolution bandwidth.

The 6 dB bandwidths 200 Hz, 9 kHz and 120 kHz and the channel filters available are not set by the automatic coupling.

Use `[SENSe:]BANDwidth|BWIDth[:RESolution]:RATio` to define the ratio RBW/span.

Parameters:

<State> ON | OFF
 *RST: ON

Example:

BAND:AUTO OFF
 Switches off the coupling of the resolution bandwidth to the span.

[SENSe:]BANDwidth|BWIDth[:RESolution]:RATio <Ratio>

This command defines the ratio between the resolution bandwidth (Hz) and the span (Hz).

Note that the ratio defined with the remote command (RBW/span) is reciprocal to that of the manual operation (span/RBW).

Parameters:

<Ratio> Range: 0.0001 to 1
 *RST: 0.01

Example:

BAND:RAT 0.01

[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE <FilterType>

This command selects the type of resolution filter.

For detailed information on filters see [chapter 3.10.1, "Selecting the Appropriate Filter Type"](#), on page 64 and [chapter 3.10.2, "List of Available RRC and Channel Filters"](#), on page 64.

When changing the filter type, the next larger filter bandwidth is selected if the same filter bandwidth is not available for the new filter type.

5 Pole filters are not available when using the sweep type "FFT".

Parameters:

<FilterType> **NORMal**
 Gaussian filters

CFILter
 channel filters

RRC
 RRC filters

P5
 5 Pole filters

*RST: **NORMal**

Example: BAND:TYPE NORM

Manual operation: See "[Filter Type \(Output Power, TX Spec ACLR, Spurious Emissions, Rel TX Power\)](#)" on page 55

[SENSe:]CORRection:EGain:INPut[:MAGNitude]

This command makes an external gain known to the analyzer, which will take it into account during the display of measurement results. With this function the gain of an antenna or of an external preamplifier can be taken into account for the measurement values.

The command is available if a tracking generator is installed and has been turned on.

Parameters:

Range: -200 dB to 200 dB
 *RST: 0 dB

Example: CORR:EGA:INP 10DB
 Takes 10 dB external gain into account.

Manual operation: See "[Antenna Gain](#)" on page 37

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency (frequency domain) or measuring frequency (time domain).

Parameters:

<Frequency> Range: 0 to f_{max}
 *RST: f_{max}/2
 Default unit: Hz
 f_{max} is specified in the data sheet. min span is 10 Hz

Example: FREQ:CENT 100 MHz

Manual operation: See "[Center](#)" on page 56

[SENSe:]SWEep:COUNT <NumberSweeps>

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

Parameters:

<NumberSweeps> 0 to 32767
 *RST: 0 (GSM: 200, PHN:1)

Example:

```
SWE:COUNT 64
Sets the number of sweeps to 64.
INIT:CONT OFF
Switches to single sweep mode.
INIT;*WAI
Starts a sweep and waits for its end.
```

[SENSe:]SWEep:COUNT:CURRent?

This query command returns the current number of started sweeps. A sweep count value should be set and the device should be in single sweep mode.

Example:

```
SWE:COUNT 64
Sets sweep count to 64
INIT:CONT OFF
Switches to single sweep mode
INIT
Starts a sweep (without waiting for the sweep end!)
SWE:COUNT:CURR?
Queries the number of started sweeps
```

Usage: Query only

[SENSe:]SWEep:EGATe:HOLDoff <DelayTime>

This command defines the delay time between the external gate signal and the continuation of the sweep.

Note: Using gate mode "level" (see [\[SENSe:\]SWEep:EGATe:TYPE](#) on page 117) and an IFP trigger (see [TRIGger<n>\[:SEQuence\]:SOURce](#) on page 126), the hold-off time for the IFP trigger is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

Parameters:

<DelayTime> 0 s to 30 s
 *RST: 0s

Example:

```
SWE:EGAT:HOLD 100us
```

Manual operation: See ["Gate Delay \(Spurious Emissions\)"](#) on page 47

[SENSe:]SWEep:EGATe:LENGth <TimeInterval>

This command defines a gate length.

Parameters:

<TimeInterval> 125 ns to 30 s
*RST: 400µs

Example: SWE:EGAT:LENG 10ms

Manual operation: See "[Gate Length \(Spurious Emissions\)](#)" on page 47

[SENSe:]SWEep:EGATe:POLarity <Polarity>

This command determines the polarity of the external gate signal. The setting applies both to the edge of an edge-triggered signal and the level of a level-triggered signal.

Parameters:

<Polarity> POSitive | NEGative
*RST: POSitive

Example: SWE:EGAT:POL POS

[SENSe:]SWEep:EGATe:TYPE <Type>

This command sets the type of triggering by the external gate signal.

A delay between applying the gate signal and the start of recording measured values can be defined, see [\[SENSe:\]SWEep:EGATe:HOLDoff](#) on page 116.

Parameters:

<Type> LEVel | EDGE

LEVel

The gate is level-triggered:

After detection of the gate signal, the gate remains open until the gate signal disappears. The gate opening time cannot be defined with the command [\[SENSe:\]SWEep:EGATe:HOLDoff](#).

Note: Using gating with gate mode "level" and an IFP trigger (see [TRIGger<n>\[:SEQuence\]:SOURce](#) on page 126), the holdoff time for the IFP trigger is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

EDGE

The gate is edge-triggered:

After detection of the set gate signal edge, the gate remains open until the gate delay ([\[SENSe:\]SWEep:EGATe:HOLDoff](#)) has expired.

*RST: EDGE

Example: SWE:EGAT:TYPE EDGE

[SENSe:]SWEep:MODE <Mode>

This command selects the spurious emission and spectrum emission mask measurements.

Parameters:

<Mode> AUTO | ESpectrum | LIST

AUTO

Switches to "Spectrum" measurement mode or stays in the current mode if it is not ESP/LIST

ESpectrum

"Spectrum Emission Mask" measurement mode

LIST

"Spurious Emissions" measurement mode

*RST: AUTO

Example:

SWE:MODE ESP

Sets the Spectrum Emission Mask measurement mode.

[SENSe:]SWEep:POINTS <NumberPoints>

This command defines the number of measurement points to be collected during one sweep.

Parameters:

<NumberPoints> Range: 101 to 32001
*RST: 691

Example:

SWE:POIN 251

[SENSe:]SWEep:TIME <Time>

This command defines the sweep time.

The range depends on the frequency span.

Parameters:

<Time> refer to data sheet
*RST: (automatic)

Example:

SWE:TIME 10s

[SENSe:]SWEep:TIME:AUTO <State>

In realtime mode, this command automatically sets the sweep time to 32 ms.

In analyzer mode, this command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings. If [SENSe:]SWEep:TIME is used, automatic coupling is switched off.

Parameters:

<State> ON | OFF
 *RST: ON

Example:

SWE:TIME:AUTO ON
 Activates automatic sweep time.

[SENSe:]SWEep:TYPE <Type>

This command selects the sweep type.

Parameters:

<Type> **SWE**
 Selects analog frequency sweeps.
AUTO
 Automatically selects the sweep type (FFT or analog frequency sweep).
FFT
 Selects FFT sweeps.
 *RST: AUTO

Example:

SWE:TYPE FFT
 Selects FFT sweeps.

4.9 SENSe:ADEMod Subsystem (BLUETOOTH, K8)

[SENSe:]ADEMod:ZOOM[:STATe].....	119
[SENSe:]ADEMod:ZOOM:START.....	120

[SENSe:]ADEMod:ZOOM[:STATe] <Mode>

The command enables or disables the zoom function. Depending on the selected measurement time and the demodulation bandwidth, the number of recorded measurement points may be greater than that shown on the display.

If the zoom function is enabled, 501 test points of the result memory are displayed from the start time specified by the [SENSe:]ADEMod:ZOOM:START command.

If the zoom function is disabled, data reduction is used to adapt the measurement points to the number of points available on the display.

Note:

The zoom function is only available for the Output Power, Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift measurements.

Parameters:

<Mode> ON | OFF
 *RST: OFF

Example:	ADEM:ZOOM ON Switches on the zoom function
Mode:	BT
Manual operation:	See " Zoom (Modulation Char, Init Carr Freq Tol, Carr Freq Drift) " on page 42

[SENSe:]ADEMod:ZOOM:STARt <Time>

The command sets the start time for the display of individual measured values.

The zoom function is enabled or disabled by the `[SENSe:]ADEMod:ZOOM[:STATe]` command.

Note:

The zoom function is only available for the Output Power, Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift measurements.

Parameters:

<Time> **0 s to (meas time – 500 / sampling rate)**
*RST: 0 s

Example:	ADEM:ZOOM ON Switches on the zoom function ADEM:ZOOM:STAR 500us Sets the starting point of the display to 500 µs.
-----------------	--

Mode: BT

Manual operation: See "[Zoom \(Modulation Char, Init Carr Freq Tol, Carr Freq Drift\)](#)" on page 42

4.10 SENSe:DDEMod Subsystem (BLUETOOTH, K8)

[SENSe:]DDEMod:FILTer:MEASurement	120
[SENSe:]DDEMod:SEARch:PULSe[:STATe]	121
[SENSe:]DDEMod:SEARch:PULSe:OFFSet	121
[SENSe:]DDEMod:SEARch:SYNC:STATe	121
[SENSe:]DDEMod:SEARch:SYNC:LAP	122
[SENSe:]DDEMod:SEARch:SYNC:OFFSet	122
[SENSe:]DDEMod:SEARch:TIME	122
[SENSe:]DDEMod:SEARch:TIME:AUTO	123

[SENSe:]DDEMod:FILTer:MEASurement <ReceiveFilter>

This command selects the receive filter for the signal to measure.

Note:

This command is only available with active Modulation Characteristics, Initial Carrier Frequency Tolerance, and Carrier Frequency Drift measurement (see [CONFigure: BT0oth:MEASurement](#) on page 96). With all other measurements it will lead to a query error.

Parameters:

<ReceiveFilter> **OFF | BTOoth**
 *RST: ON

Example:

DDEM:FILT:MEAS BTO
 Activates the Bluetooth measurement filter.

Mode: BT

Manual operation: See "[Meas Filter \(Modulation Char, Init Carr Freq Tol, Carr Freq Drift\)](#)" on page 55

[SENSe:]DDEMod:SEARch:PULSe[:STATe] <Mode>

This command switches the search for a signal burst on or off.

Parameters:

<Mode> **ON | OFF**
 *RST: ON

Example:

DDEM:SEAR:PULS OFF

Mode: BT

Manual operation: See "[Find Burst On/Off \(Output Power\)](#)" on page 38

[SENSe:]DDEMod:SEARch:PULSe:OFFSet <Time>

This command defines the time to be recorded before a signal burst is recognized.

Parameters:

<Time> **0 to 10 ms**
 *RST: 0

Example:

DDEM:SEAR:PULS:OFFS 1MS
 Sets the burst offset to 1ms before the start of the burst.

Mode: BT

Manual operation: See "[Burst Offset](#)" on page 39

[SENSe:]DDEMod:SEARch:SYNC:STATe <PatternSearch>

This command switches the search for a sync sequence on or off.

Setting parameters:

<PatternSearch> **ON | OFF**
 *RST: OFF

Example: DDEM:SEAR:SYNC ON
Switches the sync search on.

Mode: BT, VSA

Manual operation: See "Find Sync On/Off" on page 38

[SENSe:]DDEMod:SEARch:SYNC:LAP <Bits>

This command determines the 24 least significant bits (LAP) of the DUT 'Bluetooth device address'. They are used to define the synchronization pattern to determine the start of a packet.

Parameters:
<Bits> **0 to FFFFFFF hex**
*RST: #H0

Example: DDEM:SEAR:SYNC:LAP #HA3F45B
Sets on LAP A3F45B Hex

Mode: BT

Manual operation: See "LAP" on page 37

[SENSe:]DDEMod:SEARch:SYNC:OFFSet <NoBits>

This command defines the number of bits to be recorded before the first preamble bit is detected.

Parameters:
<NoBits> **0 to 10000**
*RST: 0

Example: DDEM:SEAR:SYNC:OFFS 10
Sets the sync offset to 10 bits before the preamble bits.

Mode: BT

Manual operation: See "Sync Offset" on page 38

[SENSe:]DDEMod:SEARch:TIME <RecLength>

This command selects manual setting of the record length and defines the record length to be used for the search of sync word and burst.

Note:

For information on the correlation of trigger and record length refer to [SENSe:]DDEMod:SEARch:TIME:AUTO on page 123

Parameters:
<RecLength> **100ms to [130560ms / (points per symbol)]**
*RST: 1875 us

Example: `DDEM:SEAR:TIME 100US`
Sets the record length for sync word and burst search to 100 us.

Mode: BT

Manual operation: See "[Search Len Manual](#)" on page 40

Table 4-4: Max. record length depending on points per symbol

Points per Symbol	Maximum record length
2	104.4 slots
4	52.2 slots
8	26.1 slots
16	13.1 slots
32	6.5 slots

[SENSe:]DDEMod:SEARch:TIME:AUTO <Mode>

This command activates the automatic setting of the record length for the sync word and burst search, depending on the selected packet type.

The automatic record length is determined as follows:

Trigger free run:

$\text{search length} = 3 * \text{packet length} + |\text{sync offset or burst offset}|$

All other trigger modes:

$\text{search length} = 1 * \text{packet length} + 1 \text{ Slot} + |\text{sync offset or burst offset}|$

If the selected measurement time is higher than the packet length, the following difference is added to the search length:

$\text{measurement time} - \text{packet length}$

Parameters:

<Mode> **ON | OFF**
*RST: ON

Example: `DDEM:SEAR:TIME:AUTO OFF`
Selects manual input for the record length

Mode: BT

Manual operation: See "[Search Len Auto](#)" on page 39

4.11 SYSTEM subsystem

SYSTEM:DISPlay:UPDate <State>

In remote control mode, this command switches on or off the instrument display. If switched on, only the diagrams, traces and display fields are displayed and updated.

The best performance is obtained if the display output is switched off during remote control.

Parameters:

<State> ON | OFF
*RST: OFF

Example: SYST:DISP:UPD ON

4.12 TRACe subsystem

TRACe<n>[:DATA]? <ResultType>

This command returns the current trace data or measurement results. In case of several result displays, you have to use specific parameters to query the results.

Suffix:

<n> 1...4
window; For applications that have only one measurement screen, the suffix is irrelevant.

Query parameters:

<ResultType> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6
Selects the type of result to be returned.

TRACE1 | ... | TRACE6

The query returns a list of results with one value for each sweep point in the currently set level unit.

For details see [table 4-5](#)

Example:

TRAC? TRACE1
Returns the trace data for Trace 1.

Usage:

Query only

Mode:

A, ADEMOD, BT, NF, PHN, TDS

Table 4-5: Results for <TRACe...> ResultTypes

The query returns a list of results with one value for each sweep point in the currently set level unit. By default, the list contains 691 values. The currently used number of sweep points can be determined using SWE:POIN?, see [\[SENSe:\]SWEep:POINts](#) on page 118.

FORMat REAL, 32 is used as format for binary transmission, and FORMat ASCii for ASCII transmission.

With the auto peak detector, only positive peak values can be read out.

In **IQ Analyzer mode**, if the result display configuration "Real/Imag (I/Q)" is selected, this query returns the I values of each trace point first, then the Q values:

<result>= I₁,I₂,...,I_n, Q₁,Q₂,...,Q_n

4.13 TRIGger subsystem

TRIGger<n>[:SEQuence]:IFPower:HOLDoff <Value>

This command sets the holding time before the next IF power trigger event.

Suffix:

<n> irrelevant

Parameters:

<Value> *RST: 150 ns

Example:

```
TRIG:SOUR IFP
Sets the IF power trigger source.
TRIG:IFP:HOLD 200 ns
Sets the holding time to 200 ns.
```

Manual operation: See ["Trigger Holdoff"](#) on page 63

TRIGger<n>[:SEQuence]:IFPower:HYSteresis <Value>

This command sets the limit that the hysteresis value for the IF power trigger has to fall below in order to trigger the next measurement.

Suffix:

<n> irrelevant

Parameters:

<Value> *RST: 3 dB

Example:

```
TRIG:SOUR IFP
Sets the IF power trigger source.
TRIG:IFP:HYST 10DB
Sets the hysteresis limit value.
```

Manual operation: See ["Trigger Hysteresis"](#) on page 63

TRIGger<n>[:SEQuence]:HOLDoff[:TIME] <Delay>

This command defines the length of the trigger delay.

A negative delay time (pretrigger) can be set in zero span only.

Suffix:

<n> irrelevant

Parameters:

<Delay> Range: zero span: -sweeptime (see data sheet) to 30 s;
span: 0 to 30 s
*RST: 0 s

Example:

```
TRIG:HOLD 500us
```

Manual operation: See ["Trigger Offset"](#) on page 63

TRIGger<n>[:SEQuence]:LEVel:IFPower <TriggerLevel>

This command defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

Suffix:

<n> irrelevant

Parameters:

<TriggerLevel> *RST: -20 dBm

Example: TRIG:LEV:IFP -30DBM

Manual operation: See "[Trg/Gate Level](#)" on page 62

TRIGger<n>[:SEQuence]:SLOPe <Type>

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Suffix:

<n> irrelevant

Parameters:

<Type> POSitive | NEGative
*RST: POSitive

Example: TRIG:SLOP NEG

Manual operation: See "[Trg/Gate Polarity](#)" on page 63

TRIGger<n>[:SEQuence]:SOURce <Source>

This command selects the trigger source.

For details on trigger modes refer to the "[Trg/Gate Source](#)" softkey in the base unit description.

Suffix:

<n> irrelevant

Parameters:

<Source>

IMMediate

Free Run

EXTErn

External trigger

IFPower

Power trigger at the second intermediate frequency

RFPower

Power trigger at the first intermediate frequency

VIDeo

Video mode is only available in the time domain and only in Spectrum mode.

BBPower

Baseband power (for digital input via the R&S Digital I/Q Interface, R&S FSV-B17)

PSEN

External power sensor (requires R&S FSV-K9 option)

*RST: IMMediate

Example:

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal

Manual operation:See "[Trg/Gate Source](#)" on page 60See "[Free Run](#)" on page 60See "[External](#)" on page 60See "[Video](#)" on page 60See "[RF Power](#)" on page 60See "[IF Power/BB Power](#)" on page 61See "[Power Sensor](#)" on page 61See "[Time](#)" on page 62See "[Digital IQ](#)" on page 62

4.14 Programming Example

Adapting the settings to the characteristics of the DUT

INST:SEL BTO

Activates the Bluetooth Measurements option

INIT:CONT OFF

Selects single sweep operation

CONF:BTO:CHAN 10

Selects channel 10

CONF:BTO:PCL 1

Selects power class 1

```
CONF:BTO:PRAT 4
```

Selects 4 points per symbol

```
CONF:BTO:PTYP DH1
```

Selects 1 slot packet

```
DDEM:SEAR:SYNC ON
```

Activates the FIND SYNC function

```
DDEM:SEAR:SYNC:OFFS 0
```

Sets the sync offset = 0

```
DDEM:SEAR:SYNC:LAP #H0
```

Sets the lower address part = 0

```
DDEM:SEAR:TIME:AUTO ON
```

Selects automatic search length

List of Commands

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