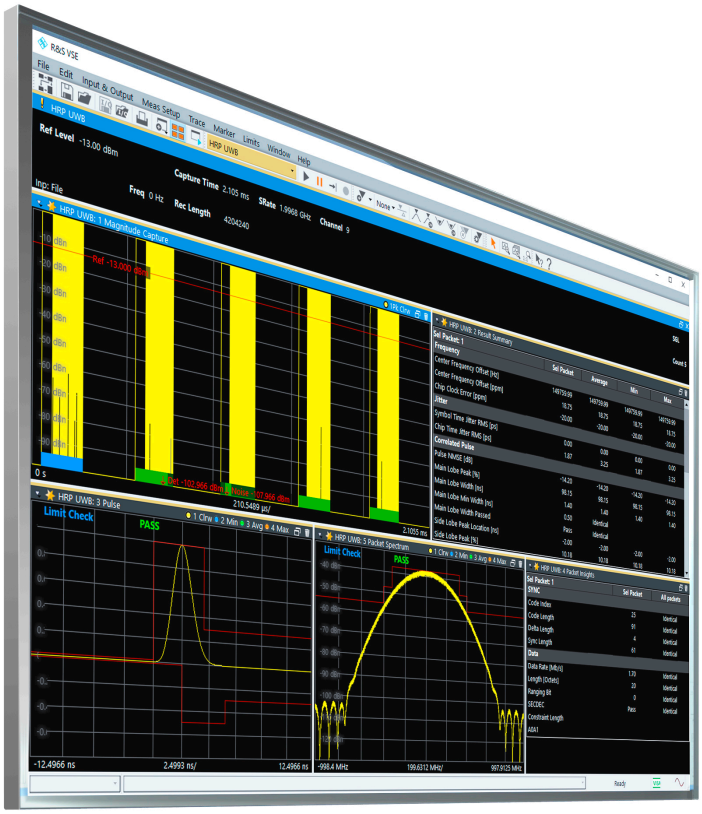
R&S®VSE-K149
HRP UWB Measurement Application
User Manual



1179331502
Version 04

ROHDE&SCHWARZ
Make ideas real

This manual applies to the following software, version 2.30 and later:

- R&S®VSE Enterprise Edition base software (1345.1105.06)
- R&S®VSE Basic Edition base software (1345.1011.06)

The following firmware options are described:

- R&S VSE-K149 (1345.1463.06)
- R&S VSE-KT149 (1345.2082.02)

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

Contents

1 Preface

1.1 About this manual

This R&S VSE HRP UWB User Manual provides all the information **specific to the application**. All general software functions and settings common to all applications and operating modes are described in the R&S VSE Base Software User Manual.

The main focus in this manual is on the measurement results and the tasks required to obtain them. The following topics are included:

- **Welcome to the R&S VSE HRP UWB application**
  Introduction to and getting familiar with the application
- **Measurements and Result Displays**
  Details on supported measurements and their result types
- **Configuration + Analysis**
  A concise description of all functions and settings available to configure measurements and analyze results with their corresponding remote control command
- **How to Perform Measurements in the R&S VSE HRP UWB application**
  The basic procedure to perform each measurement and step-by-step instructions for more complex tasks or alternative methods
- **Remote Commands for R&S VSE HRP UWB application Measurements**
  Remote commands required to configure and perform R&S VSE HRP UWB application measurements in a remote environment, sorted by tasks
  (Commands required to set up the environment or to perform common tasks in the software are provided in the R&S VSE Base Software User Manual)
  Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **List of remote commands**
  Alphabetical list of all remote commands described in the manual
- **Index**

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 and knob names are enclosed by square brackets.
`Filenames, commands, program code`	Filenames, commands, coding samples and screen output are distinguished by their font.
Input	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 operating 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.

1.2.3 Notes on screenshots

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

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

2 Welcome to the HRP UWB application

The R&S VSE-K149 is a firmware application that adds functionality to perform High Rate Pulse Repetition Frequency (HRP) Ultrawideband (UWB) measurements with the R&S VSE.

The R&S VSE HRP UWB application features:

- Analysis of High Rate Pulse Repetition Frequency (HRP) Ultrawideband (UWB) signals
- Time of flight (TOF) measurements
- Spectrum analysis
- Pulse mask analysis
- In Depth packet insights

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

Functions that are not discussed in this manual are the same as in the spectrum application and are described in the R&S VSE User Manual. The latest version is available for download at the product homepage.

2.1 Starting the HRP UWB application

Ultrawideband measurements require a separate application on the R&S VSE. It is activated by creating a new measurement channel in HRP UWB mode.

To activate the HRP UWB application

1. 

   Select the "Add Channel" function in the Sequence tool window.

   A dialog box opens that contains all operating modes and applications currently available in your R&S VSE.

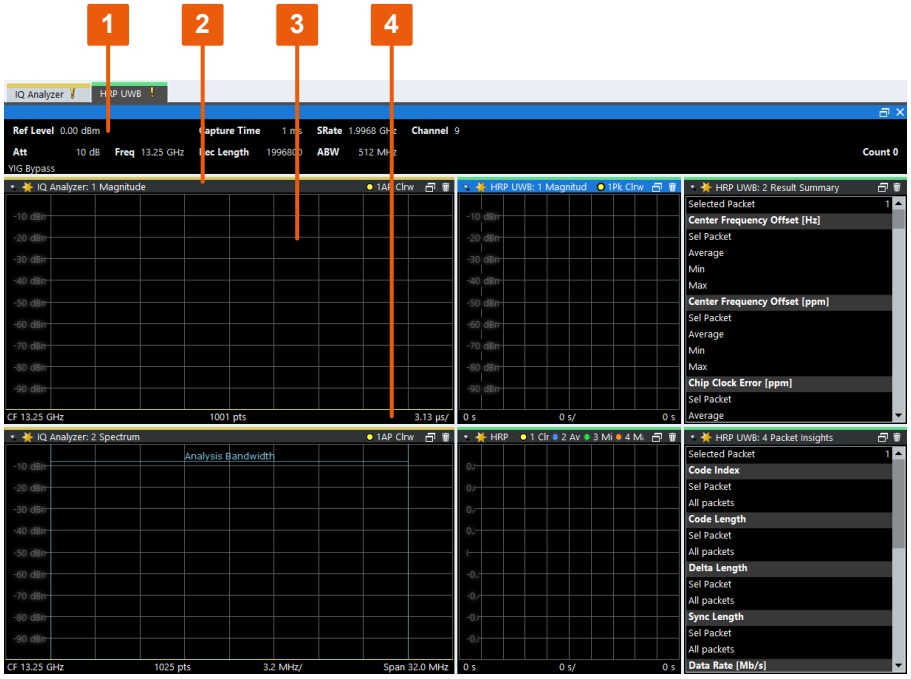
2. Select the "HRP UWB" item.

   The R&S VSE opens a new measurement channel for the R&S VSE HRP UWB application.

2.2 Understanding the display information

The following figure shows a measurement diagram during analyzer operation. All different information areas are labeled. They are explained in more detail in the following sections.



1 = Channel bar for firmware and measurement settings
2 = Window title bar with diagram-specific (trace) information
3 = Diagram area
4 = Diagram footer with diagram-specific information

The color of the bars below the bursts is defined as follows:

- Blue: Selected packet
- Green: Successful sync of all sections
- Red: Detected burst, but no successful demodulation of SYNC section
- Yellow: Successful demodulaton of just SYNC section

Channel bar information

In the R&S VSE HRP UWB application, the R&S VSE shows the following settings:

Table 2-1: Information displayed in the channel bar in the HRP UWB application

Ref Level	Reference level
Att	RF attenuation
Freq	Center frequency for the RF signal
Capture Time	Measurement time (data acquisition time)
Rec Length	Record length

SRate	Sample rate
ABW	Analysis Bandwidth
Channel	Measurement Channel
Group	Selected group of packets Default configuration for all windows, set in the "Analysis" dialog.
Sel Packet	Selected packet Default configuration for all windows, set in the "Analysis" dialog.

In addition, the channel bar also displays information on instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values (e.g. transducer or trigger settings). This information is displayed only when applicable for the current measurement. For details see the R&S VSE Base Software User Manual.

Window title bar information

For each diagram, the header provides the following information:

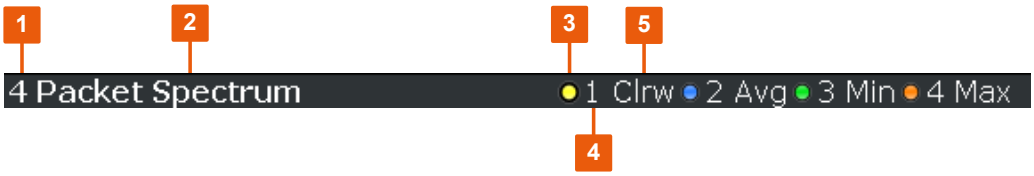
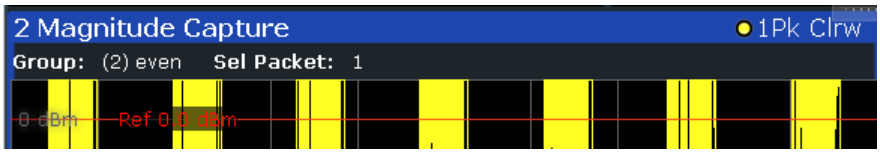


Figure 2-1: Window title bar information in the R&S VSE HRP UWB application

1 = Window number
2 = Window type
3 = Trace color
4 = Trace number
5 = Trace mode

If a result display shows a different group or a different selected packet, this information is displayed right below the window title:



The group and selected packet can either be set in the analysis dialog for all displays or in the result config dialog for individual displays.

Status bar information

The software status, errors and warnings and any irregularities in the software are indicated in the status bar at the bottom of the R&S VSE window.

3 Measurements and result displays

The data that was measured by the R&S VSE can be evaluated using various different methods.

All results are determined from the I/Q data set captured for the measurement.

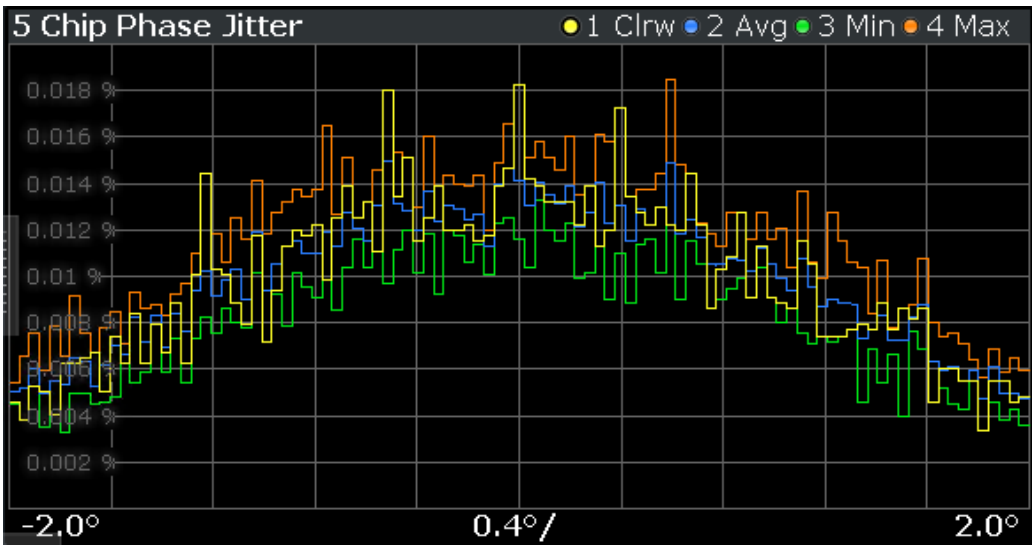
Storing Results

The results of the HRP UWB measurement can be stored to a file in ASCII format.

3.1 Evaluation methods for HRP UWB

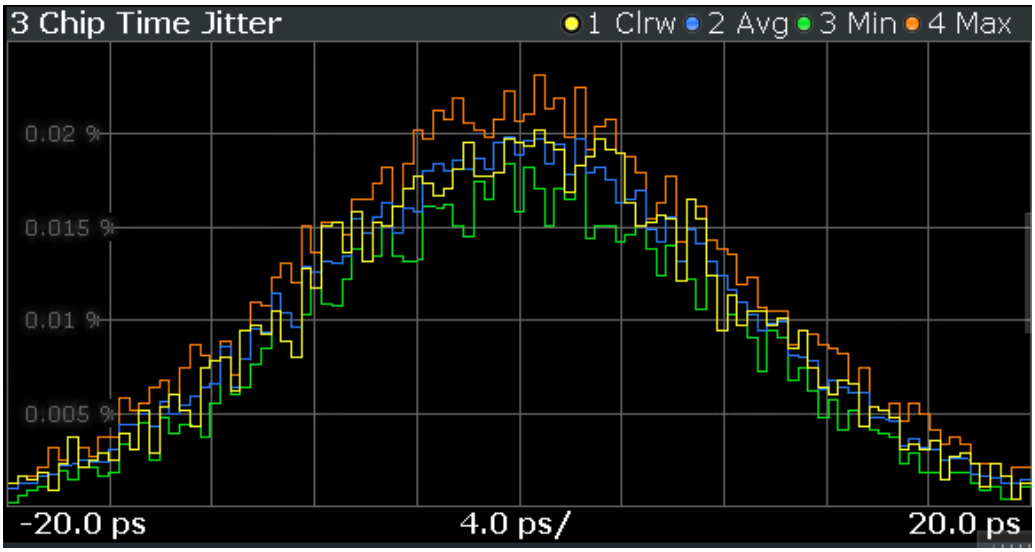
The following evaluation methods can be selected for HRP UWB measurements.

Chip Phase Jitter
Displays a histogram of the phase jitter of chips in SYNC section of each packet.



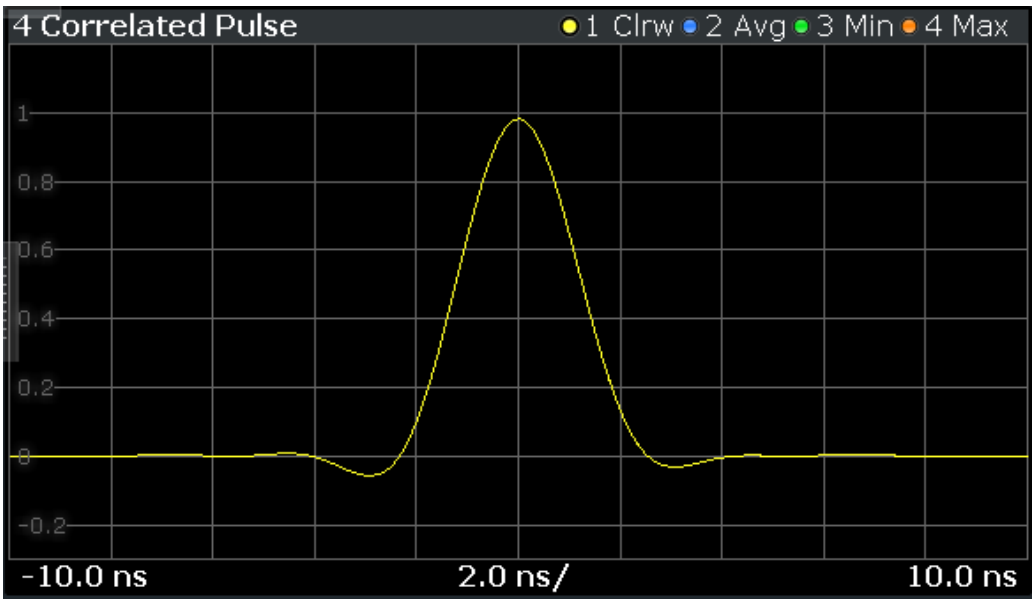
Remote command:
`LAY:ADD? '1',RIGH,CJPH`

Chip Time Jitter
Displays a histogram of the time jitter of chips in SYNC section of each packet.



Remote command:
`LAY:ADD? '1',RIGH,CJT`

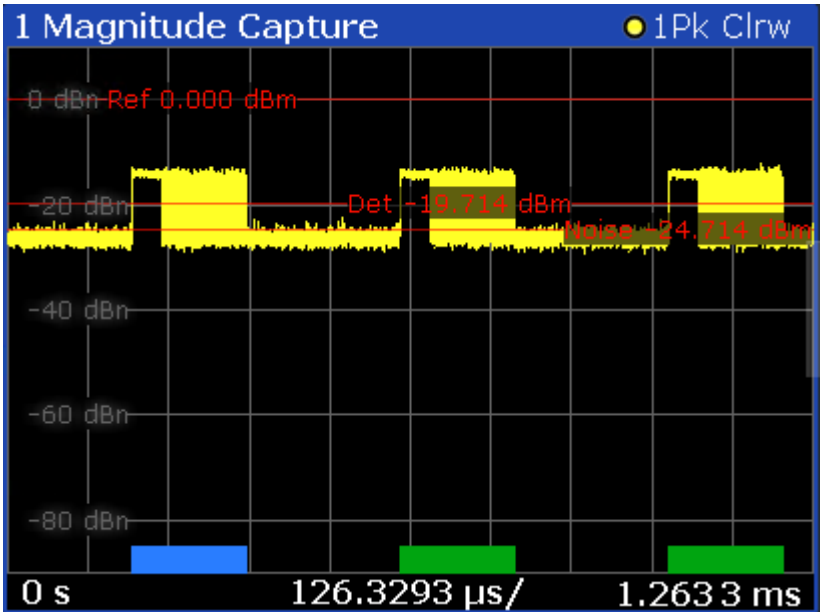
Correlated Pulse
Displays the cross correlation of the measured UWB pulse of sync section and root raised cosine (RRC) pulse defined in IEEE 802.15.4-2020.



Remote command:
`LAY:ADD? '1',RIGH,XCOR`

Magnitude Capture
Displays the magnitude capture using a trace with "Positive Peak" detector. There are different methods to configure packet detection. See Chapter 4.5, "Burst/Sync", on page 43 for further details.

To calculate the "telegram length" of a burst, the start and stop positions of the highlights corresponding to each burst can be queried via SCPI. The commands `FETCh<n>:TRACe:HLIGht:STARt:ALL?` and `FETCh<n>:TRACe:HLIGht:STOP:ALL?` return the start and stop of each detected burst in seconds.



Remote command:
`LAY:ADD? '1',RIGH,MCAP`
Retrieving results see Chapter 6.5.2, "Magnitude capture", on page 63

Marker Table
Displays a table with the current marker values for the active markers.

This table is displayed automatically if configured accordingly.

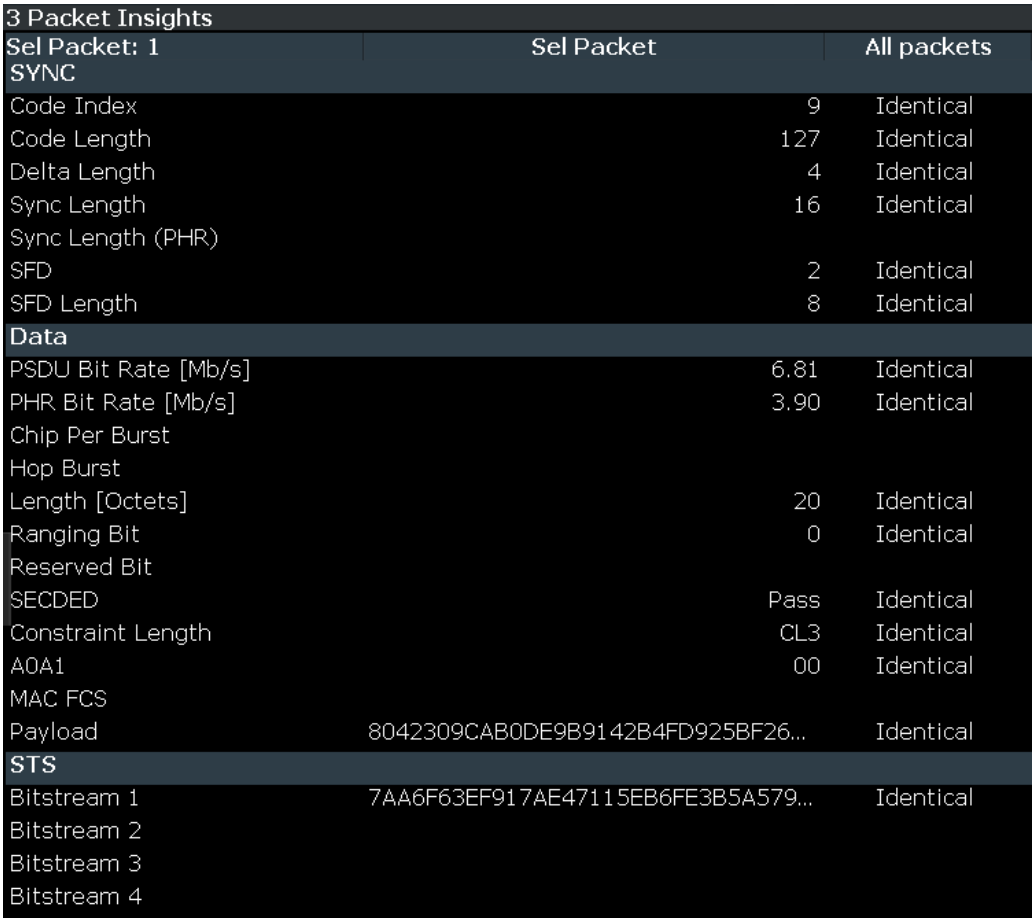
1 Marker Table

Wnd	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
2	M1		1	2.1725 ms	-6.80 dBm		
2	D2	M1	1	13.859 ms	-0.00 dB		
2	D3	M1	1	4.6259 ms	-0.00 dB		
2	D4	M1	1	9.2331 ms	-0.00 dB		

Tip: To navigate within long marker tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:
`LAY:ADD? '1',RIGH, MTAB`

Packet Insights
Displays the values from the "Selected Packet" or the values of "All Packets": For all packets in statistics, the values are “Identical” or “Mixed”. "Identical" means that the packets have the same value (displayed in the Sel Packet column), whereas "Mixed" indicates different values.



3 Packet Insights		
Sel Packet: 1	Sel Packet	All packets
SYNC		
Code Index	9	Identical
Code Length	127	Identical
Delta Length	4	Identical
Sync Length	16	Identical
Sync Length (PHR)		
SFD	2	Identical
SFD Length	8	Identical
Data		
PSDU Bit Rate [Mb/s]	6.81	Identical
PHR Bit Rate [Mb/s]	3.90	Identical
Chip Per Burst		
Hop Burst		
Length [Octets]	20	Identical
Ranging Bit	0	Identical
Reserved Bit		
SECDED	Pass	Identical
Constraint Length	CL3	Identical
AOA1	00	Identical
MAC FCS		
Payload	8042309CAB0DE9B9142B4FD925BF26...	Identical
STS		
Bitstream 1	7AA6F63EF917AE47115EB6FE3B5A579...	Identical
Bitstream 2		
Bitstream 3		
Bitstream 4		

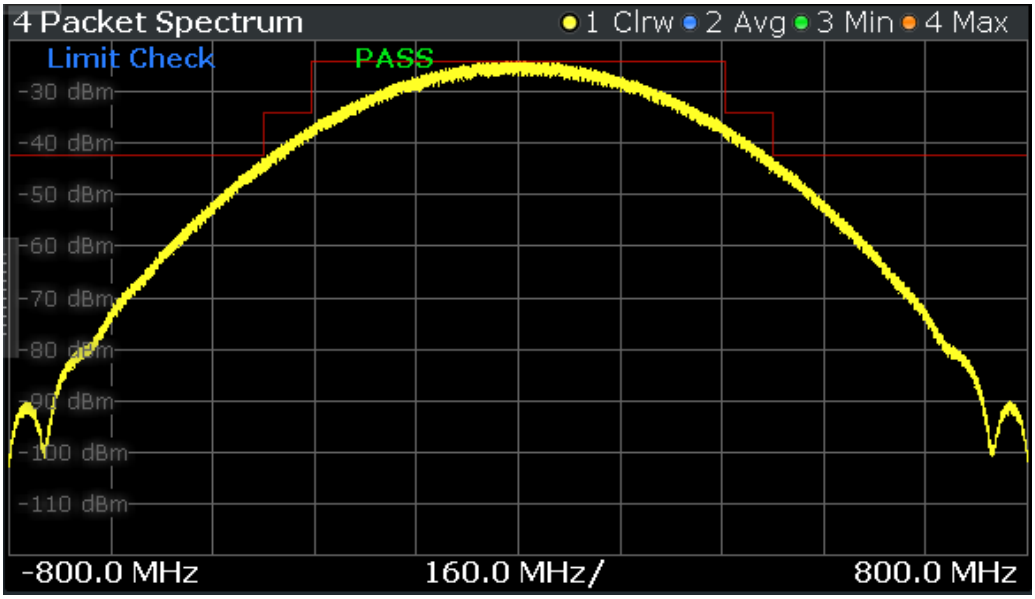
Table 3-1: Displayed values

SYNC	
Code Index	Code index
Code Length	Corresponding code length
Delta Length	Delta length
Sync Length	Number of analyzed symbols in SYNC section of the packet including symbols in settling time
SFD	non-ERDEV: “short” / “long” HRP-ERDEV BPRF: 0, 2 HRP-ERDEV HPRF: 1, 2, 3, 4
Data	
PSDU Bit Rate [Mb/s]	Bit rate according to IEEE 802.15.4-2020 (Table 15-3) and IEEE 802.15.4z-2020 (Table 15-9a and Table 15-10b)
PHR Bit Rate [Mb/s]	“Bit rate transmitted in Data Rate field of PHR according to IEEE 802.15.4-2020 (Table 15-8)
Chip Per Burst	Non-HPRF: Chips Per Burst in line with IEEE 802.15.4-2020 (Table 15-3)

Hop Burst	Non-HPRF: Hop Burst in line with IEEE 802.15.4-2020 (Table 15-3)
Length [Octets]	Length of payload in octets including MAC FCS octets
Ranging Bit	Ranging bit set or not
Reserved Bit	Non-HPRF: Status of reserved bit
SECDEC	SECDEC pass or fail
Constraint Length	HPRF mode: CL3 or CL7
A0A1	HPRF mode: Values of A0 and A1 are shown
MAC FCS	Verification result of MAC frame check sequence (FCS)
Payload	Payload according to IEEE 802.15.4-2020 (Section 15.2.8) and IEEE 802.15.4z-2020 (Section 15.2.8 and Section 15.3.4)
STS Bitstream 1-4	Bitstream of STS sections 1 to 4 according to IEEE 802.15.4z-2020 (Section 15.2.9)

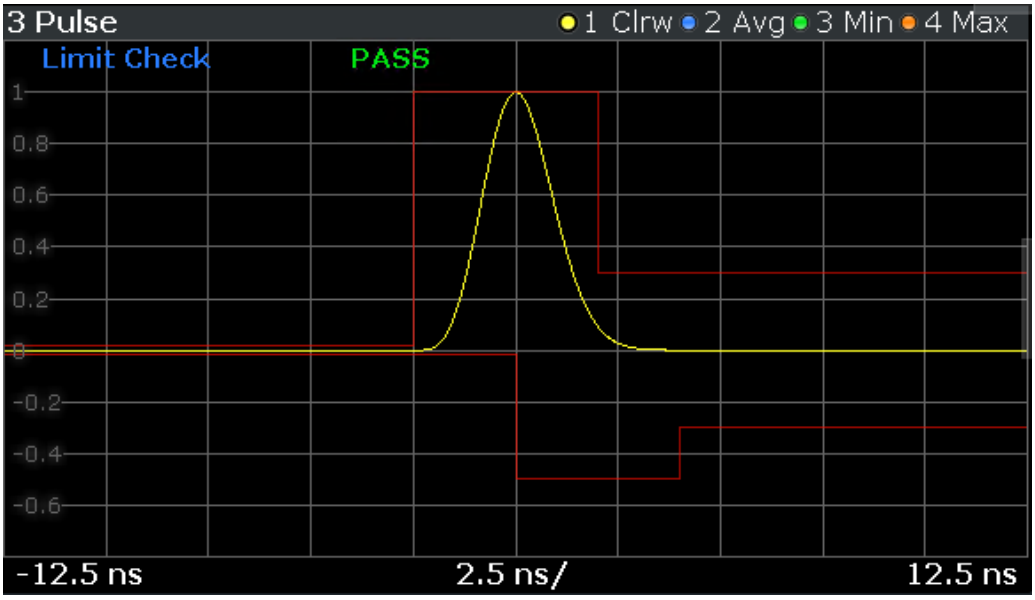
Remote command:
`LAY:ADD? '1',RIGH,PINS`
Retrieving results see Chapter 6.5.3, "Packet insights", on page 65

Packet Spectrum
Displays the spectrum of the selected packet. Limit Lines are defined in Transmit Power Spectral Density (IEEE 802.15.4-2020, Section 15.4.5). The limits are checked only against the selected packet.



Remote command:
`LAY:ADD? '1',RIGH,PSP`

Pulse
Displays the pulse of the SYNC section of an UWB packet. Limit lines are set according to FIRA UWB PHY Technical Requirements v1.2, Section 5.2.5. The limits are checked only against the selected packet.



Remote command:
`LAY:ADD? '1',RIGH,PULS`

Result Summary
Displays various measurement results in numerical form, combined in one table.

2 Result Summary				
Sel Packet: 1	Sel Packet	Average	Min	Max
Frequency				
Center Frequency Offset [Hz]	14.59	15.07	12.97	18.77
Center Frequency Offset [ppm]	0.00	0.00	0.00	0.00
Chip Clock Error [ppm]	0.01	0.00	-0.00	0.01
Jitter				
Symbol Time Jitter RMS [ps]	0.65	0.77	0.65	0.88
Chip Time Jitter RMS [ps]	6.10	6.19	6.08	6.37
Correlated Pulse				
Pulse NMSE [dB]	-14.82	-14.82	-14.82	-14.81
Main Lobe Peak [%]	98.39	98.39	98.39	98.39
Main Lobe Width [ns]	1.39	1.39	1.39	1.39
Main Lobe Min Width [ns]	0.50	Identical		
Main Lobe Width Passed	Pass	Identical		
Side Lobe Peak Location [ns]	2.01	-1.19	-2.00	2.01
Side Lobe Peak [%]	10.23	10.23	10.21	10.26
Side Lobe Peak Passed	Pass	Identical		
Pulse				
Pulse Mask	Fail	Identical		
Pulse Rise Monotonic	Pass	Identical		
Pulse Rise Time [ns]	2.07	2.07	2.07	2.07
Pulse Rise Time Passed	Pass	Identical		
SYNC Pulse Location & Polarity	Pass	Identical		
SFD Pulse Location & Polarity	Pass	Identical		
STS Pulse Location & Polarity				
EVM				
SHR NRMSE [%]	0.92	0.93	0.92	0.94
PHR NRMSE [%]	1.00	1.00	0.98	1.03
PSDU NRMSE [%]	0.95	0.93	0.92	0.95
STS NRMSE [%]				
PHR Pulse Level [dB]	-0.01	-0.00	-0.01	-0.00
PSDU Pulse Level [dB]	-0.00	-0.00	-0.01	-0.00
STS Pulse Level [dB]				
Power				
Packet Mean [dBm]	-32.66	-32.66	-32.66	-32.66
Packet Peak [dBm]	-20.71	-20.76	-20.78	-20.71
SHR Mean [dBm]	-32.72	-32.72	-32.72	-32.72
SHR Peak [dBm]	-22.22	-22.23	-22.25	-22.18
PSDU Mean [dBm]	-32.47	-32.47	-32.48	-32.47
PSDU Peak [dBm]	-21.52	-21.57	-21.60	-21.52
STS Mean [dBm]				
STS Peak [dBm]				
IQ Offset [dB]	-50.25	-50.33	-50.45	-50.20
Spectrum				
Max Spectral Power [dBm / MHz]	-56.28	-56.28	-56.29	-56.26
Spectrum Mask Passed	Pass	Identical		
Ranging		Sel Packet		
RMarker [ps]		142 788 243		
SRMarker1 [ps]				
SRMarker2 [ps]				
SRMarker3 [ps]				
SRMarker4 [ps]				

Table 3-2: Displayed values

Frequency	
Center Frequency Offset [Hz]	Estimated frequency offset of the SYNC section. >0 => DUT has higher frequency than analyzer
Center Frequency Offset [ppm]	Estimated frequency offset of the SYNC section relative to carrier frequency. >0 => DUT has higher CLK frequency than analyzer
Chip Clock Error [ppm]	Estimated chip clock frequency error of the SYNC section.
Jitter	
Symbol Time Jitter RMS [ps]	RMS of the time jitter of symbols of the SYNC section
Chip Time Jitter RMS [ps]	RMS of the time jitter of chips of the SYNC section
Correlated Pulse	Cross correlation of measured UWB pulse and root raised cosine (RRC) pulse defined in IEEE 802.15.4-2020
Pulse NMSE [dB]	NMSE of the correlated pulse
Main Lobe Peak [%]	Amplitude of the main lobe peak
Main Lobe Width [ns]	Main lobe width of pulse at 80%
Main Lobe Min Width [ns]	Required minimum width of main lobe according to IEEE 802.15.4-2020 (Table 15-12)
Main Lobe Width Passed	Passed if main lobe width is above minimum main lobe width
Side Lobe Peak Location [ns]	Location of side lobe peak relative to main lobe peak
Side Lobe Peak [%]	Amplitude of side lobe peak
Side Lobe Peak Passed	Passed if side lobe peak is below 30%
Pulse	FIRA UWB PHY Technical Requirements v1.2 RC2
Pulse Mask	Passed if time domain pulse meets mask
Pulse Rise Monotonic	Passed if time domain pulse rises monotonically
Pulse Rise Time [ns]	Rise time of pulse
Pulse Rise Time Passed	Pass if pulse rise time is smaller than 2.5ns
SYNC Pulse Location & Polarity	Pass if all pulses of SYNC section have correct location and polarity
SFD Pulse Location & Polarity	Pass if all pulses of SFD section have correct location and polarity
STS Pulse Location & Polarity	Passed if all pulses of STS section have correct location and polarity
EVM	FIRA UWB PHY Technical Requirements v1.2 RC2
SHR NRMSE [%]	NRMSE of SHR section (omitting first µs)

PHR NRMSE [%]	NRMSE of PHR section
PSDU NRMSE [%]	NRMSE of PSDU section
STS NRMSE [%]	NRMSE of STS section
PHR Pulse Level [dB]	Pulse level of PHR section relative to SHR section
PSDU Pulse Level [dB]	Pulse level of PSDU section relative to SHR section
STS Pulse Level [dB]	Pulse level of STS section relative to SHR section
Power	
Packet Mean [dBm]	Mean power of whole packet
Packet Peak [dBm]	Peak power of whole packet
SHR Mean [dBm]	Mean Power of SHR section
SHR Peak [dBm]	Peak Power of SHR section
PSDU Mean [dBm]	Mean Power of PSDU section
PSDU Peak [dBm]	Peak Power of PSDU section
STS mean [dBm]	Mean power of STS section
STS peak [dBm]	Peak power of STS section
IQ Offset [dB]	IQ offset estimated from SYNC section
Spectrum	Transmit Power Spectral Density defined in IEEE 802.15.4-2020, Section 15.4.5
Max Spectral Power [dBm / MHz]	Maximum Spectral Power Density
Spectrum Mask Passed	Passed if transmit PSD mask limits are met
Ranging	
RMarker [ps]	Ranging marker position defined in IEEE 802.15.4-2020 and IEEE 802.15.4z-2020, relative to capture buffer To estimate the time difference between several captured packets, the RMarker can be evaluated.
Ranging marker in STS 1-4 [ps]	Ranging marker position within STS in line with IEEE 802.15.4z-2020, relative to capture buffer

For each result type, several values are displayed.

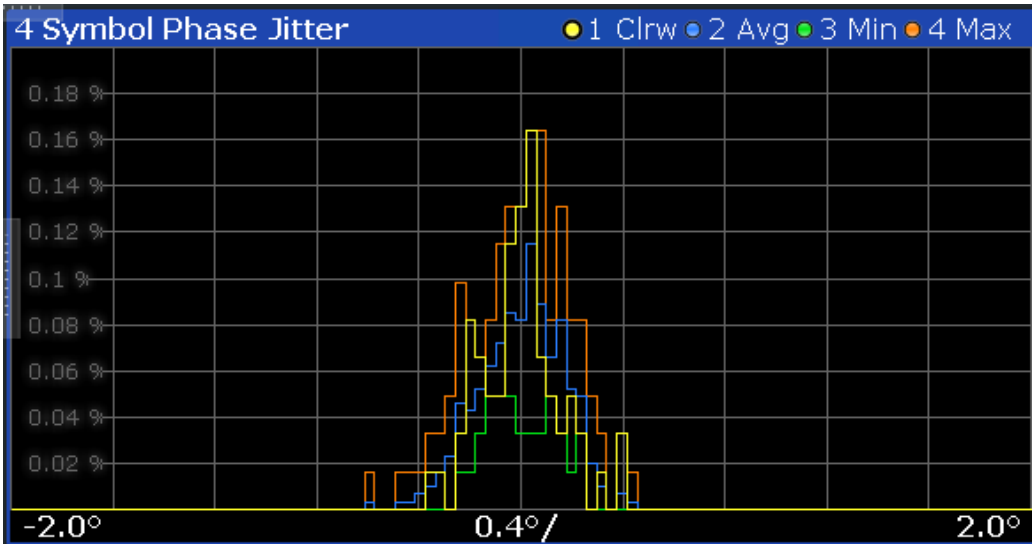
- **Sel packet**
  Values measured for the selected packet.
- **Average**
  Average value measured over all packets.
- **Min**
  Lowest value measured over all packets.
- **Max**
  Highest value measured over all packets.

Remote command:

```
LAY:ADD? '1',RIGH,RSUM
```

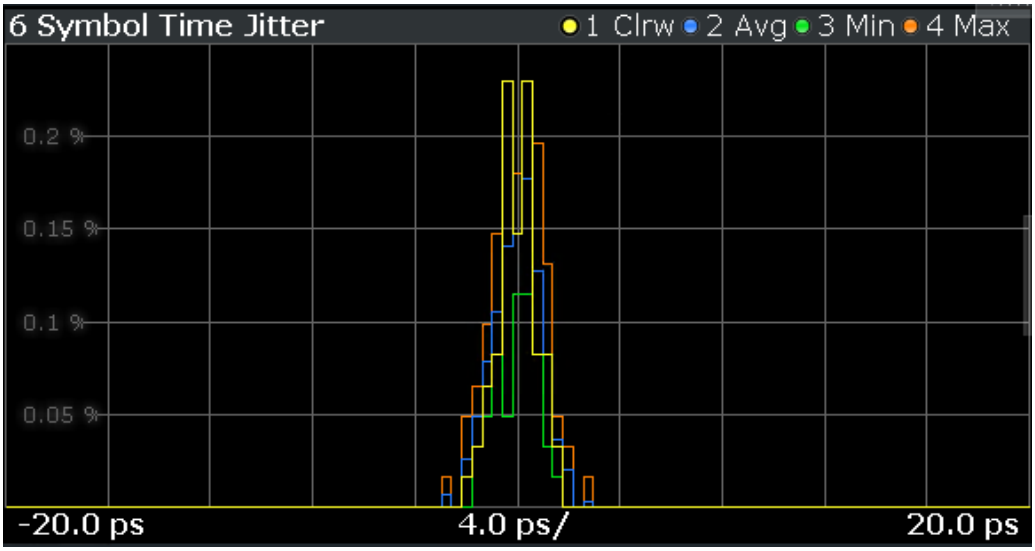
Retrieving results see Chapter 6.5.4, "Result summary", on page 66

Symbol Phase Jitter
Displays a histogram of the phase jitter of symbols in SYNC section of each packet.



Remote command:
`LAY:ADD? '1',RIGH,SJPH`

Symbol Time Jitter
Displays a histogram of the time jitter of symbols in SYNC section of each packet.



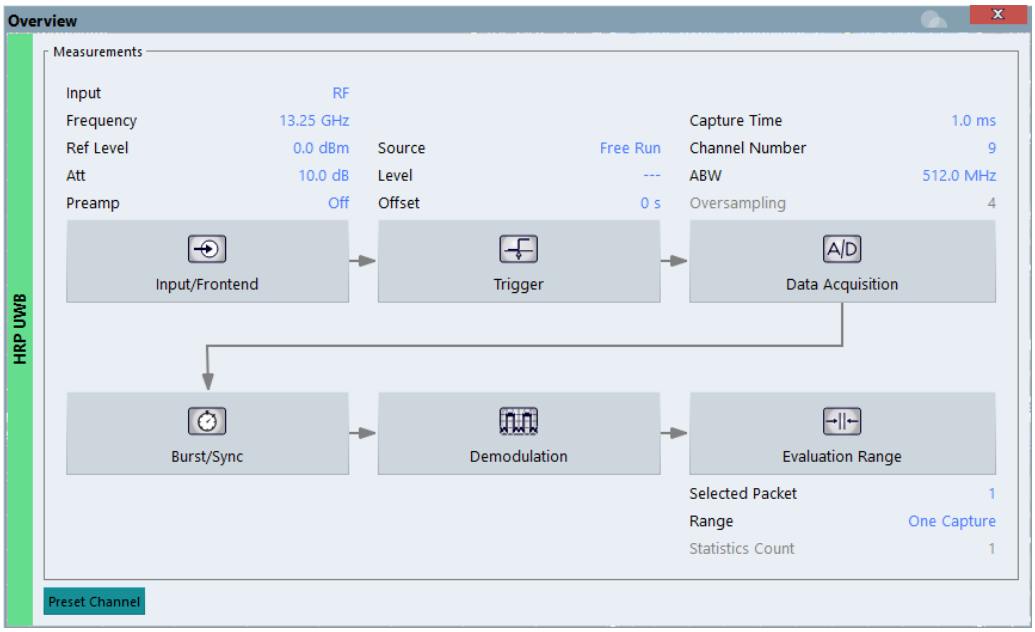
Remote command:
`LAY:ADD? '1',RIGH,SJT`

4 Configuration

4.1 Configuration overview

Throughout the measurement channel configuration, an overview of the most important currently defined settings is provided in the "Overview".

The "Overview" is displayed when you select the "Overview" icon, which is available in the Meas Setup menu.



In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. The individual configuration steps are displayed in the order of the data flow. Thus, you can easily configure an entire measurement channel from input over processing to output and analysis by stepping through the dialog boxes as indicated in the "Overview".

To configure settings

► Select any button in the "Overview" to open the corresponding dialog box.

Preset Channel
Select the "Preset Channel" button in the lower left-hand corner of the "Overview" to restore all measurement settings *in the current channel* to their default values.

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 62

4.2 Input and frontend settings

Access: "Overview" > "Input/Frontend"

The R&S VSE can evaluate signals from different input sources and provide various types of output (such as trigger signals).

The frequency and amplitude settings represent the "frontend" of the measurement setup.

4.2.1 Input source settings

Access: "Overview" > "Input/Frontend" > "Input Source"

Or: "Input & Output" > "Input Source"

The R&S VSE can control the input sources of the connected instruments.

4.2.1.1 Radio frequency input

Or: "Input & Output" > "Input Source" > "Radio Frequency"

The default input source for the connected instrument is "Radio Frequency". Depending on the connected instrument, different input parameters are available.

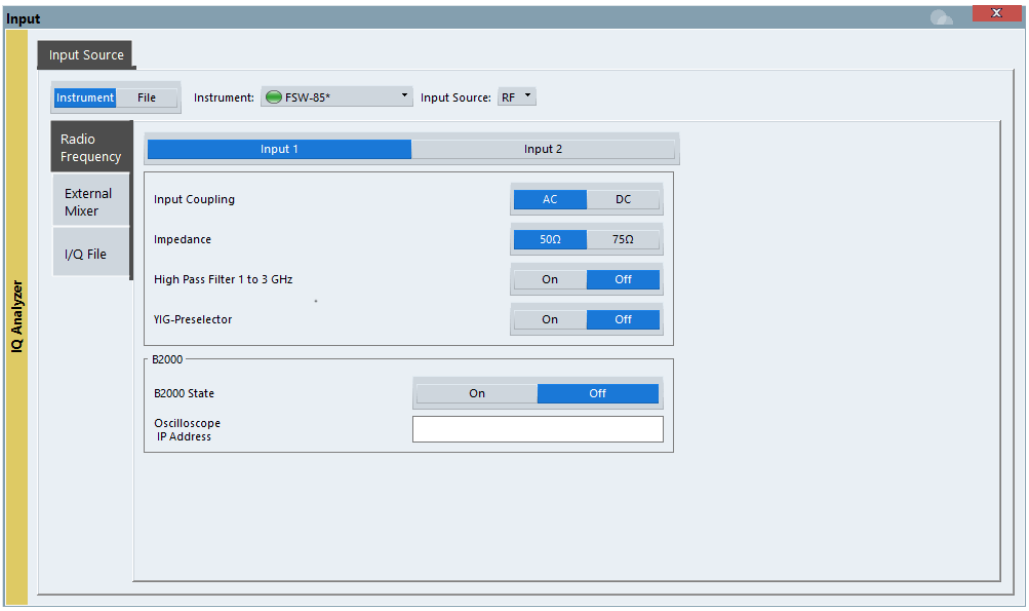


Figure 4-1: RF input source settings for an R&S FSW with B2000 option

If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE HRP UWB application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

Input Type (Instrument / File)
Selects an instrument or a file as the type of input provided to the channel.

Note: External mixers are only available for input from a connected instrument.

Note: If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si> on page 76
INPut<ip>:SELect on page 76

Instrument
Specifies a configured instrument to be used for input.

Input 1 / Input 2
For instruments with two input connectors, you must define which input source is used for each measurement channel.

If an external frontend is active, select the connector the external frontend is connected to. You cannot use the other RF input connector simultaneously for the same channel. However, you can configure the use of the other RF input connector for another active channel at the same time.

"Input 1" R&S FSW85: 1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G)

"Input2" R&S FSW85: 1.85 mm RF input connector for frequencies up to 67 GHz

Remote command:
INPut:TYPE on page 76

Input Coupling
The RF input of the R&S VSE can be coupled by alternating current (AC) or direct current (DC).

The RF input of the connected instrument can be coupled by alternating current (AC) or direct current (DC).

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can be distorted.

However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the data sheet.

Remote command:
INPut<ip>:COUPling<ant> on page 71

Impedance
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 Ω.

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

Remote command:
INPut<ip>:IMPedance<ant> on page 73

Direct Path
Enables or disables the use of the direct path for small frequencies.

In spectrum analyzers, passive analog mixers are used for the first conversion of the input signal. In such mixers, the LO signal is coupled into the IF path due to its limited isolation. The coupled LO signal becomes visible at the RF frequency 0 Hz. This effect is referred to as LO feedthrough.

To avoid the LO feedthrough the spectrum analyzer provides an alternative signal path to the A/D converter, referred to as the *direct path*. By default, the direct path is selected automatically for RF frequencies close to zero. However, this behavior can be disabled. If "Direct Path" is set to "Off" , the spectrum analyzer always uses the analog mixer path.

"Auto" (Default) The direct path is used automatically for frequencies close to zero.

"Off" The analog mixer path is always used.

Remote command:
`INPut:DPATh` on page 72

High Pass Filter 1 to 3 GHz
Activates an additional internal highpass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the analyzer to measure the harmonics for a DUT, for example.

For some connected instruments, this function requires an additional hardware option on the instrument.

Note: For RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

Remote command:
`INPut:FILTer:HPASs[:STATe]` on page 72

YIG-Preselector
Enables or disables the YIG-preselector.

This setting requires an additional option on the connected instrument.

Note: Note that the YIG-preselector is active only higher frequencies, depending on the connected instrument. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

To use the optional 90 GHz frequency extension (R&S FSW-B90G), the YIG-preselector must be disabled.

To use the optional 54 GHz frequency extension (R&S FSV3-B54G), the YIG-preselector must be disabled.

Remote command:
`INPut<ip>:FILTer:YIG[:STATe]` on page 73

Capture Mode
Determines how data from an oscilloscope is input to the R&S VSE software.

This function is only available for a connected R&S oscilloscope with a firmware version 3.0.1.1 or higher (for other versions and instruments the input is always I/Q data).

"I/Q" The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.
For data imports with small bandwidths, importing data in this format is quicker. However, the maximum record length is restricted by the R&S oscilloscope. (Memory options on the R&S oscilloscope are not available for I/Q data.)

"Waveform" The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.
For data imports with large bandwidths, this format is more convenient as it allows for longer record lengths if appropriate memory options are available on the R&S oscilloscope.

"Auto" Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement, oscilloscope baseband input).

Remote command:
`INPut:RF:CAPMode` on page 74

B2000 State
Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

Note: The R&S VSE software supports input from a connected R&S FSW with a B2000 option installed. However, the R&S FSW interface to the oscilloscope must be set up and aligned directly on the instrument before the R&S VSE software can start analyzing the input.
The analysis bandwidth is defined in the data acquisition settings of the application as usual. Note that the maximum bandwidth cannot be restricted manually as for other bandwidth extension options.

Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]` on page 78

Oscilloscope Sample Rate
Determines the sample rate used by the connected oscilloscope.

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

"10 GHz" Default for waveform Capture Mode (not available for I/Q Capture Mode); provides maximum record length

"20 GHz" Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).
For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHZ is always used in waveform Capture Mode

"40 GHz" Provides a maximum sample rate.
Only available for I/Q Capture Mode, and only for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet)

Remote command:
Input source R&S FSW via oscilloscope:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe` on page 79
Input source oscilloscope waveform mode:
`INPut:RF:CAPMode:WAVeform:SRATe` on page 75
Input source oscilloscope I/Q mode:
`INPut:RF:CAPMode:IQ:SRATe` on page 75

Oscilloscope Splitter Mode
Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S FSW and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input user manual.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe]` on page 79

Oscilloscope IP Address
When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an R&S FSW as the connected instrument, the entire measurement, as well as both instruments, are controlled by the R&S VSE software. Thus, the instruments must be connected via LAN, and the TCPIP address of the oscilloscope must be defined in the R&S VSE software.

For tips on how to determine the computer name or TCPIP address, see the oscilloscope's user documentation.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip` on page 78

Preselector State
Turns the preselector on and off.

When you turn on the preselector, you can configure the characteristics of the preselector and add the preamplifier into the signal path.

When you turn off the preselector, the signal bypasses the preselector and the preamplifier, and is fed into the input mixer directly.

Remote command:
`INPut<ip>:PRESelection[:STATe]` on page 74

Preselector Mode
Selects the preselection filters to be applied to the measurement.

"Auto" Automatically applies all available bandpass filters in a measurement. Available with the optional preamplifier.

"Auto Wide" Automatically applies the wideband filters consecutively:

- Lowpass 40 MHz
- Bandpass 30 MHz to 2250 MHz
- Bandpass 2 GHz to 8 GHz
- Bandpass 8 GHz to 26.5 GHz

Available with the optional preselector.

"Auto Narrow" Automatically applies the most suitable narrowband preselection filters in a measurement, depending on the bandwidth you have selected.
For measurement frequencies up to 30 MHz, the connected instrument uses combinations of lowpass and highpass filters. For higher frequencies, the connected instrument uses bandpass filters.
Available with the optional preselector.

"Manual" Applies the filter settings you have defined manually.

Remote command:
`INPut:PRESelection:SET` on page 74

10 dB Minimum Attenuation
Turns the availability of attenuation levels of less than 10 dB on and off.

When you turn on this feature, the attenuation is always at least 10 dB. This minimum attenuation protects the input mixer and avoids accidental setting of 0 dB, especially if you measure EUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:
`INPut:ATTenuation:PROTection:RESet` on page 71

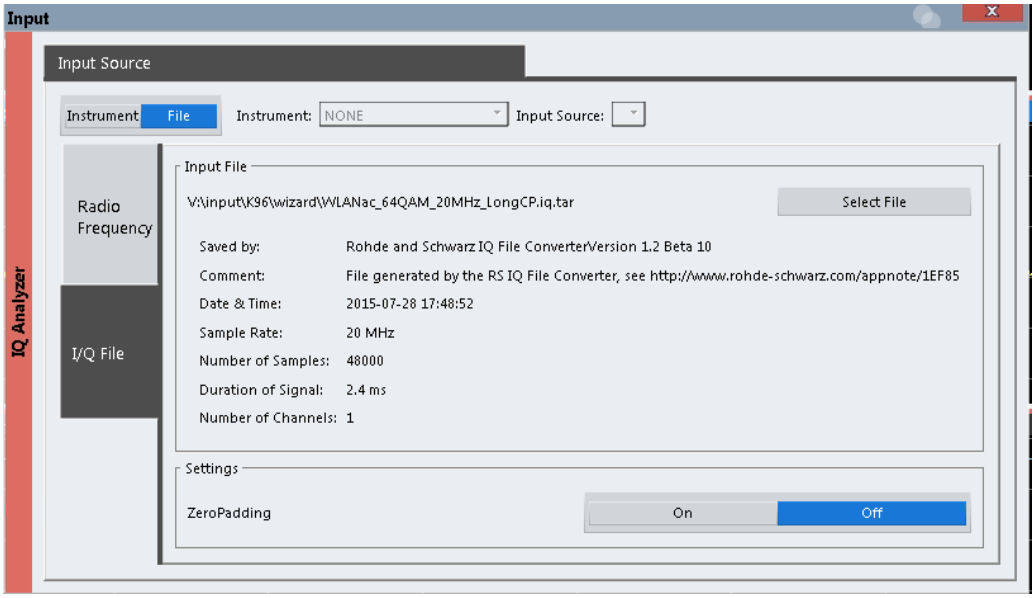
4.2.1.2 I/Q file input

Or: "Input & Output" > "Input Source" > "I/Q File"

Loading a file via drag&drop
You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

The "Input Source" settings defined in the "Input" dialog box are identical to those configured for a specific channel in the "Measurement Group Setup" window.



If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE HRP UWB application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset.

Input Type (Instrument / File)
Selects an instrument or a file as the type of input provided to the channel.

Note: External mixers are only available for input from a connected instrument.

Note: If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 76
`INPut<ip>:SELect` on page 76

Input File
Specifies the I/Q data file to be used for input.

Select "Select File" to open the "Load I/Q File" dialog box.

Zero Padding
Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can effect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.

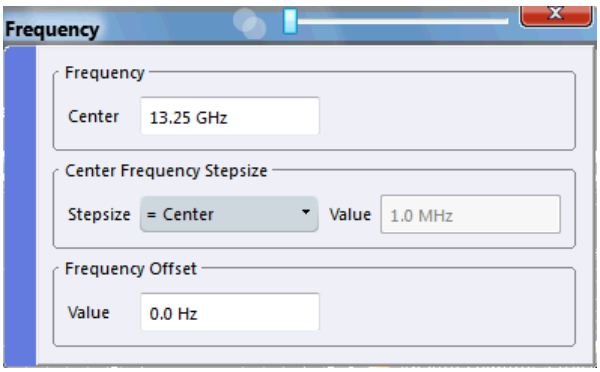
If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

Note: You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

Remote command:
`INPut:FILE:ZPADing` on page 72

4.2.2 Frequency settings

Access: "Overview" > "Input/Frontend" > "Frequency" tab



Center Frequency
Defines the center frequency of the signal in Hertz.

0 Hz ≤ f_{center} ≤ f_{max}

Note: For file input, you can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the sample rate of the file data.

$$CF_{shift_{max}} = CF_{file} \pm \frac{SR_{file}}{2}$$

If the file does not provide the center frequency, it is assumed to be 0 Hz.

To ensure that the input data remains within the valid analysis bandwidth, define the center frequency and the analysis bandwidth for the measurement such that the following applies:

$$CF + \frac{ABW_{channel}}{2} > CF_{file} + \frac{ABW_{file}}{2}$$

$$CF - \frac{ABW_{channel}}{2} > CF_{file} - \frac{ABW_{file}}{2}$$

Remote command:
[SENSe:]FREQuency:CENTer on page 104

Center Frequency Stepsize
Defines the step size by which the center frequency is increased or decreased using the arrow keys.

When you use the mouse wheel, the center frequency changes in steps of only 1/10 of the span.

The step size can be coupled to another value or it can be manually set to a fixed value.

"Manual" Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.

Remote command:
[SENSe:]FREQuency:CENTer:STEP on page 104

Frequency Offset
Shifts the displayed frequency range along the x-axis by the defined offset.

This parameter has no effect on the instrument's hardware, on the captured data, or on data processing. It is simply a manipulation of the final results in which absolute frequency values are displayed. Thus, the x-axis of a spectrum display is shifted by a constant offset if it shows absolute frequencies. However, if it shows frequencies relative to the signal's center frequency, it is not shifted.

A frequency offset can be used to correct the display of a signal that is slightly distorted by the measurement setup, for example.

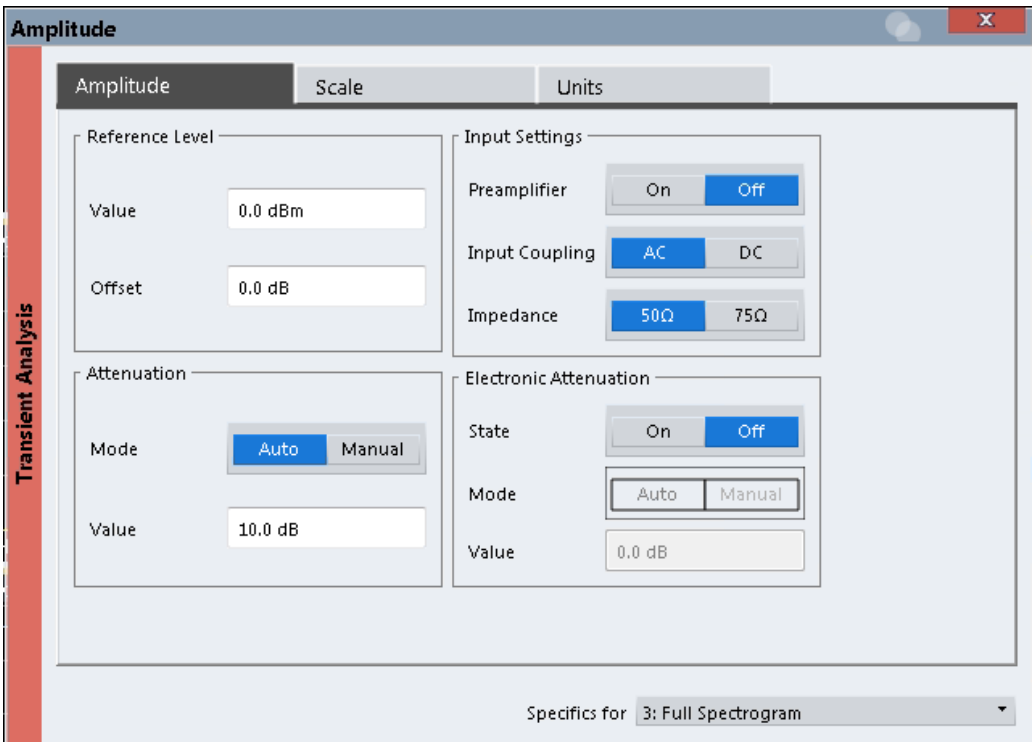
The allowed values range from -1 THz to 1 THz. The default setting is 0 Hz.

Remote command:
[SENSe:]FREQuency:OFFSet on page 104

4.2.3 Amplitude settings

Access: "Overview" > "Input/Frontend" > "Amplitude" tab

Amplitude settings affect the signal power or error levels.



Note that amplitude settings are not window-specific, as opposed to the scaling and unit settings.

Reference Level

Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

The reference level can also be used to scale power diagrams; the reference level is then used for the calculation of the maximum on the y-axis.

Since the hardware of the connected instrument is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimal measurement (no compression, good signal-to-noise ratio).

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 105

Shifting the Display (Offset) ← Reference Level
Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S VSE so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is ±200 dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset" . Thus, it is important to keep in mind the actual power level the R&S VSE must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet` on page 106

RF Attenuation
Defines the mechanical attenuation for RF input.

Attenuation Mode / Value ← RF Attenuation
Defines the attenuation applied to the RF input of the R&S VSE.

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). Automatic attenuation ensures that no overload occurs at the RF Input connector for the current reference level. It is the default setting.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed.

NOTICE! Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload can lead to hardware damage.

Remote command:
`INPut:ATTenuation` on page 110
`INPut:ATTenuation:AUTO` on page 110

Using Electronic Attenuation
If the (optional) Electronic Attenuation hardware is installed on the connected instrument, you can also activate an electronic attenuator.

In "Auto" mode, the settings are defined automatically; in "Manual" mode, you can define the mechanical and electronic attenuation separately.

Note: Note that restrictions can apply concerning which frequencies electronic attenuation is available for, depending on which instrument is connected to the R&S VSE software. Check your instrument documentation for details.
In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation can provide a better signal-to-noise ratio, however.

When you switch off electronic attenuation, the RF attenuation is automatically set to the same mode (auto/manual) as the electronic attenuation was set to. Thus, the RF attenuation can be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

If the defined reference level cannot be set for the given attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed in the status bar.

Remote command:
`INPut:EATT:STATe` on page 111
`INPut:EATT:AUTO` on page 111
`INPut:EATT` on page 110

Input Settings
Some input settings affect the measured amplitude of the signal, as well.

For information on other input settings see Chapter 4.2.1.1, "Radio frequency input", on page 23.

Preamplifier ← Input Settings
If the (optional) internal preamplifier hardware is installed on the connected instrument, a preamplifier can be activated for the RF input signal.

Note: If an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

"Off"	Deactivates the preamplifier.
"15 dB"	The RF input signal is amplified by about 15 dB.
"30 dB"	The RF input signal is amplified by about 30 dB.

Depending on the connected instrument, different settings are available. See the instrument's documentation for details.

Remote command:
`INPut<ip>:GAIN<ant>:STATe` on page 106
`INPut<ip>:GAIN<ant>[:VALue]` on page 107

Impedance ← Input Settings
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 Ω.

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

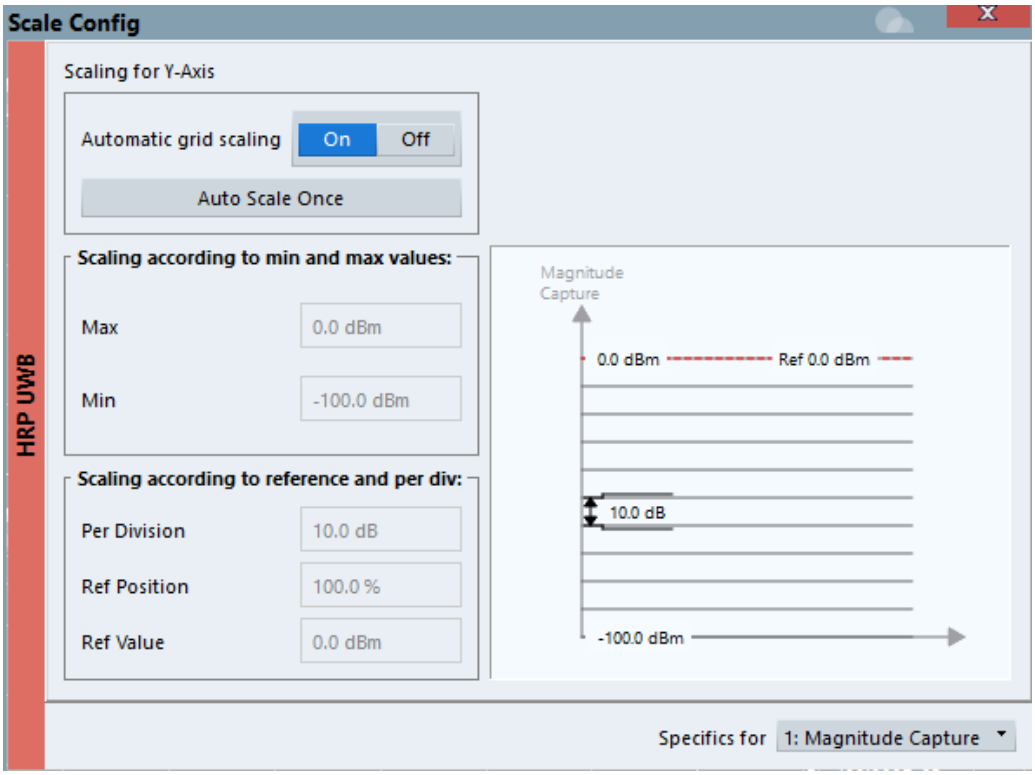
Remote command:
`INPut<ip>:IMPedance<ant>` on page 73

4.2.4 Scaling

Access: "Input & Output" > "Scale"

Depending on the type of display (time, spectrum or statistics), various scaling functions are available to adapt the result display to the current data.

Note that scaling settings are window-specific, as opposed to the amplitude settings.



A visualization of the diagram scaling with the current settings is displayed at the right side of the dialog box.

Auto Scale Once

Automatically determines the optimal range and reference level position to be displayed for the current measurement settings.

The display is only set once; it is not adapted further if the measurement settings are changed again.

This function is only available for RF measurements.

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE`

on page 107

Defining Min and Max Values
Defines the displayed y-axis range in dB.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum
on page 108
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum
on page 108

Range per Division
Defines the value range to be displayed per division.

Note: If fewer divisions are displayed (e.g. because the window is reduced in height), the range per division is increased to display the same result range in the smaller window. In this case, the per division value does not correspond to the actual display.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision
on page 108

Reference Position
Defines the position of the reference value on the y-axis. The position is defined as a percentage value, where 0 % refers to the bottom edge, 100 % refers to the top edge of the screen. The y-axis is adapted so that the reference value is displayed at the reference position.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition
on page 109

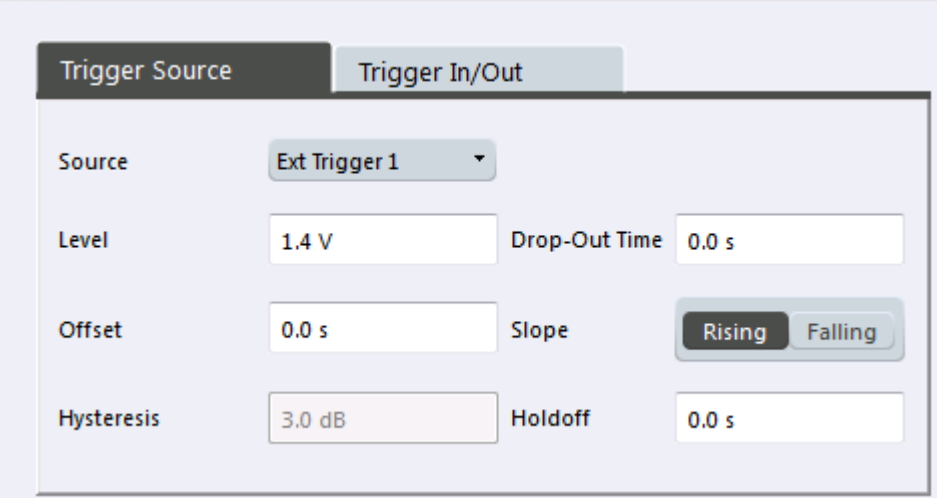
Reference Value
Defines a reference value on the y-axis in the current unit. The y-axis is adapted so that the reference value is displayed at the reference postion.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue
on page 109

4.3 Trigger settings

Access: "Overview" > "Trigger" > "Trigger Source"/"Trigger In/Out"

Trigger settings determine when the input signal is measured. Note that gating is not available for hop measurements.



External triggers from one of the [TRIGGER INPUT/OUTPUT] connectors on the connected instrument are configured in a separate tab of the dialog box.

For details see R&S VSE Base Software User Manual.

For step-by-step instructions on configuring triggered measurements, see the R&S VSE User Manual.

Trigger Settings
The trigger settings define the beginning of a measurement.

Trigger Source ← Trigger Settings
Defines the trigger source. If a trigger source other than "Free Run" is set, "TRG" is displayed in the channel bar and the trigger source is indicated.

Note: When triggering is activated, the squelch function is automatically disabled.

Remote command:
`TRIGger[:SEQuence]:SOURce` on page 115

Free Run ← Trigger Source ← Trigger Settings
No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitly.

Remote command:
`TRIG:SOUR IMM`, see `TRIGger[:SEQuence]:SOURce` on page 115

External Trigger 1/2/3/4 ← Trigger Source ← Trigger Settings
Data acquisition starts when the TTL signal fed into the specified input connector meets or exceeds the specified trigger level.

Note: If the optional 2 GHz bandwidth extension (B2000) is active, only External Channel 3 is supported.

For details, see the "Instrument Tour" chapter in the R&S VSE Getting Started manual.

"External Trigger 1"
Trigger signal from the "TRIGGER 1 INPUT" connector.

"External Trigger 2"
Trigger signal from the "TRIGGER 2 INPUT / OUTPUT" connector.

Remote command:
See `TRIGger[:SEQuence]:SOURce` on page 115

External Channel 3 ← Trigger Source ← Trigger Settings
Data acquisition starts when the signal fed into the "Ch3" input connector on the oscilloscope meets or exceeds the specified trigger level.

Note: In previous firmware versions, the external trigger was connected to the *"Ch2"* input on the oscilloscope. As of firmware version R&S VSE 2.30, the *"Ch3"* input on the oscilloscope must be used!

Note: Since the external trigger uses a second channel on the oscilloscope, the maximum memory size, and thus record length, available for the input channel 1 may be reduced by half. For details, see the oscilloscope's data sheet and documentation.

Remote command:
`TRIG:SOUR EXT`, see `TRIGger[:SEQuence]:SOURce` on page 115

IF Power ← Trigger Source ← Trigger Settings
The R&S VSE starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

(The third IF represents the center frequency.)

This trigger source is only available for RF input.

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.

Remote command:
`TRIG:SOUR IFP`, see `TRIGger[:SEQuence]:SOURce` on page 115

I/Q Power ← Trigger Source ← Trigger Settings
Triggers the measurement when the magnitude of the sampled I/Q data exceeds the trigger threshold.

Remote command:
TRIG:SOUR IQP, see TRIGger[:SEQuence]:SOURce on page 115

RF Power ← Trigger Source ← Trigger Settings
Defines triggering of the measurement via signals which are outside the displayed measurement range.

For this purpose, the software uses a level detector at the first intermediate frequency.

The resulting trigger level at the RF input depends on the RF attenuation and preamplification. For details on available trigger levels, see the instrument's data sheet.

Note: If the input signal contains frequencies outside of this range (e.g. for fullspan measurements), the measurement can be aborted. A message indicating the allowed input frequencies is displayed in the status bar.

A "Trigger Offset" , "Trigger Polarity" and "Trigger Holdoff" (to improve the trigger stability) can be defined for the RF trigger, but no "Hysteresis" .

Remote command:
TRIG:SOUR RFP, see TRIGger[:SEQuence]:SOURce on page 115

Trigger Level ← Trigger Settings
Defines the trigger level for the specified trigger source.

For details on supported trigger levels, see the instrument data sheet.

Remote command:
TRIGger[:SEQuence]:LEVel[:EXTernal<port>] on page 113

Drop-Out Time ← Trigger Settings
Defines the time that the input signal must stay below the trigger level before triggering again.

Remote command:
TRIGger[:SEQuence]:DTIMe on page 112

Trigger Offset ← Trigger Settings
Defines the time offset between the trigger event and the start of the measurement.

Offset > 0:	Start of the measurement is delayed
Offset < 0:	Measurement starts earlier (pretrigger)

(If supported by the connected instrument.)

Remote command:
TRIGger[:SEQuence]:HOLDoff[:TIME] on page 112

Slope ← Trigger Settings
For all trigger sources except time, you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

Remote command:
TRIGger[:SEQuence]:SLOPe on page 115

Hysteresis ← Trigger Settings
Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Setting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

This setting is only available for "IF Power" or "Magnitude (Offline)" trigger sources.

Remote command:
`TRIGger[:SEQuence]:IFPower:HYSTeresis` on page 113
`TRIGger[:SEQuence]:MAPower:HYSTeresis` on page 117

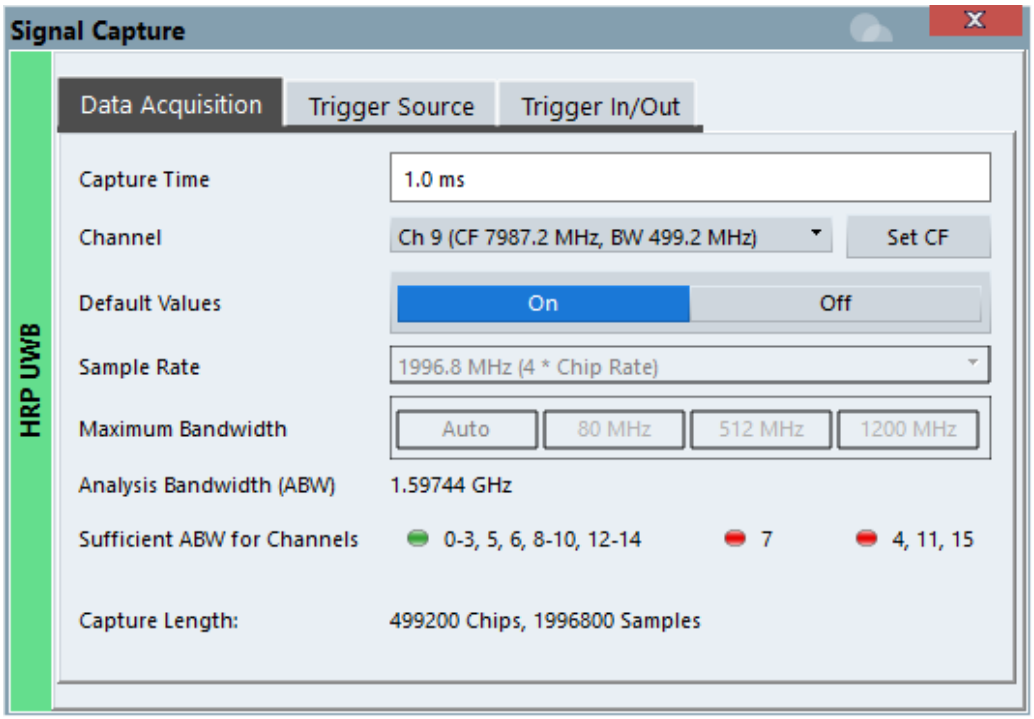
Trigger Holdoff ← Trigger Settings
Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

Remote command:
`TRIGger[:SEQuence]:IFPower:HOLDoff` on page 113
`TRIGger[:SEQuence]:MAPower:HOLDoff` on page 117

4.4 Data acquisition

Access: "Overview" > "Data Acquisition"

The data acquisition settings of the R&S VSE can be configured to evaluate signals from different UWB channels.



Capture Time
Specifies the duration (and therefore the amount of data) to be captured in the capture buffer. If the capture time is too short, demodulation will fail. In particular, if the result length does not fit in the capture buffer, demodulation will fail.

When connecting to an R&S RTP oscilloscope, different modes are possible. See R&S VSE base unit user manual for further details. The maximum capture time depends on the available software and hardware options of the connected R&S RTP oscilloscope.

Remote command:
`[SENSe:]SWEep:TIME` on page 119

Channel
Selects the HRP UWB Channel according to the IEEE 802.15.4z-2020 standard, a center frequency and a measurement bandwidth is predefined. By selecting the "Set CF" button, the center frequency of the R&S VSE is set according to the definition in the selected channel.

Remote command:
`[SENSe:]CAPTure:PRESet` on page 120
`[SENSe:]CAPTure:FSET` on page 120

Default Values
If the default values button is set to "On", Sample Rate and Maximum Bandwidth BW are set automatically for the selected channel. Select "Off" to configure the settings for Sample Rate and Maximum Bandwidth manually.

Remote command:
`[SENSe:]CAPTure:DEFault` on page 120

Sample Rate
Defines the sample rate used for the measurement. The sample rate can be set as an even multiple of the chip rate.

Remote command:
`[SENSe:]CAPTure:OVERsampling` on page 121
`[SENSe:]SRATe` on page 121

Maximum Bandwidth
If "Auto" is selected, the analysis bandwidth is defined automatically. The available analysis bandwidths depend on the installed bandwidth extension options of the R&S VSE.

Remote command:
`TRACe:IQ:WBANd[:STATe]` on page 121
`TRACe:IQ:WBANd:MBWidth` on page 121

Analysis Bandwidth
Displays the selected analysis bandwidth for the signal.

It the "Sufficient ABW for channels" marker is green, the analysis bandwidth is sufficient for the analysis of the corresponding channels.

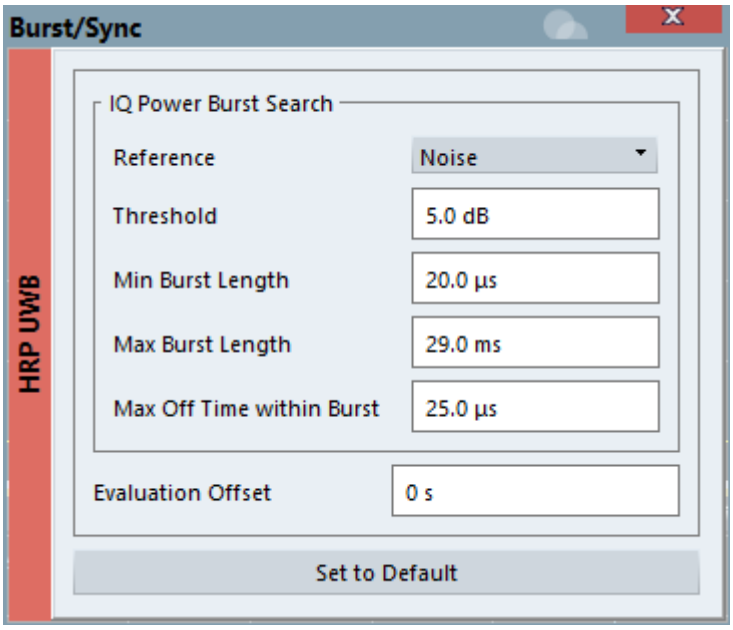
Capture Length
Shows the capture length in chips and samples.

Remote command:
`[SENSe:]CAPTure:LENGth:CHIPs?` on page 121

4.5 Burst/Sync

Access: "Overview" > "Burst/Sync"

The "Burst/Sync" dialog provides functionality to configure how packets are detected.



Reference
Select the reference for packet detection.

- "Noise": The noise floor is detected and shown in the magnitude capture result display. The detection level is the noise level + the defined threshold in dB.
- "Absolute": The absolute detection level in dBm is defined by the threshold in dBm. In the magnitude capture result display, only the detection level is shown.

- "Peak": The peak level of the whole capture buffer is detected. The detection level is the peak level + the defined threshold in dB.
- "Ref level": The detection level is the reference level + the defined threshold in dB. In the magnitude capture result display, just the detection level is shown.

Remote command:
`[SENSe:]DETect:REFerence` on page 122

Threshold
Defines the detection threshold in dB.

Remote command:
`[SENSe:]DETect:THReshold` on page 122

Min Burst Length
Defines the minimum burst length.

Remote command:
`[SENSe:]DETect:BURSt:LENGth:MINimum` on page 122

Max Burst Length
Defines the maximum burst length.

Remote command:
`[SENSe:]DETect:BURSt:LENGth:MAXimum` on page 122

Max Off Time within Burst
Defines the maximum allowed off time within a burst.

Remote command:
`[SENSe:]DETect:OFF:TIME:MAXimum` on page 123

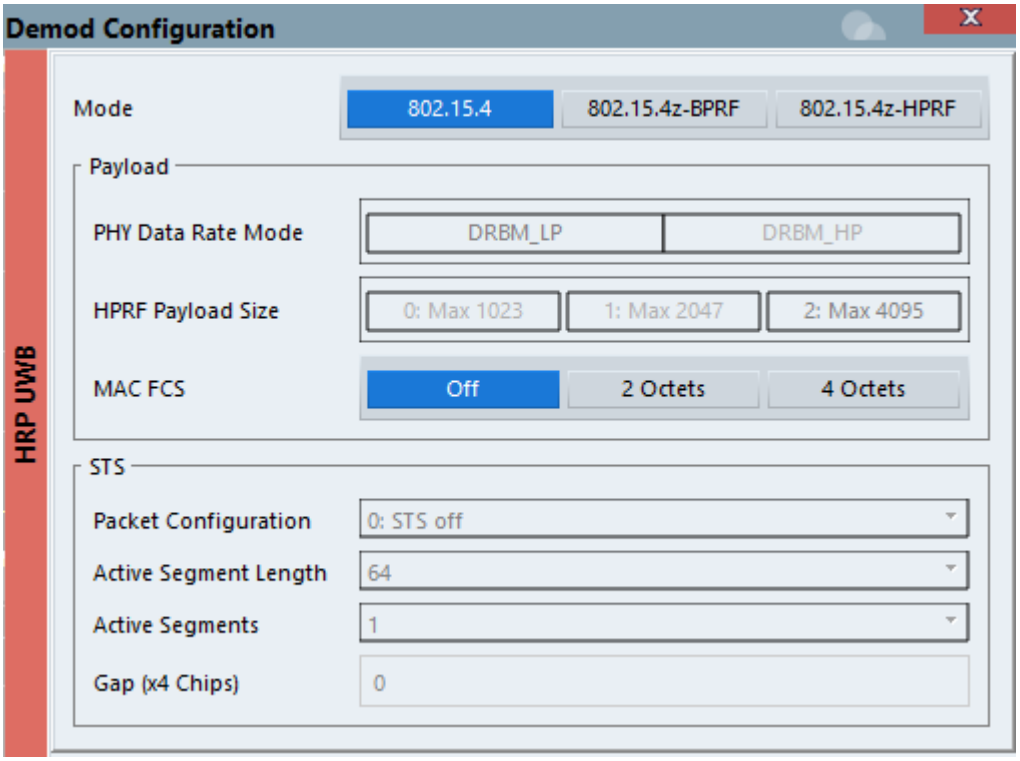
Evaluation Offset
Sets the offset of the beginning of the detected burst to where to start detection within SYNC section.

Remote command:
`[SENSe:]DETect:EVALuation:OFFSet` on page 123

4.6 Demodulation

Access: "Overview" > "Demodulation"

The settings of the R&S VSE can be configured to demodulate different UWB signals.



Mode
Sets the HRP UWB mode.

- "802.15.4": Enables HRP non-ERDEV mode.
- "802.15.4z-BPRF": Enables HRP-ERDEV base pulse repetition frequency (BPRF) mode.
- "802.15.4z-HPRF": Enables HRP-ERDEV higher pulse repetition frequency (HPRF) mode.

Remote command:
`[SENSe:]DEMod:MODE` on page 123

Packet Configuration
Sets the scrambled timestamp sequence (STS) packet configuration:

- 0: STS off
- 1: SYNC/SFD, STS, PHR/PSDU
- 2: SYNC/SFD, PHR/PSDU, STS
- 3: SYNC/SFD, STS

STS settings are only available in "BPRF" or "HPRF" mode.

Remote command:
[SENSe:]DEMod:STS:FORMat on page 124

PHY Data Rate Mode
In "BPRF" mode, "DRBM_LP" and "DRBM_HP" can be selected. In "HPRF" mode, "DRHM_LR" and "DRHM_HR" can be selected.

Remote command:
[SENSe:]DEMod:PHRRate on page 124

HPRF Payload Size
Defines the maximum payload size in "HPRF" mode. It influences how A0A1-Bits in the header are handled. See "A0A1" row in the packet insights table.

Remote command:
[SENSe:]DEMod:PAYLoad:MAX on page 124

MAC FCS
Enable FCS check of payload either with 2 octet or with 4 octet format.

Remote command:
[SENSe:]DEMod:MAC:FCS on page 125

Active Segment Length
If the packet format is not "0", the active STS segment length can be defined.

STS settings are only available in "BPRF" or "HPRF" mode.

Remote command:
[SENSe:]DEMod:STS:LENGth on page 124

Active Segments
If the packet format is not "0", the number of active STS segments can be defined.

STS settings are only available in "BPRF" or "HPRF" mode.

Remote command:
[SENSe:]DEMod:STS:SEGMents on page 124

Gap (x4 chips)
Gap between payload and STS section in packet configuration 2.

Remote command:
[SENSe:]DEMod:STS:GAP on page 125

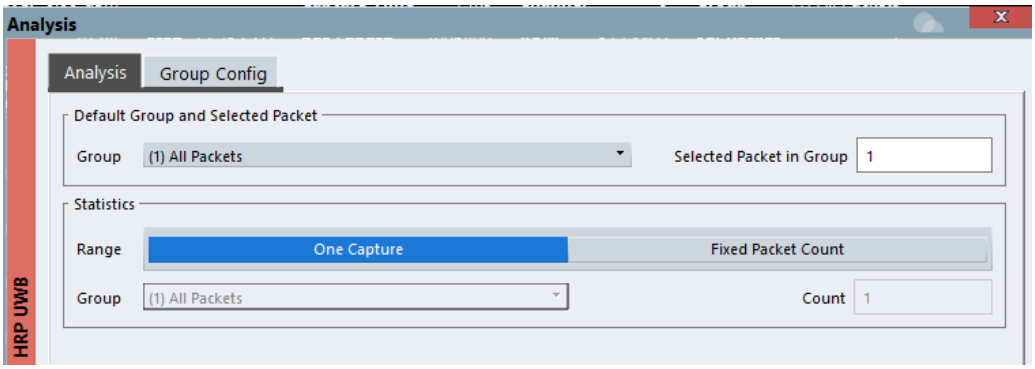
4.7 Evaluation range

Access: "Overview" > "Evaluation Range"

The evaluation range dialog of the R&S VSE provides functionality to configure the number of analyzed UWB packets.

To select different evaluation modes, see Chapter 5.3, "Evaluation modes", on page 55.

4.7.1 Analysis



Default Group and Selected Packet
Sets the default group to be analyzed for all displays and the number of the selected packet within the group. For each display, a group and selected packet which is different to the default configuration can be set in the result config dialog.

Remote command:
`[SENSe:]EVALuation:PACKet:GROup` on page 125
`[SENSe:]EVALuation:PACKet:NUMBer` on page 126

Range
Sets the type of range used for evaluating packets.

Remote command:
`[SENSe:]EVALuation:STATistics:RANGe` on page 126

Group
Sets the statistics group to be analyzed, i.e. packets of which group should be counted up.

Remote command:
`[SENSe:]EVALuation:STATistics:GROup` on page 126

Count
Sets the number of packets to capture

Remote command:
`[SENSe:]EVALuation:STATistics:COUNt` on page 126
`[SENSe:]EVALuation:PACKet:COUNt?` on page 126

4.7.2 Group Config

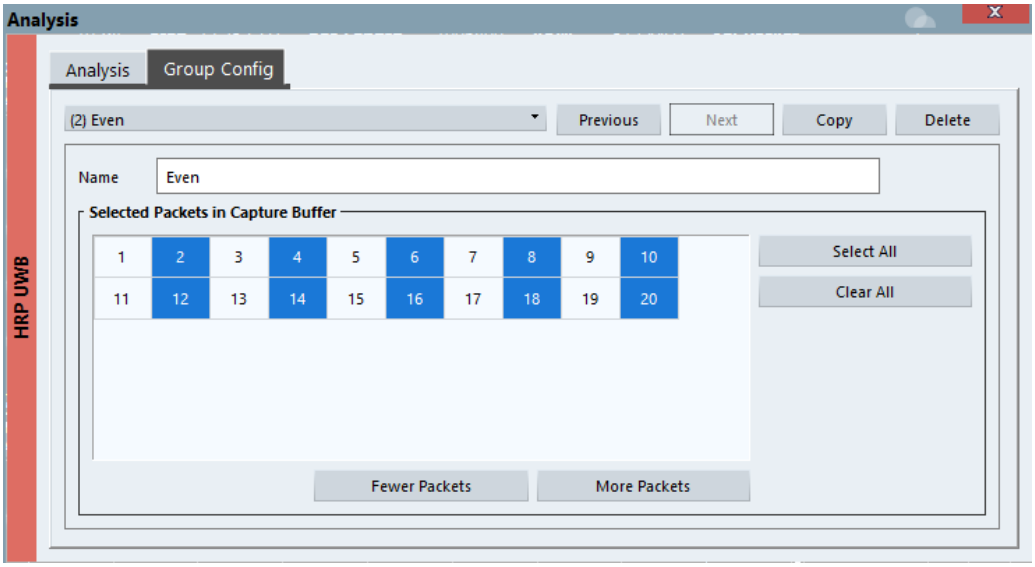


Figure 4-2: Exemplary configuration of an "even" group

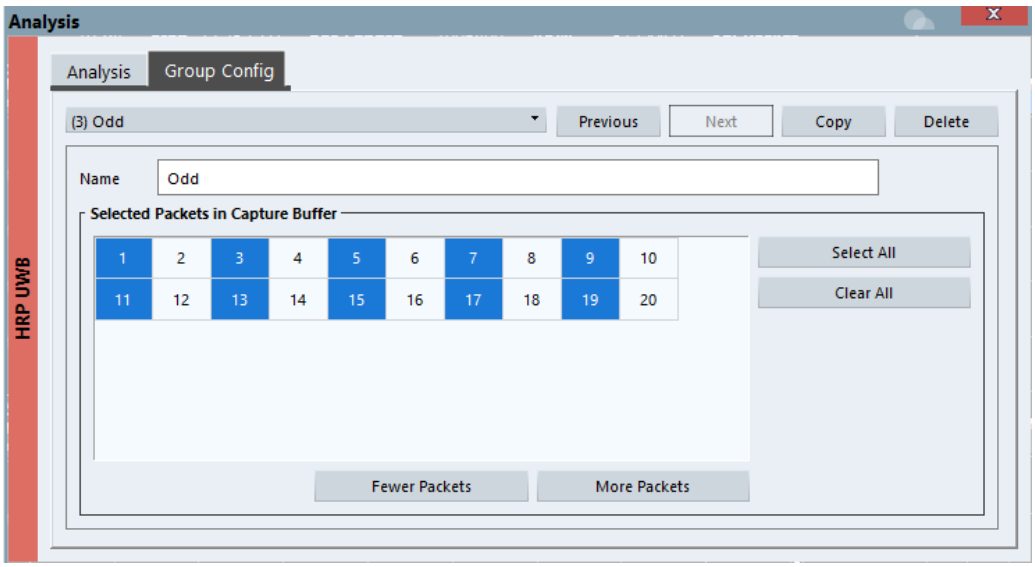


Figure 4-3: Exemplary configuration of an "odd" group

In specific measurement scenarios, such as a triggered time of flight (TOF) measurement, the packets in the capture buffer originate from different DUTs or signal generators. For the analysis, i.e. just the packets from the DUT and not from the signal generator are of interest. The user defined groups define which packet belongs to which group. For the analysis, all windows of the application show just the packets and the statistics for a certain group. This is the "Default Group" defined in the Analysis dialog.

For each display/table, a group and also a selected packet within that group can be defined which deviates from the "Default Group". This can be done in the Result Config

dialog. The default group is "All Packets" which contains all packets. This group cannot be edited.

You can define an arbitrary number of groups, each with a different combination of packets belonging to that group.

Remote command:

`[SENSe:]EVALuation:FILTer<n>:SET` on page 128

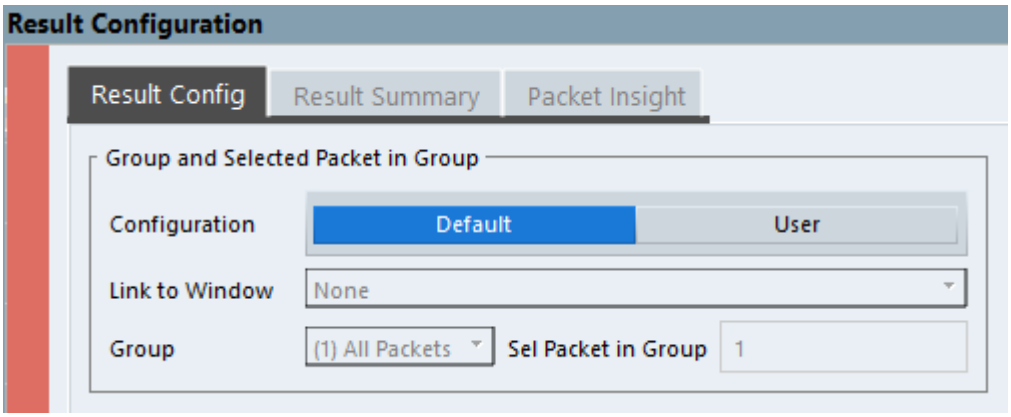
`[SENSe:]EVALuation:FILTer<n>:NAME` on page 127

`[SENSe:]EVALuation:FILTer<n>:DELete` on page 127

4.8 Result configuration

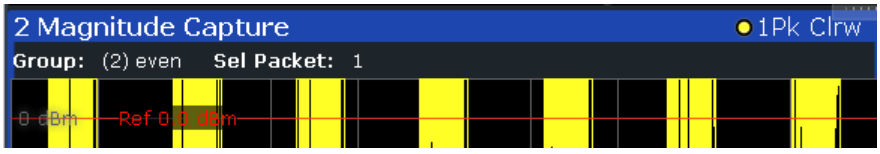
4.8.1 Result config

Access: "Meas" > "Result Config"



For each window, i.e. trace display or table, the group of the shown packets is either the default configuration (see Chapter 4.7, "Evaluation range", on page 46) or user defined. Also the selected packet in the group can be specified for each window. To change these values for several user configured windows at a time, several windows can be linked using the "Link to Window" functionality.

User defined displays show the group and the selected packet in a second line below the header:



For histogram traces, the number of bins and the x-scale (+/-) can be configured in picoseconds for time jitter traces and in degrees for phase jitter traces.

Remote command:

SENSe[:WINDow<n>]:DISPlay:RWConfig on page 128

SENSe[:WINDow<n>]:DISPlay:RWConfig:CONFigure on page 128

SENSe[:WINDow<n>]:DISPlay:RWConfig:GROup on page 128

SENSe[:WINDow<n>]:DISPlay:RWConfig:LINK on page 129

SENSe[:WINDow<n>]:DISPlay:RWConfig:PACKet on page 129

SENSe[:WINDow<n>]:DISPlay:CONFig:BINS on page 129

SENSe[:WINDow<n>]:DISPlay:CONFig:SCALe on page 129

4.8.2 Result summary

Defines the values to be displayed in the Result Summary display.

4.8.3 Packet insight

Defines the values to be displayed in the Packet Insights display.

5 Analysis

The UWB application provides several tools to get more information about the results.

Most of these tools are similar to those available in the spectrum application. For more information about these tools, refer to the R&S VSE user manual.

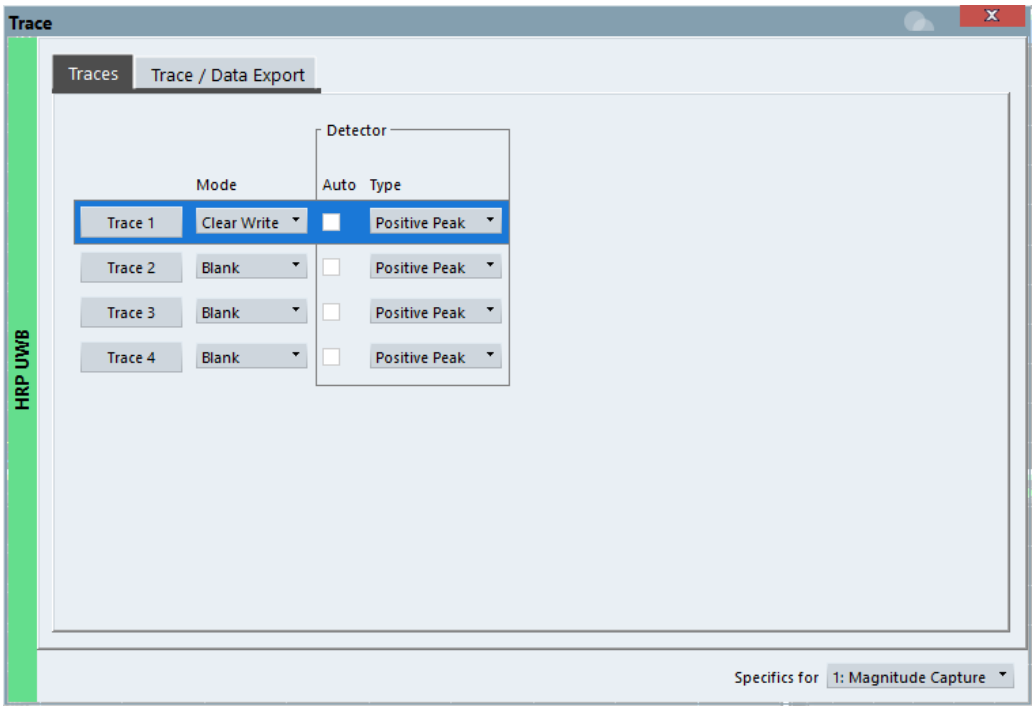
5.1 Configuring traces

The UWB application provides several tools to configure and evaluate traces.

5.1.1 Selecting the trace information

Access: [TRACE] > "Trace Config" > "Traces"

Each result display contains one or several traces specific to the corresponding result type.



Trace Mode
Defines the update mode for subsequent traces.

Clear Write	Overwrite mode (default): the trace is overwritten by each measurement.
Max Hold	The maximum value is determined over several measurements and displayed. The R&S VSE saves each trace point in the trace memory only if the new value is greater than the previous one.
Min Hold	The minimum value is determined from several measurements and displayed. The R&S VSE saves each trace point in the trace memory only if the new value is lower than the previous one.
Average	The average is formed over several measurements.
View	The current contents of the trace memory are frozen and displayed.
Blank	Removes the selected trace from the display.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE` on page 130

Detector
Defines the trace detector to be used for trace analysis.

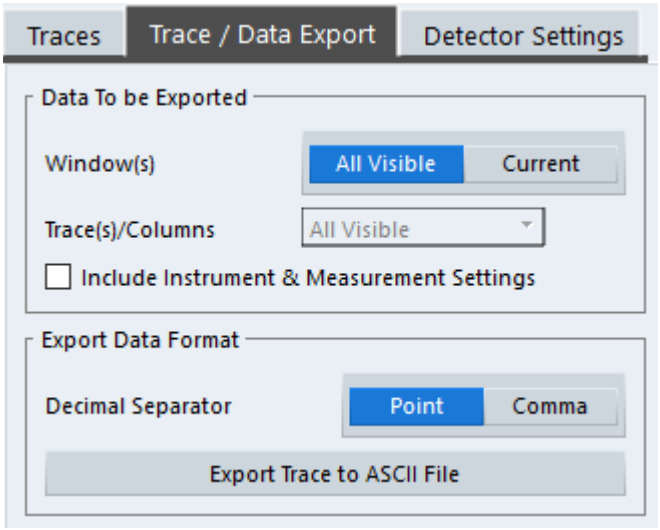
Auto	The detector for the respective trace is selected automatically.
Positive Peak	The positive detector displays the maximum level that has been detected during the measurement.
Negative Peak	The negative peak detector displays the minimum level that has been detected during the measurement.
Average	The average detector displays the average value that has been detected during the measurement.
RMS	The RMS detector displays the RMS average value that has been detected during the measurement.

Remote command:
`[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion]` on page 131

5.1.2 Exporting traces

Access: [TRACE] > "Trace Config" > "Trace / Data Export"

The functionality to export traces is similar to the Spectrum application. When you export a trace, the R&S VSE writes the trace data into an ASCII file. You can use the exported data for further evaluation in other programs like a spreadsheet.



Selecting data to export
The "Window(s)" toggle button selects the data that you want to export.

"All Visible" exports all traces in all result displays that are currently visible.

"Current" exports the traces in the currently selected (highlighted blue) result display.

If you export data from the currently selected result display, you can also select if you want to export all traces in that result display, or a single trace only from the "Trace(s) / Columns" dropdown menu.

Remote command:
`MMEMory:STORe<n>:TRACe` on page 131

Include Instrument & Measurement Settings
Includes additional instrument and measurement settings in the header of the export file for result data.

Remote command:
`FORMat:DEXPort:HEADer` on page 132

Decimal Separator
Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

Remote command:
`FORMat:DEXPort:DSEParator` on page 132

Export Trace
The "Export Trace To ASCII File" button opens a dialog box to select a directory and file name for the ASCII file.

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Note: Secure user mode.
In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S VSE base software user manual.

Remote command:
`MMEMory:STORe<n>:TRACe` on page 131

5.2 Using markers

The UWB application provides up to 16 markers in most result displays.

For more information on the available marker types and the usage, refer to the R&S VSE user manual.

5.2.1 Configuring markers

Access: "Overview" > "Result Config" > "Marker Settings"

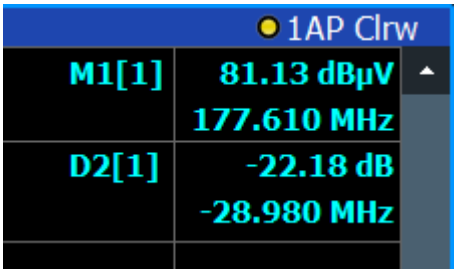
The "Marker Settings" contain settings that apply to all markers or have a general effect on marker functionality.

Marker Table Display
Defines how the marker information is displayed.

"On"	Displays the marker information in a table in a separate area beneath the diagram.
"Off"	No separate marker table is displayed.
"Auto"	(Default) If more than two markers are active, the marker table is displayed automatically.

Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 137

Marker Info
Turns the marker information displayed in the diagram on and off.



Remote command:
`DISPlay[:WINDow<n>]:MINFo[:STATe]` on page 137

5.3 Evaluation modes

The R&S VSE-K149 application shows the following behaviour in different run modes:

Run Mode	Range	Covered Packets in Statistics
Run Single	One Capture	Statistics over all packets in one capture
Run Single	Fixed Packet Count	Statistics over user defined number of packets, either in one capture or in multiple captures, if capture time is too short for all packets.
Run Continuous	One Capture	Statistics over all captured packets in all captures

6 Remote commands for HRP UWB measurements

The following commands are required to perform measurements in the HRP UWB application in a remote environment. The R&S VSE must already be set up for remote operation in a network as described in the base unit manual.

Note that basic tasks that are also performed in the base unit in the same way are not described here. For a description of such tasks, see the R&S VSE User Manual.

In particular, this includes:

- Managing Settings and Results, i.e. storing and loading settings and result data
- Basic instrument configuration, e.g. checking the system configuration, customizing the screen layout, or configuring networks and remote operation
- Using the common status registers (specific status registers for HRP UWB measurements are not used)

After a short introduction, the tasks specific to the HRP UWB application are described here:

6.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

The syntax of a SCPI command consists of a header and, usually, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

A header contains one or more keywords, separated by a colon. Header and parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). If there is more than one parameter for a command, they are separated by a comma from one another.

Only the most important characteristics that you need to know when working with SCPI commands are described here. For a more complete description, refer to the user manual of the R&S VSE.

Remote command examples

Note that some remote command examples mentioned in this general introduction are possibly not supported by this particular application.

6.1.1 Conventions used in descriptions

The following conventions are used in the remote command descriptions:

- **Command usage**
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**
  If not specified otherwise, a parameter can be used to set a value and it is the result of a query.
  Parameters required only for setting are indicated as **Setting parameters**.
  Parameters required only to refine a query are indicated as **Query parameters**.
  Parameters that are only returned as the result of a query are indicated as **Return values**.
- **Conformity**
  Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S VSE follow the SCPI syntax rules.
- **Asynchronous commands**
  A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.
- **Reset values (*RST)**
  Default parameter values that are used directly after resetting the instrument (`*RST` command) are indicated as ***RST** values, if available.
- **Default unit**
  The default unit is used for numeric values if no other unit is provided with the parameter.
- **Manual operation**
  If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

6.1.2 Long and short form

The keywords have a long and a short form. You can use either the long or the short form, but no other abbreviations of the keywords.

The short form is emphasized in uppercase letters. Note however, that this emphasis only serves the purpose to distinguish the short from the long form in the manual. For the instrument, the case does not matter.

Example:

`SENSe:FREQuency:CENTer` is the same as `SENS:FREQ:CENT`.

6.1.3 Numeric suffixes

Some keywords have a numeric suffix if the command can be applied to multiple instances of an object. In that case, the suffix selects a particular instance (e.g. a measurement window).

Numeric suffixes are indicated by angular brackets (<n>) next to the keyword.

If you do not quote a suffix for keywords that support one, a 1 is assumed.

Example:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe` enables the zoom in a particular measurement window, selected by the suffix at `WINDow`.

`DISPlay:WINDow4:ZOOM:STATe ON` refers to window 4.

6.1.4 Optional keywords

Some keywords are optional and are only part of the syntax because of SCPI compliance. You can include them in the header or not.

If an optional keyword has a numeric suffix and you need to use the suffix, you have to include the optional keyword. Otherwise, the suffix of the missing keyword is assumed to be the value 1.

Optional keywords are emphasized with square brackets.

Example:

Without a numeric suffix in the optional keyword:

`[SENSe:]FREQuency:CENTer` is the same as `FREQuency:CENTer`

With a numeric suffix in the optional keyword:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe`

`DISPlay:ZOOM:STATe ON` enables the zoom in window 1 (no suffix).

`DISPlay:WINDow4:ZOOM:STATe ON` enables the zoom in window 4.

6.1.5 Alternative keywords

A vertical stroke indicates alternatives for a specific keyword. You can use both keywords to the same effect.

Example:

`[SENSe:]BANDwidth|BWIDth[:RESolution]`

In the short form without optional keywords, `BAND 1MHZ` would have the same effect as `BWID 1MHZ`.

6.1.6 SCPI parameters

Many commands feature one or more parameters.

If a command supports more than one parameter, they are separated by a comma.

Example:

```
LAYout:ADD:WINDow Spectrum,LEFT,MTABle
```

Parameters can have different forms of values.

6.1.6.1 Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. For physical quantities, you can also add the unit. If the unit is missing, the command uses the basic unit.

Example:

With unit: `SENSe:FREQuency:CENTer 1GHZ`

Without unit: `SENSe:FREQuency:CENTer 1E9` would also set a frequency of 1 GHz.

Values exceeding the resolution of the instrument are rounded up or down.

If the number you have entered is not supported (e.g. for discrete steps), the command returns an error.

Instead of a number, you can also set numeric values with a text parameter in special cases.

- MIN/MAX
  Defines the minimum or maximum numeric value that is supported.
- DEF
  Defines the default value.
- UP/DOWN
  Increases or decreases the numeric value by one step. The step size depends on the setting. Sometimes, you can customize the step size with a corresponding command.

Querying numeric values

When you query numeric values, the system returns a number. For physical quantities, it applies the basic unit (e.g. Hz for frequencies). The number of digits after the decimal point depends on the type of numeric value.

Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

Query: `SENSe:FREQuency:CENTer?` would return `1E9`

Sometimes, numeric values are returned as text.

- INF/NINF
  Infinity or negative infinity. Represents the numeric values 9.9E37 or -9.9E37.
- NAN
  Not a number. Represents the numeric value 9.91E37. NAN is returned if errors occur.

6.1.6.2 Boolean

Boolean parameters represent two states. The "on" state (logically true) is represented by "`ON`" or the numeric value 1. The "off" state (logically untrue) is represented by "`OFF`" or the numeric value 0.

Querying Boolean parameters

When you query Boolean parameters, the system returns either the value 1 ("`ON`") or the value 0 ("`OFF`").

Example:

Setting: `DISPlay:WINDow:ZOOM:STATe ON`

Query: `DISPlay:WINDow:ZOOM:STATe?` would return `1`

6.1.6.3 Character data

Character data follows the syntactic rules of keywords. You can enter text using a short or a long form. For more information, see Chapter 6.1.2, "Long and short form", on page 57.

Querying text parameters

When you query text parameters, the system returns its short form.

Example:

Setting: `SENSe:BANDwidth:RESolution:TYPE NORMal`

Query: `SENSe:BANDwidth:RESolution:TYPE?` would return `NORM`

6.1.6.4 Character strings

Strings are alphanumeric characters. They have to be in straight quotation marks. You can use a single quotation mark (') or a double quotation mark (").

Example:

```
INSTRument:DELete 'Spectrum'
```

6.1.6.5 Block data

Block data is a format which is suitable for the transmission of large amounts of data.

The ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. The data bytes follow. During the transmission of these data bytes, all end or other control signs are ignored until all bytes are transmitted. #0 specifies a data block of indefinite length. The use of the indefinite format requires an `NL^END` message to terminate the data block. This format is useful when the length of the transmission is not known or if speed or other considerations prevent segmentation of the data into blocks of definite length.

6.2 Common suffixes

In the R&S VSE HRP UWB application, the following common suffixes are used in remote commands:

Table 6-1: Common suffixes used in remote commands in the R&S VSE HRP UWB application

Suffix	Value range	Description
<m>	1 to 16	Marker
<n>	1 to 16	Window (**in the currently selected channel**)
<t>	1 to 4	Trace
	1 to 8	Limit line

6.3 Activating HRP UWB measurements

HRP UWB measurements require a special application in the R&S VSE. The common commands for configuring and controlling measurement channels, as well as blocks and sequences, are also used in the R&S VSE HRP UWB application.

They are described in the R&S VSE base software user manual.

6.4 Configuring the result display

The following commands are required to configure the screen display in a remote environment.

6.4.1 Restoring the default configuration (Preset)

SYSTem:PRESet:CHANnel[:EXEC]

Restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.

Example: `INST:SEL 'Spectrum2'`
Selects the channel for "Spectrum2".
`SYST:PRES:CHAN:EXEC`
Restores the factory default settings to the "Spectrum2"channel.

Usage: Event

Manual operation: See "Preset Channel" on page 23

6.4.2 Layout configuration in R&S VSE-K149

LAYout:SELect <SelectedLayout>

Sets and queries the window layout. The layout number increases with a new release of the R&S VSE-K149 application, if a new default layout is defined. This ensures backwards compatibility for scripts that were created using a different layout in a previous version of the application.

Parameters:
<SelectedLayout>

Example: `LAY:SEL 1`

6.5 Retrieving results

6.5.1 General

[SENSe:]CAPTure:COMPatible? <ChannelNumber>

Checks if the analysis bandwidth is high enough to demodulate the selected UWB channel in the signal capture dialog.

Query parameters:
<ChannelNumber> <numeric value>

Example: `SENSe:CAPTure:COMPatible?`

Usage: Query only

6.5.2 Magnitude capture

The following remote commands provide functionality to query specific values from the Magnitude Capture result display.

FETCh<n>:TRACe:HLIGht:STARt:ALL?

Returns the list of positions of the start of each burst in the magnitude capture trace in window n (position values in seconds). Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

Return values:
<Result>

Example: `FETC:TRAC:HLIG:STAR:ALL?`

Usage: Query only

FETCh<n>:TRACe:HLIGht:STARt<l>?

Returns the position of the start of burst l in the magnitude capture trace in window n (position value in seconds). Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

<l> 1..n

Return values:
<Result> <numeric value>

Example: `FETC2:TRAC:HLIG:STAR3?`

Usage: Query only

FETCh<n>:TRACe:HLIGht:STATe:ALL?

Returns the state of burst l in the magnitude capture trace in window n. The state can be: SELECTED, OK. Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

Return values:
<Result>

Example: `FETC:TRAC:HLIG:STAT:ALL?`

Usage: Query only

FETCh<n>:TRACe:HLIGht:STATe<l>?

Returns the list of states of bursts l in the magnitude capture trace in window n. The state can be: SELECTED, OK. Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

<l> 1..n

Return values:
<Result>

Example: `FETC:TRAC:HLIG:STAT3?`

Usage: Query only

FETCh<n>:TRACe:HLIGht:STOP:ALL?

Returns the list of positions of the end of each burst in the magnitude capture trace in window n (position values in seconds). Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

Return values:
<Result>

Example: `FETC:TRAC:HLIG:STOP:ALL?`

Usage: Query only

FETCh<n>:TRACe:HLIGht:STOP<l>?

Returns the position of the end of burst l in the magnitude capture trace in window n (position value in seconds). Only the analyzed packets are considered.

Suffix:
<n> 1..n
Window

<l> 1..n

Return values:
<Result> <numeric value>

Example: `FETC2:TRAC:HLIG:STOP3?`

Usage: Query only

6.5.3 Packet insights

The following remote commands provide functionality to query specific values from the Packet Insights result display.

FETCh<n>:PACKet:ALL?
FETCh<n>:PACKet:DATA:A?
FETCh<n>:PACKet:DATA:A:APACkets?
FETCh<n>:PACKet:DATA:CONStraint:LENGth?
FETCh<n>:PACKet:DATA:CONStraint:LENGth:APACkets?
FETCh<n>:PACKet:DATA:DATA:LENGth?
FETCh<n>:PACKet:DATA:DATA:LENGth:APACkets?
FETCh<n>:PACKet:DATA:DATA:RATE?
FETCh<n>:PACKet:DATA:DATA:RATE:PHR?
FETCh<n>:PACKet:STS:BST<m>?
FETCh<n>:PACKet:DATA:DATA:RATE:APACkets?
FETCh<n>:PACKet:DATA:RANGing:BIT?
FETCh<n>:PACKet:DATA:RANGing:BIT:APACkets?
FETCh<n>:PACKet:DATA:SECDed?
FETCh<n>:PACKet:DATA:SECDed:APACkets?
FETCh<n>:PACKet:SYNC:CODE:INDex?
FETCh<n>:PACKet:SYNC:CODE:INDex:APACkets?
FETCh<n>:PACKet:SYNC:CODE:LENGth?
FETCh<n>:PACKet:SYNC:CODE:LENGth:APACkets?
FETCh<n>:PACKet:SYNC:DELTa:LENGth?
FETCh<n>:PACKet:SYNC:DELTa:LENGth:APACkets?
FETCh<n>:PACKet:SYNC:SYNC:LENGth?
FETCh<n>:PACKet:SYNC:SYNC:LENGth:APACkets?
FETCh<n>:PACKet:DATA:CBURst?
FETCh<n>:PACKet:DATA:CBURst:APACkets?
FETCh<n>:PACKet:DATA:HBURsts?
FETCh<n>:PACKet:DATA:HBURsts:APACkets?
FETCh<n>:PACKet:DATA:MAC:FCS?
FETCh<n>:PACKet:DATA:MAC:FCS:APACkets?
FETCh<n>:PACKet:DATA:REServed:BIT?
FETCh<n>:PACKet:DATA:REServed:BIT:APACkets?
FETCh<n>:PACKet:SYNC:SFD?
FETCh<n>:PACKet:SYNC:SFD:APACkets?
FETCh<n>:PACKet:DATA:PAYLoad?

Returns the payload of the packet in hexadecimal format.

In accordance with IEEE 802.15.4, the LSB of each octet of the payload is output first.

Suffix:
<n> Use <n> to select a "Packet Insights" result display.
Window

Return values:
<Result>

Usage: Query only

6.5.4 Result summary

The following remote commands provide functionality to query specific values from the Result Summary result display.

FETCh<n>:SUMMary:ALL?
FETCh<n>:SUMMary:EVM:PHR:LEVel?
FETCh<n>:SUMMary:EVM:PHR:LEVel:AVERage?
FETCh<n>:SUMMary:EVM:PHR:LEVel:MAXimum?
FETCh<n>:SUMMary:EVM:PHR:LEVel:MINimum?
FETCh<n>:SUMMary:EVM:PHR:NRMSe?
FETCh<n>:SUMMary:EVM:PHR:NRMSe:AVERage?
FETCh<n>:SUMMary:EVM:PHR:NRMSe:MAXimum?
FETCh<n>:SUMMary:EVM:PHR:NRMSe:MINimum?
FETCh<n>:SUMMary:EVM:PSDU:LEVel?
FETCh<n>:SUMMary:EVM:PSDU:LEVel:AVERage?
FETCh<n>:SUMMary:EVM:PSDU:LEVel:MAXimum?
FETCh<n>:SUMMary:EVM:PSDU:LEVel:MINimum?
FETCh<n>:SUMMary:EVM:PSDU:NRMSe?
FETCh<n>:SUMMary:EVM:PSDU:NRMSe:AVERage?
FETCh<n>:SUMMary:EVM:PSDU:NRMSe:MAXimum?
FETCh<n>:SUMMary:EVM:PSDU:NRMSe:MINimum?
FETCh<n>:SUMMary:EVM:SHR:NRMSe?
FETCh<n>:SUMMary:EVM:SHR:NRMSe:AVERage?
FETCh<n>:SUMMary:EVM:SHR:NRMSe:MAXimum?
FETCh<n>:SUMMary:EVM:SHR:NRMSe:MINimum?
FETCh<n>:SUMMary:EVM:STS:LEVel?
FETCh<n>:SUMMary:EVM:STS:LEVel:AVERage?
FETCh<n>:SUMMary:EVM:STS:LEVel:MAXimum?
FETCh<n>:SUMMary:EVM:STS:LEVel:MINimum?
FETCh<n>:SUMMary:EVM:STS:NRMSe?
FETCh<n>:SUMMary:EVM:STS:NRMSe:AVERage?
FETCh<n>:SUMMary:EVM:STS:NRMSe:MAXimum?
FETCh<n>:SUMMary:EVM:STS:NRMSe:MINimum?
FETCh<n>:SUMMary:FREQuency:CHIP:ERRor?
FETCh<n>:SUMMary:FREQuency:CHIP:ERRor:AVERage?
FETCh<n>:SUMMary:FREQuency:CHIP:ERRor:MAXimum?
FETCh<n>:SUMMary:FREQuency:CHIP:ERRor:MINimum?
FETCh<n>:SUMMary:FREQuency:OFFSet:HZ?
FETCh<n>:SUMMary:FREQuency:OFFSet:HZ:AVERage?
FETCh<n>:SUMMary:FREQuency:OFFSet:HZ:MAXimum?

FETCh<n>:SUMMary:FREQuency:OFFSet:HZ:MINimum?
FETCh<n>:SUMMary:FREQuency:OFFSet:PPM?
FETCh<n>:SUMMary:FREQuency:OFFSet:PPM:AVERage?
FETCh<n>:SUMMary:FREQuency:OFFSet:PPM:MAXimum?
FETCh<n>:SUMMary:FREQuency:OFFSet:PPM:MINimum?
FETCh<n>:SUMMary:JITTer:CHIP?
FETCh<n>:SUMMary:JITTer:CHIP:AVERage?
FETCh<n>:SUMMary:JITTer:CHIP:MAXimum?
FETCh<n>:SUMMary:JITTer:CHIP:MINimum?
FETCh<n>:SUMMary:JITTer:SYMBol?
FETCh<n>:SUMMary:JITTer:SYMBol:AVERage?
FETCh<n>:SUMMary:JITTer:SYMBol:MAXimum?
FETCh<n>:SUMMary:JITTer:SYMBol:MINimum?
FETCh<n>:SUMMary:POWer:PSDU:MEAN?
FETCh<n>:SUMMary:POWer:PSDU:MEAN:AVERage?
FETCh<n>:SUMMary:POWer:PSDU:MEAN:MAXimum?
FETCh<n>:SUMMary:POWer:PSDU:MEAN:MINimum?
FETCh<n>:SUMMary:POWer:PSDU:PEAK?
FETCh<n>:SUMMary:POWer:PSDU:PEAK:AVERage?
FETCh<n>:SUMMary:POWer:PSDU:PEAK:MAXimum?
FETCh<n>:SUMMary:POWer:PSDU:PEAK:MINimum?
FETCh<n>:SUMMary:POWer:SHR:MEAN?
FETCh<n>:SUMMary:POWer:SHR:MEAN:AVERage?
FETCh<n>:SUMMary:POWer:SHR:MEAN:MAXimum?
FETCh<n>:SUMMary:POWer:SHR:MEAN:MINimum?
FETCh<n>:SUMMary:POWer:SHR:PEAK?
FETCh<n>:SUMMary:POWer:SHR:PEAK:AVERage?
FETCh<n>:SUMMary:POWer:SHR:PEAK:MAXimum?
FETCh<n>:SUMMary:POWer:SHR:PEAK:MINimum?
FETCh<n>:SUMMary:POWer:PACKet:MEAN?
FETCh<n>:SUMMary:POWer:PACKet:MEAN:AVERage?
FETCh<n>:SUMMary:POWer:PACKet:MEAN:MAXimum?
FETCh<n>:SUMMary:POWer:PACKet:MEAN:MINimum?
FETCh<n>:SUMMary:POWer:PACKet:PEAK?
FETCh<n>:SUMMary:POWer:PACKet:PEAK:AVERage?
FETCh<n>:SUMMary:POWer:PACKet:PEAK:MAXimum?
FETCh<n>:SUMMary:POWer:PACKet:PEAK:MINimum?
FETCh<n>:SUMMary:POWer:IQOFfset?
FETCh<n>:SUMMary:PULSe:MASK:PASSed?
FETCh<n>:SUMMary:POWer:IQOFfset:AVERage?
FETCh<n>:SUMMary:POWer:IQOFfset:MAXimum?
FETCh<n>:SUMMary:POWer:IQOFfset:MINimum?
FETCh<n>:SUMMary:PULSe:MASK:PASSed:AVERage?
FETCh<n>:SUMMary:PULSe:MASK:PASSed:MAXimum?
FETCh<n>:SUMMary:PULSe:MASK:PASSed:MINimum?
FETCh<n>:SUMMary:PULSe:RISE:MONotonic?
FETCh<n>:SUMMary:PULSe:RISE:MONotonic:AVERage?
FETCh<n>:SUMMary:PULSe:RISE:MONotonic:MAXimum?
FETCh<n>:SUMMary:PULSe:RISE:MONotonic:MINimum?
FETCh<n>:SUMMary:PULSe:LOCation:SYNC?

FETCh<n>:SUMMary:PULSe:LOCation:SYNC:AVERage?
FETCh<n>:SUMMary:PULSe:LOCation:SYNC:MAXimum?
FETCh<n>:SUMMary:PULSe:LOCation:SYNC:MINimum?
FETCh<n>:SUMMary:PULSe:LOCation:SFD?
FETCh<n>:SUMMary:PULSe:LOCation:SFD:AVERage?
FETCh<n>:SUMMary:PULSe:LOCation:SFD:MAXimum?
FETCh<n>:SUMMary:PULSe:LOCation:SFD:MINimum?
FETCh<n>:SUMMary:PULSe:LOCation:STS?
FETCh<n>:SUMMary:PULSe:LOCation:STS:AVERage?
FETCh<n>:SUMMary:PULSe:LOCation:STS:MAXimum?
FETCh<n>:SUMMary:PULSe:LOCation:STS:MINimum?
FETCh<n>:SUMMary:RANGing:RMARker:LOCation?
FETCh<n>:SUMMary:SPECtrum:MASK:PASSed?
FETCh<n>:SUMMary:SPECtrum:MASK:PASSed:AVERage?
FETCh<n>:SUMMary:SPECtrum:MASK:PASSed:MAXimum?
FETCh<n>:SUMMary:SPECtrum:MASK:PASSed:MINimum?
FETCh<n>:SUMMary:SPECtrum:MAXimum:POWer?
FETCh<n>:SUMMary:SPECtrum:MAXimum:POWer:AVERage?
FETCh<n>:SUMMary:SPECtrum:MAXimum:POWer:MAXimum?
FETCh<n>:SUMMary:SPECtrum:MAXimum:POWer:MINimum?
FETCh<n>:SUMMary:XCORr:MLOBe:MINimum:WIDTh?
FETCh<n>:SUMMary:XCORr:MLOBe:MINimum:WIDTh:AVERage?
FETCh<n>:SUMMary:XCORr:MLOBe:MINimum:WIDTh:MAXimum?
FETCh<n>:SUMMary:XCORr:MLOBe:MINimum:WIDTh:MINimum?
FETCh<n>:SUMMary:XCORr:MLOBe:PEAK?
FETCh<n>:SUMMary:XCORr:MLOBe:PEAK:AVERage?
FETCh<n>:SUMMary:XCORr:MLOBe:PEAK:MAXimum?
FETCh<n>:SUMMary:XCORr:MLOBe:PEAK:MINimum?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:AVERage?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:MAXimum?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:MINimum?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:PASSed?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:PASSed:AVERage?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:PASSed:MAXimum?
FETCh<n>:SUMMary:XCORr:MLOBe:WIDTh:PASSed:MINimum?
FETCh<n>:SUMMary:XCORr:NMSE?
FETCh<n>:SUMMary:XCORr:NMSE:AVERage?
FETCh<n>:SUMMary:XCORr:NMSE:MAXimum?
FETCh<n>:SUMMary:XCORr:NMSE:MINimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:AVERage?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:LOCation?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:LOCation:AVERage?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:LOCation:MAXimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:LOCation:MINimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:MAXimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:MINimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:PASSed?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:PASSed:AVERage?

FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:PASSed:MAXimum?
FETCh<n>:SUMMary:XCORr:SLOBe:PEAK:PASSed:MINimum?
FETCh<n>:SUMMary:POWer:STS:MEAN?
FETCh<n>:SUMMary:POWer:STS:MEAN:AVERage?
FETCh<n>:SUMMary:POWer:STS:MEAN:MAXimum?
FETCh<n>:SUMMary:POWer:STS:MEAN:MINimum?
FETCh<n>:SUMMary:POWer:STS:PEAK?
FETCh<n>:SUMMary:POWer:STS:PEAK:AVERage?
FETCh<n>:SUMMary:POWer:STS:PEAK:MAXimum?
FETCh<n>:SUMMary:POWer:STS:PEAK:MINimum?
FETCh<n>:SUMMary:PULSe:RISE:TIME?
FETCh<n>:SUMMary:PULSe:RISE:TIME:AVERage?
FETCh<n>:SUMMary:PULSe:RISE:TIME:MAXimum?
FETCh<n>:SUMMary:PULSe:RISE:TIME:MINimum?
FETCh<n>:SUMMary:PULSe:RISE:TIME:PASSed?
FETCh<n>:SUMMary:PULSe:RISE:TIME:PASSed:AVERage?
FETCh<n>:SUMMary:PULSe:RISE:TIME:PASSed:MAXimum?
FETCh<n>:SUMMary:PULSe:RISE:TIME:PASSed:MINimum?
FETCh<n>:SUMMary:RANGing:SRMarker<m>:LOCation?

Suffix:

<n> Window

<m> Marker

Return values:

<Result> <numeric value>

Example: `FETCh:SUMMary:RANGing:SRMarker3:LOCation?`

Usage: Query only

6.6 Configuring the measurement

The following commands are required to configure the measurement in a remote environment.

6.6.1 Input/output settings

The R&S VSE can analyze signals from different input sources (such as RF, power sensors etc.) and provide various types of output (such as noise or trigger signals). The following commands are required to configure data input and output.

6.6.1.1 Configuring data input

The following commands are required to configure data input.

Data output is described in the R&S VSE Base Software User Manual.

RF input

Remote commands exclusive to configuring RF input:

INPut:ATTenuation:PROTection[:STATe] <State>

Turns the availability of attenuation levels of 10 dB or less on and off.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Attenuation levels of 10 dB or less are not allowed to protect the RF input connector of the connected instrument.

OFF | 0
Attenuation levels of 10 dB or less are not blocked. Provide appropriate protection for the RF input connector of the connected instrument yourself.

*RST: 1

Example: `INP:ATT:PROT ON`
Turns on the input protection.

INPut:ATTenuation:PROTection:RESet [<DeviceName>]

Resets the attenuator and reconnects the RF input with the input mixer for the connected instrument after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the `STAT:QUES:POW` status register) and the `INPUT OVLD` message in the status bar are cleared.

The command works only if the overload condition has been eliminated first.

For details on the protection mechanism, see the instrument's documentation.

Setting parameters:

<DeviceName> string

Name of the instrument for which the RF input protection is to be reset.

Example: `INP:ATT:PROT:RES 'MyDevice'`

Manual operation: See "10 dB Minimum Attenuation" on page 29

INPut<ip>:COUPling<ant> <CouplingType>

Selects the coupling type of the RF input.

Suffix:

<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:

<CouplingType> AC | DC

AC
AC coupling

DC
DC coupling
*RST: AC

Example: `INP:COUP DC`

Manual operation: See "Input Coupling " on page 25

INPut:DPATh <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

Parameters:
<DirectPath> AUTO | OFF

AUTO | 1
(Default) the direct path is used automatically for frequencies close to 0 Hz.

OFF | 0
The analog mixer path is always used.

Example: `INP:DPAT OFF`

Manual operation: See "Direct Path " on page 26

INPut:FILE:ZPADing <State>

Enables or disables zeropadding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `INP:FILE:ZPAD ON`

Manual operation: See "Zero Padding" on page 31

INPut:FILTer:HPASs[:STATe] <State>

Activates an additional internal high-pass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the connected instrument to measure the harmonics for a DUT, for example.

Requires an additional high-pass filter hardware option.

(Note: for RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: `INP:FILT:HPAS ON`
Turns on the filter.

Manual operation: See "High Pass Filter 1 to 3 GHz " on page 26

INPut<ip>:FILTer:YIG[:STATe] <State>

Enables or disables the YIG filter.

Suffix:

<ip> 1 | 2
irrelevant

Parameters:

<State> ON | OFF | 0 | 1

Example: `INP:FILT:YIG OFF`
Deactivates the YIG-preselector.

Manual operation: See "YIG-Preselector " on page 26

INPut<ip>:IMPedance<ant> <Impedance>

Selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

Suffix:

<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:

<Impedance> 50 | 75

*RST: 50 Ω
Default unit: OHM

Example: `INP:IMP 75`

Manual operation: See "Impedance " on page 25

INPut:PRESelection:SET <Mode>

Selects the preselector mode.

The command is available with the optional preselector.

Parameters:

<Mode>

NARRow
Performs a measurement by automatically applying all available combinations of low and high pass filters consecutively. These combinations all have a narrow bandwidth.

WIDE
Performs a measurement by automatically applying all available bandpass filters consecutively. The bandpass filters have a wide bandwidth.

Manual operation: See "Preselector Mode" on page 28

INPut<ip>:PRESelection[:STATe] <State>

Turns the preselector on and off.

Suffix:

<ip>

1 | 2
irrelevant

Manual operation: See "Preselector State" on page 28

INPut:RF:CAPMode <CAPMode>

Determines how data from an oscilloscope is input to the R&S VSE software.

Is only available for connected oscilloscopes.

Parameters:

<CAPMode>

AUTO | IQ | WAVeform

IQ
The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.

WAVeform
The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.

AUTO
Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement).

*RST: IQ

Example:

```
INP:RF:CAPM WAV
```

Manual operation: See "Capture Mode" on page 26

INPut:RF:CAPMode:IQ:SRATe <SamplingRate>

Determines the sample rate used by the connected oscilloscope for I/Q capture mode (see `INPut:RF:CAPMode` on page 74).

This setting is only available if an R&S oscilloscope is used to obtain the input data.

Parameters:

<SamplingRate> 20 GHz | 40 GHz

No other sample rate values are allowed.

20 GHz
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).

40 GHz
Provides a maximum sample rate.
Only available for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet).

*RST: 20 GHz
Default unit: HZ

Example:

```
INP:RF:CAPM IQ
INP:RF:CAPM:IQ:SRAT 40 GHZ
```

Manual operation: See "Oscilloscope Sample Rate" on page 27

INPut:RF:CAPMode:WAVeform:SRATe <SamplingRate>

Determines the sample rate used by the connected oscilloscope for waveform capture mode (see `INPut:RF:CAPMode` on page 74).

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

Parameters:

<SamplingRate> 10 GHz | 20 GHz

No other sample rate values are allowed.

10 GHz
Default ; provides maximum record length

20 GHz
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).
For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHZ is always used.

*RST: 10 GHz
Default unit: HZ

Example:
```
INP:RF:CAPM WAV
INP:RF:CAPM:WAVE:SRAT 10000000
```

Manual operation: See "Oscilloscope Sample Rate" on page 27

INPut<ip>:SELect <Source>

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S VSE.

Suffix:
<ip> 1 | 2
For R&S FSW85 models with two RF input connectors:
1: Input 1 (1 mm [RF Input] connector)
2: Input 2 (1.85 mm [RF2 Input] connector)
For all other models:
irrelevant

Parameters:
<Source> **RF**
Radio Frequency ("RF INPUT" connector)

FIQ
I/Q data file

*RST: RF

Manual operation: See "Input Type (Instrument / File)" on page 24

INPut:TYPE <Input>

The command selects the input path for R&S FSW85 models.

Parameters:
<Input> **INPUT1**
Selects RF input 1.

INPUT2
Selects RF input 2.

*RST: INPUT1

Example:
```
//Select input path
INP:TYPE INPUT1
```

Manual operation: See "Input 1 / Input 2" on page 25

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si> <Type>

Selects an instrument or a file as the source of input provided to the channel.

Suffix:
<si> 1 to 99
LTE-MIMO only: input source number

Parameters:
<Type> FILE | DEVice | NONE

FILE
A loaded file is used for input.

DEVice
A configured device provides input for the measurement

NONE
No input source defined.

Manual operation: See "Input Type (Instrument / File)" on page 24

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:CONFig <Port>

Configures the port to be used for input on the selected instrument.

Is only available if an oscilloscope is connected.

Suffix:
<si> 1 to 99
LTE-MIMO only: input source number

Parameters:
<Port>

INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:TYPE <Source>

Configures the source of input to be used from the selected instrument.

Not all input sources are supported by all R&S VSE applications.

Suffix:
<si> 1 to 99
LTE-MIMO only: input source number

Parameters:
<Source>

RF
Radio Frequency ("RF INPUT" connector)

'Channel 1' | 'Channel 2' | 'Channel 3' | 'Channel 4'
Oscilloscope input channel 1, 2, 3, or 4

'Channel 1,2 (I+Q)'
I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)

'Channel 1,3 (I+Q)' | 'Channel 2,4 (I+Q)'
I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)

'Channels 1-4 (diff. I+Q)'
Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only):
Channel 1: I (pos.)
Channel 2: $\bar{I}$ (neg.)
Channel 3: Q (pos.)
Channel 4: $\bar{Q}$ (neg.)

'Channels 1,3 (Waveform)'
Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)

'Channels 2,4 (Waveform)'
Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)

'Channels 1-4 (Waveform)'
Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

*RST: RF

Example: INST:BLOC:CHAN:SOUR:TYPE 'Channel 2,4 (I+Q)'
I/Q data is provided by oscilloscope input channels 2 and 4

SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe] <State>

Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

Note: Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SYST:COMM:RDEV:OSC ON`

Manual operation: See "B2000 State" on page 27

SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip <Address>

Defines the TCPIP address or computer name of the oscilloscope connected to the R&S VSE via LAN.

Note: The IP address is maintained after a [PRESET], and is transferred between applications.

Parameters:
<Address> computer name or IP address

Example: `SYST:COMM:RDEV:OSC:TCP '192.0.2.0'`

Example: `SYST:COMM:RDEV:OSC:TCP 'FSW43-12345'`

Manual operation: See "Oscilloscope IP Address" on page 28

SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe] <State>

Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S VSE and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input User Manual

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SYST:COMM:RDEV:OSC:PSM ON`

Manual operation: See "Oscilloscope Splitter Mode" on page 28

SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe <Rate>

Determines whether the 10 GHz mode (default) or 20 GHz mode of the connected oscilloscope is used. The 20 GHZ mode achieves a higher decimation gain, but reduces the record length by half.

Parameters:

<Rate> 10 GHz | 20 GHz

No other sample rate values are allowed.

*RST: 10 GHz
Default unit: HZ

Example:

```
TRAC:IQ:SRAT?
//Result: 100000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 200000000
TRAC:IQ:RLEN?
//Result: 1564
```

Manual operation: See "Oscilloscope Sample Rate" on page 27

SYSTem:COMMunicate:RDEVice:OSCilloscope:VDEVice?

Queries whether the connected instrument is supported by the 2 GHz bandwidth extension option(B2000).

Return values:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SYST:COMM:RDEV:OSC:VDEV?`

Usage: Query only

SYSTem:COMMunicate:RDEVice:OSCilloscope:VFIRmware?

Queries whether the firmware on the connected oscilloscope is supported by the 2 GHz bandwidth extension (B2000) option.

Return values:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `SYST:COMM:RDEV:OSC:VFIR?`

Usage: Query only

Using external mixers

The commands required to work with external mixers in a remote environment are described here. Note that these commands require the connected instrument to have an external mixer option installed and an external mixer to be connected to the connected instrument.

Basic settings

The basic settings concern general usage of an external mixer.

[SENSe:]MIXer<x>[:STATe] <State>

Activates or deactivates the use of a connected external mixer as input for the measurement. This command is only available if the optional External Mixer is installed and an external mixer is connected.

Suffix:
<x> 1..n
irrelevant

Parameters:
<State> ON | OFF | 1 | 0
*RST: 0

Example: `MIX ON`

[SENSe:]MIXer<x>:BIAS:HIGH <BiasSetting>

Defines the bias current for the high (last) range.

Is only available if the external mixer is active (see `[SENSe:]MIXer<x>[:STATe]` on page 81).

Suffix:
<x> 1..n
irrelevant

Parameters:
<BiasSetting> *RST: 0.0 A
Default unit: A

[SENSe:]MIXer<x>:BIAS[:LOW] <BiasSetting>

Defines the bias current for the low (first) range.

Is only available if the external mixer is active (see `[SENSe:]MIXer<x>[:STATe]` on page 81).

Suffix:
<x> 1..n
irrelevant

Parameters:
<BiasSetting> *RST: 0.0 A
Default unit: A

[SENSe:]MIXer<x>:LOPower <Level>

Specifies the LO level of the external mixer's LO port.

Suffix:
<x> 1..n
irrelevant

Parameters:

<Level>
Range: 13.0 dBm to 17.0 dBm
Increment: 0.1 dB
*RST: 15.5 dBm
Default unit: DBM

Example:
```
MIX:LOP 16.0dBm
```

Mixer settings

The following commands are required to configure the band and specific mixer settings.

[SENSe:]MIXer<x>:FREQuency:HANDover <Frequency>

Defines the frequency at which the mixer switches from one range to the next (if two different ranges are selected). The handover frequency for each band can be selected freely within the overlapping frequency range.

Is only available if the external mixer is active (see `[SENSe:]MIXer<x>[:STATe]` on page 81).

Suffix:

<x>
1..n
irrelevant

Parameters:

<Frequency>
Default unit: HZ

Example:
```
MIX ON
```
Activates the external mixer.
```
MIX:FREQ:HAND 78.0299GHz
```
Sets the handover frequency to 78.0299 GHz.

[SENSe:]MIXer<x>:FREQuency:STARt

Sets or queries the frequency at which the external mixer band starts.

Suffix:
<x> 1..n
irrelevant

Example: `MIX:FREQ:STAR?`
Queries the start frequency of the band.

[SENSe:]MIXer<x>:FREQuency:STOP

Sets or queries the frequency at which the external mixer band stops.

Suffix:
<x> 1..n
irrelevant

Example: `MIX:FREQ:STOP?`
Queries the stop frequency of the band.

[SENSe:]MIXer<x>:HARMonic:BAND:PRESet

Restores the preset frequency ranges for the selected standard waveguide band.

Note: Changes to the band and mixer settings are maintained even after using the [PRESET] function. Use this command to restore the predefined band ranges.

Suffix:
<x> 1..n
irrelevant

Example: `MIX:HARM:BAND:PRES`
Presets the selected waveguide band.

[SENSe:]MIXer<x>:HARMonic:BAND <Band>

Selects the external mixer band. The query returns the currently selected band.

Is only available if the external mixer is active (see `[SENSe:]MIXer<x>[:STATe]` on page 81).

Suffix:
<x> 1..n
irrelevant

Parameters:
<Band> KA | Q | U | V | E | W | F | D | G | Y | J | USER
Standard waveguide band or user-defined band.

Table 6-2: Frequency ranges for pre-defined bands

Band	Frequency start [GHz]	Frequency stop [GHz]
KA (A) *)	26.5	40.0
Q	33.0	50.0
U	40.0	60.0
V	50.0	75.0
E	60.0	90.0
W	75.0	110.0
F	90.0	140.0
D	110.0	170.0
G	140.0	220.0
J	220.0	325.0
Y	325.0	500.0
USER	32.18 (default)	68.22 (default)
***)** The band formerly referred to as "A" is now named "KA".		

[SENSe:]MIXer<x>:HARMonic:HIGH:STATe <State>

Specifies whether a second (high) harmonic is to be used to cover the band's frequency range.

Suffix:
<x> 1..n

Parameters:
<State> ON | OFF
*RST: ON

Example:
```
MIX:HARM:HIGH:STAT ON
```

[SENSe:]MIXer<x>:HARMonic:HIGH[:VALue] <HarmOrder>

Specifies the harmonic order to be used for the high (second) range.

Suffix:
<x> 1..n
irrelevant

Parameters:
<HarmOrder> Range: 2 to 128 (USER band); for other bands: see band definition

Example:
```
MIX:HARM:HIGH:STAT ON
MIX:HARM:HIGH 3
```

[SENSe:]MIXer<x>:HARMonic:TYPE <OddEven>

Specifies whether the harmonic order to be used should be odd, even, or both.

Which harmonics are supported depends on the mixer type.

Suffix:
<x> 1..n
irrelevant

Parameters:
<OddEven> ODD | EVEN | EODD
ODD | EVEN | EODD
*RST: EVEN

Example: `MIX:HARM:TYPE ODD`

[SENSe:]MIXer<x>:HARMonic[:LOW] <HarmOrder>

Specifies the harmonic order to be used for the low (first) range.

Suffix:
<x> 1..n
irrelevant

Example: `MIX:HARM 3`

[SENSe:]MIXer<x>:IF?

Queries the intermediate frequency currently used by the external mixer.

Suffix:
<x> 1..n
irrelevant

Example: `MIX:IF?`

Example: See "Programming example: working with an external mixer" on page 87.

Usage: Query only

[SENSe:]MIXer<x>:LOSS:HIGH <Average>

Defines the average conversion loss to be used for the entire high (second) range.

Suffix:
<x> 1..n

Parameters:
<Average> Range: 0 to 100
*RST: 24.0 dB
Default unit: dB

Example: `MIX:LOSS:HIGH 20dB`

[SENSe:]MIXer<x>:LOSS:TABLe:HIGH <FileName>

Defines the conversion loss table to be used for the high (second) range.

Suffix:
<x> 1..n

Parameters:
<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (`.acl` file).

[SENSe:]MIXer<x>:LOSS:TABLe[:LOW] <FileName>

Defines the file name of the conversion loss table to be used for the low (first) range.

Suffix:
<x> 1..n

Parameters:
<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (`.acl` file).

Example:
```
MIX:LOSS:TABL '101567'
MIX:LOSS:TABL?
//Result:
'101567_MAG_6_B5000_3G5.B5G'
```

[SENSe:]MIXer<x>:LOSS[:LOW] <Average>

Defines the average conversion loss to be used for the entire low (first) range.

Suffix:
<x> 1..n

Parameters:
<Average> Range: 0 to 100
*RST: 24.0 dB
Default unit: dB

Example:
```
MIX:LOSS 20dB
```

[SENSe:]MIXer<x>:PORTs <PortType>

Selects the mixer type.

Suffix:
<x> 1..n
irrelevant

Parameters:
<PortType> **2 | 3**

2
Two-port mixer.

3
Three-port mixer.

*RST: 2

Example:
```
MIX:PORT 3
```

[SENSe:]MIXer<x>:RFOVerrange[:STATe] <State>

If enabled, the band limits are extended beyond "RF Start" and "RF Stop" due to the capabilities of the used harmonics.

Suffix:
<x> 1..n
irrelevant

Parameters:
<State> ON | OFF | 1 | 0

*RST: 0

Programming example: working with an external mixer

This example demonstrates how to work with an external mixer in a remote environment. It is performed in the Spectrum application in the default layout configuration. Note that without a real input signal and connected mixer, this measurement will not return useful results.

```
//--------------Preparing the instrument -----------
//Reset the instrument
*RST
//Activate the use of the connected external mixer.
SENS:MIX ON
//----------- Configuring basic mixer behavior -------------
//Set the LO level of the mixer's LO port to 15 dBm.
SENS:MIX:LOP 15dBm
//Set the bias current to -1 mA .
SENS:MIX:BIAS:LOW -1mA
//----------- Configuring the mixer and band settings -------------
//Use band "V" to full possible range extent for assigned harmonic (6).
SENS:MIX:HARM:BAND V
SENS:MIX:RFOV ON
//Query the possible range
SENS:MIX:FREQ:STAR?
//Result: 47480000000 (47.48 GHz)
```

```
SENS:MIX:FREQ:STOP?
//Result: 138020000000 (138.02 GHz)
//Use a 3-port mixer type
SENS:MIX:PORT 3
//Split the frequency range into two ranges;
//range 1 covers 47.48 GHz GHz to 80 GHz; harmonic 6, average conv. loss of 20 dB
//range 2 covers 80 GHz to 138.02 GHz; harmonic 8, average conv.loss of 30 dB
SENS:MIX:HARM:TYPE EVEN
SENS:MIX:HARM:HIGH:STAT ON
SENS:MIX:FREQ:HAND 80GHz
SENS:MIX:HARM:LOW 6
SENS:MIX:LOSS:LOW  20dB
SENS:MIX:HARM:HIGH 8
SENS:MIX:LOSS:HIGH 30dB
//--------- Activating automatic signal identification functions -----------
//Activate both automatic signal identification functions.
SENS:MIX:SIGN ALL
//Use auto ID threshold of 8 dB.
SENS:MIX:THR 8dB

//--------------Performing the Measurement-----
//Select single sweep mode.
INIT:CONT OFF
//Initiate a basic frequency sweep and wait until the sweep has finished.
INIT;*WAI
//---------------Retrieving Results-------------
//Return the trace data for the input signal without distortions
//(default screen configuration)
TRAC:DATA? TRACE3
```

Remote commands for external frontend control

The following commands are available and required only if the optional external frontend control is installed on the connected instrument.

Further commands for external frontend control described elsewhere:

- `INPut:SELect RF`; see `INPut<ip>:SELect` on page 76
- `[SENSe:]FREQuency:CENTer` on page 104
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 105
- `INPut:ATTenuation:AUTO` on page 110
- `INPut:ATTenuation` on page 110
- Commands for initial configuration.....89

Commands for initial configuration

The following commands are required when you initially set up a measurement with an external frontend on the connected instrument. Note that some commands are not available for all connected instruments, or only as queries.

[SENSe:]EFRontend:ALIGnment<ch>:FILE <File>

Selects or queries the touchstone file that contains correction data to compensate for signal losses in the cable occurring at different IF signal frequencies.

Suffix:

<ch> 1..n
Currently irrelevant

Parameters:

<File> string in double quotes
Path and file name of the correction data file. The file must be in `s2p` format.
If the specified file is not found or does not have the correct format, an error message is returned (`-256, "File name not found", -150, "String data error"`).

Example: `EFR:ALIG:FILE "FE44S.s2p"`

[SENSe:]EFRontend:ALIGnment<ch>:STATe <State>

Activates correction of the IF signal due to cable loss from the frontend to the analyzer. Specify the file with correction data using `[SENSe:]EFRontend:ALIGnment<ch>:FILE` on page 89.

Suffix:
<ch> 1..n
Currently irrelevant

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

[SENSe:]EFRontend:CONNection[:STATe] <State>

Queries the external frontend connection state in the firmware.

Note: to query the physical connection state of the external frontend, use `[SENSe:]EFRontend:CONNection:CSTate?` on page 91.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
The connection to the frontend is deactivated temporarily. The frontend is thus available for use elsewhere, for example by a signal generator. The measurement settings on the R&S VSE remain untouched.

ON | 1
Frontend connection enabled.
The frontend is reserved for exclusive use by the R&S VSE.

*RST: 0

Example:
```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S","123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

[SENSe:]EFRontend:CONNection:CONFig <Type>, <IPAddress>[, <DeviceID>, <SymbolicName>]

Configures the connection to the external frontend.

Parameters:
<Type> String in double quotes containing the type of frontend to be connected.

<IPAddress> string in double quotes

The IP address or computer name of the frontend connected to the R&S VSE via LAN. The IP address and computer name are indicated on the electronic ink display on the side panel of the frontend.

<DeviceID> string in double quotes

Unique device ID consisting of <type>-<serialnumber>
Not required or relevant for the R&S VSE.

<SymbolicName> string in double quotes

Symbolic name of the external frontend.
Not required or relevant for the R&S VSE.

Example:

```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S","123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

[SENSe:]EFRontend:CONNection:CSTate?

Queries the status of the physical connection to the external frontend.

Return values:

<State> ON | OFF | 0 | 1

OFF | 0
Frontend not connected; connection error

ON | 1
Frontend connected

Usage: Query only

[SENSe:]EFRontend:FREQuency:BAND:COUNt?

Queries the number of frequency bands provided by the selected frontend.

Return values:

<NoBands> integer

Number of frequency bands

Example:

```
//Query number of frequency bands
EFR:FREQ:BAND:COUN?
//Result: 2
```

Usage: Query only

[SENSe:]EFRontend:FREQuency:BAND<b>:LOWer?

Queries the start of the frequency range supported by the selected frontend frequency band.

Suffix:
<b> 1..n
Band for multi-band frontends
Use [SENSe:]EFRontend:FREQuency:BAND:COUNt? on page 91 to determine the number of available bands.

Return values:
<StartFreq> Start frequency of the specified band

Example:
```
//Query start frequency of second band
EFR:FREQ:BAND2:LOW?
//Result: 24000000000
```

Usage: Query only

[SENSe:]EFRontend:FREQuency:BAND<b>:UPPer?

Queries the end of the frequency range supported by the selected frontend frequency band.

Suffix:
<b> 1..n
Band for multi-band frontends
Use [SENSe:]EFRontend:FREQuency:BAND:COUNt? on page 91 to determine the number of available bands.

Return values:
<StopFreq> End frequency of the specified band

Example:
```
//Query end frequency of second band
EFR:FREQ:BAND2:UPP?
//Result: 44000000000
```

Usage: Query only

[SENSe:]EFRontend:FREQuency:BCONfig:AUTO <State>

Determines whether the frequency band of the external frontend is configured automatically or manually.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Uses the frequency band configured by [SENSe:]EFRontend<fe>:FREQuency:BCONfig:SELect on page 93.

ON | 1
Configures the frequency band automatically

*RST: 1

Example: //Configures the use of the IF high band manually.
```
EFR:FREQ:BCON:AUTO 0
EFR:FREQ:BCON:SEL "IF HIGH"
```

[SENSe:]EFRontend:FREQuency:BCONfig:LIST?

Returns the intermediate frequency (output) range of the external frontend.

Return values:

<BandConfigs> string

"IF LOW"
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the R&S VSE.

"IF HIGH"
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the R&S VSE.

Example:
```
EFR:FREQ:BCON:LIST?
//Result: "IF HIGH", "IF LOW"
EFR:FREQ:BCON:SEL "IF HIGH"
```

Usage: Query only

[SENSe:]EFRontend<fe>:FREQuency:BCONfig:SELect <BandConfig>

Defines the intermediate frequency (output) range of the external frontend.

Suffix:

<fe> 1
Connected frontend

Parameters:

<BandConfig>

"IF HIGH"
(R&S FE44S/ R&S FE50DTR)
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the connected instrument.

"IF LOW"
(R&S FE44S/ R&S FE50DTR)
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the connected instrument.

"Spur Optimized"
(R&S FE170SR only)
The selected IF range avoids unwanted spurious effects.

"EVM Optimized"
(R&S FE170SR only)
The selected IF range provides an optimal EVM result.

Example:
```
EFR:FREQ:BCON:LIST?
//Result: "IF HIGH", "IF LOW"
EFR:FREQ:BCON:SEL "IF HIGH"
```

[SENSe:]EFRontend:FREQuency:IFRequency:SIDeband?

Queries the currently used sideband for frequency conversion.

Return values:

<Sideband> "USB" | "LSB"

"USB"
Upper sideband

"LSB"
Lower sideband

Example:
```
EFR:FREQ:IFR?
EFR:FREQ:IFR:SID?
```

Usage: Query only

[SENSe:]EFRontend:FREQuency:IFRequency[:VALue]?

Queries the currently used intermediate frequency (IF) for frequency conversion.

Return values:

<IFFrequency> numeric

Example:
```
EFR:FREQ:IFR?
```

Usage: Query only

[SENSe:]EFRontend:FREQuency:REFerence <Frequency>

Sets the reference frequency that is used for frequency conversion on the frontend. Depending on the connected type of frontend, different values are available. To determine which reference levels are available, use `[SENSe:]EFRontend:FREQuency:REFerence:LIST?` on page 94.

Parameters:

<Frequency> Default unit: HZ

Example:
```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 10000000,640000000,1000000000
//Use 640 MHz reference
EFR:FREQ:REF 640000000
```

[SENSe:]EFRontend:FREQuency:REFerence:LIST?

Queries the available reference signals for the connected frontend type.

Return values:
<References> 10000000 | 640000000 | 1000000000

Example:
```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 10000000,640000000,1000000000
//Use 640 MHz reference
EFR:FREQ:REF 640000000
```

Usage: Query only

[SENSe:]EFRontend:IDN?

Queries the device identifcation information (`*IDN?`) of the frontend.

Return values:
<DevInfo> string without quotes

Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>

Example:
```
EFR:IDN?
//Result: Rohde&Schwarz,FE44S,
1234.5678K00/123456,0.8.0
```

Usage: Query only

[SENSe:]EFRontend[:STATe] <State>

Enables or disables the general use of an external frontend for the application.

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
The frontend is disconnected. The application adapts the measurement settings to the common settings supported by the R&S VSE.

ON | 1
The R&S VSE allows you to configure and connect an external frontend for the application. The application adapts the available measurement settings to the connected frontend.
The channel bar indicates "Inp: ExtFe".

*RST: 0

Example:
```
EFR ON
```

Working with power sensors

The following commands describe how to work with power sensors.

These commands require the use of a Rohde & Schwarz power sensor. For a list of supported sensors, see the data sheet.

Configuring power sensors

SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe] <State>

Turns automatic assignment of a power sensor to the power sensor index on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1
*RST: 1

Example: `SYST:COMM:RDEV:PMET:CONF:AUTO OFF`

SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt?

Queries the number of power sensors currently connected to the R&S VSE.

Suffix:
<p> Power sensor index

Return values:
<NumberSensors> Number of connected power sensors.

Example: `SYST:COMM:RDEV:PMET:COUN?`

Usage: Query only

SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine <Placeholder>, <Type>, <Interface>, <SerialNo>

Assigns the power sensor with the specified serial number to the selected power sensor index (configuration).

The query returns the power sensor type and serial number of the sensor assigned to the specified index.

Suffix:
<p> Power sensor index

Parameters:
<Placeholder> Currently not used

<Type> Detected power sensor type, e.g. "NRP-Z81".

<Interface> Interface the power sensor is connected to; always "USB"

<SerialNo> Serial number of the power sensor assigned to the specified index

Example: `SYST:COMM:RDEV:PMET2:DEF '','NRP-Z81','', '123456'`
Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".
`SYST:COMM:RDEV:PMET2:DEF?`
Queries the sensor assigned to "Power Sensor 2".
Result:
`'','NRP-Z81','USB','123456'`
The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".

Configuring power sensor measurements

CALibration:PMETer<p>:ZERO:AUTO ONCE

Zeroes the power sensor.

Note that you have to disconnect the signals from the power sensor input before you start to zero the power sensor. Otherwise, results are invalid.

Suffix:
<p> Power sensor index

Example: `CAL:PMET2:ZERO:AUTO ONCE;*WAI`
Starts zeroing the power sensor 2 and delays the execution of further commands until zeroing is concluded.

Usage: Event

CALCulate<n>:PMETer<p>:RELative[:MAGNitude] <RefValue>

Defines the reference value for relative measurements.

Suffix:
<n> Window

<p> Power sensor index

Parameters:
<RefValue> Range: -200 dBm to 200 dBm
*RST: 0
Default unit: DBM

Example: `CALC:PMET2:REL -30`
Sets the reference value for relative measurements to -30 dBm for power sensor 2.

CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE

Sets the current measurement result as the reference level for relative measurements.

Suffix:
<n> Window

<p> Power sensor index

Example: `CALC:PMET2:REL:AUTO ONCE`
Takes the current measurement value as reference value for relative measurements for power sensor 2.

Usage: Event

CALCulate<n>:PMETer<p>:RELative:STATe <State>

Turns relative power sensor measurements on and off.

Suffix:
<n> Window

<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:PMET2:REL:STAT ON`
Activates the relative display of the measured value for power sensor 2.

FETCh:PMETer<p>?

Queries the results of power sensor measurements.

Suffix:
<p> Power sensor index

Usage: Query only

READ:PMETer<p>?

Initiates a power sensor measurement and queries the results.

Suffix:
<p> Power sensor index

Usage: Query only

[SENSe:]PMETer<p>:DCYCle[:STATe] <State>

Turns the duty cycle correction on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
```
PMET2:DCYC:STAT ON
```

[SENSe:]PMETer<p>:DCYCle:VALue <Percentage>

Defines the duty cycle for the correction of pulse signals.

The power sensor uses the duty cycle in combination with the mean power to calculate the power of the pulse.

Suffix:
<p> Power sensor

Parameters:
<Percentage> Range: 0.001 to 99.999
*RST: 99.999
Default unit: %

Example:
```
PMET2:DCYC:STAT ON
```
Activates the duty cycle correction.
```
PMET2:DCYC:VAL 0.5
```
Sets the correction value to 0.5%.

[SENSe:]PMETer<p>:FREQuency <Frequency>

Defines the frequency of the power sensor.

Suffix:
<p> Power sensor index

Parameters:
<Frequency> The available value range is specified in the data sheet of the power sensor in use.
*RST: 50 MHz
Default unit: HZ

Example: `PMET2:FREQ 1GHZ`
Sets the frequency of the power sensor to 1 GHz.

[SENSe:]PMETer<p>:FREQuency:LINK <Coupling>

Selects the frequency coupling for power sensor measurements.

Suffix:
<p> Power sensor index

Parameters:
<Coupling> **CENTer**
Couples the frequency to the center frequency of the analyzer
MARKer1
Couples the frequency to the position of marker 1
OFF
Switches the frequency coupling off
*RST: CENTer

Example: `PMET2:FREQ:LINK CENT`
Couples the frequency to the center frequency of the analyzer

[SENSe:]PMETer<p>:MTIMe <Duration>

Selects the duration of power sensor measurements.

Suffix:
<p> Power sensor index

Parameters:
<Duration> SHORt | NORMal | LONG
*RST: NORMal

Example: `PMET2:MTIM SHOR`
Sets a short measurement duration for measurements of stationary high power signals for the selected power sensor.

[SENSe:]PMETer<p>:MTIMe:AVERage:COUNt <NumberReadings>

Sets the number of power readings included in the averaging process of power sensor measurements.

Extended averaging yields more stable results for power sensor measurements, especially for measurements on signals with a low power, because it minimizes the effects of noise.

Suffix:
<p> Power sensor index

Parameters:
<NumberReadings> An average count of 0 or 1 performs one power reading.

Range: 0 to 256
Increment: binary steps (1, 2, 4, 8, ...)

Example:
```
PMET2:MTIM:AVER ON
```
Activates manual averaging.
```
PMET2:MTIM:AVER:COUN 8
```
Sets the number of readings to 8.

[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe] <State>

Turns averaging for power sensor measurements on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example:
```
PMET2:MTIM:AVER ON
```
Activates manual averaging.

[SENSe:]PMETer<p>:ROFFset[:STATe] <State>

Includes or excludes the reference level offset of the analyzer for power sensor measurements.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET2:ROFF OFF`
Takes no offset into account for the measured power.

[SENSe:]PMETer<p>:SOFFset <SensorOffset>

Takes the specified offset into account for the measured power. Only available if `[SENSe:]PMETer<p>:ROFFset[:STATe]` is disabled.

Suffix:
<p> Power sensor index

Parameters:
<SensorOffset> Default unit: DB

Example: `PMET2:SOFF 0.001`

[SENSe:]PMETer<p>[:STATe] <State>

Turns a power sensor on and off.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET1 ON`
Switches the power sensor measurements on.

[SENSe:]PMETer<p>:UPDate[:STATe] <State>

Turns continuous update of power sensor measurements on and off.

If on, the results are updated even if a single sweep is complete.

Suffix:
<p> Power sensor index

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `PMET1:UPD ON`
The data from power sensor 1 is updated continuously.

UNIT<n>:PMETer<p>:POWer <Unit>

Selects the unit for absolute power sensor measurements.

Suffix:
<n> irrelevant

<p> Power sensor index

Parameters:
<Unit> DBM | WATT | W | DB | PCT
*RST: DBM

Example: `UNIT:PMET:POW DBM`

UNIT<n>:PMETer<p>:POWer:RATio <Unit>

Selects the unit for relative power sensor measurements.

Suffix:
<n> irrelevant

<p> Power sensor index

Parameters:
<Unit> DB | PCT
*RST: DB

Example: `UNIT:PMET:POW:RAT DB`

6.6.2 Frontend configuration

The following commands are required to configure frequency and amplitude settings, which represent the "frontend" of the measurement setup.

6.6.2.1 Frequency

[SENSe:]FREQuency:CENTer <Frequency>

Defines the center frequency.

Parameters:

<Frequency> The allowed range and f_{max} is specified in the data sheet.

*RST: fmax/2
Default unit: Hz

Example:

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

Sets the center frequency to 110 MHz.

Manual operation: See "Center Frequency " on page 31

[SENSe:]FREQuency:CENTer:STEP <StepSize>

Defines the center frequency step size.

Parameters:

<StepSize> f_{max} is specified in the data sheet.

Range: 1 to fMAX
*RST: 0.1 x span
Default unit: Hz

Example:

```
//Set the center frequency to 110 MHz.
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

Manual operation: See "Center Frequency Stepsize " on page 32

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

Couples or decouples the center frequency step size to the span.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example:

```
FREQ:CENT:STEP:AUTO ON
```

Activates the coupling of the step size to the span.

[SENSe:]FREQuency:OFFSet <Offset>

Defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

Parameters:

<Offset> Range: -1 THz to 1 THz
*RST: 0 Hz
Default unit: HZ

Example: `FREQ:OFFS 1GHZ`

Manual operation: See "Frequency Offset " on page 32

6.6.2.2 Amplitude settings

The following commands are required to configure the amplitude settings in a remote environment.

Useful commands for amplitude settings described elsewhere:

- `INPut<ip>:COUPling<ant>` on page 71
- `INPut<ip>:IMPedance<ant>` on page 73

Remote commands exclusive to amplitude settings:

[SENSe:]ADJust:LEVel

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The R&S VSE is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

Example: `ADJ:LEV`

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>
<ReferenceLevel>

Defines the reference level (for all traces in all windows).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:

<ReferenceLevel> The unit is variable.

Range: see datasheet
*RST: 0 dBm
Default unit: DBM

Example: `DISP:TRAC:Y:RLEV -60dBm`

Manual operation: See "Reference Level " on page 33

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet <Offset>

Defines a reference level offset (for all traces in all windows).

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:

<Offset> Range: -200 dB to 200 dB
*RST: 0dB
Default unit: DB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Manual operation: See "Shifting the Display (Offset)" on page 34

INPut<ip>:GAIN<ant>:STATe <State>

Turns the internal preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

Suffix:

<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example: INP:GAIN:STAT ON
INP:GAIN:VAL 15
Switches on 15 dB preamplification.

Manual operation: See "Preamplifier " on page 35

INPut<ip>:GAIN<ant>[:VALue] <Gain>

Selects the "gain" if the preamplifier is activated (INP:GAIN:STAT ON, see INPut<ip>:GAIN<ant>:STATe on page 106).

The command requires the additional preamplifier hardware option.

Suffix:
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

Parameters:
<Gain> 15 dB and 30 dB
All other values are rounded to the nearest of these two.
30 dB

Default unit: DB

Example: INP:GAIN:STAT ON
INP:GAIN:VAL 30
Switches on 30 dB preamplification.

Manual operation: See "Preamplifier " on page 35

6.6.2.3 Scaling

Remote commands exclusive to scaling:

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

Suffix:
<n> Window

<t> irrelevant

Manual operation: See "Auto Scale Once " on page 36

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum
<Value>

This command defines the value at the bottom of the y-axis.

Suffix:
<n> Window
<w> irrelevant
<t> irrelevant

Parameters:
<Value> <numeric value>
Default unit: Depends on the result display.

Example: //Define y-axis level range
```
DISP:TRAC:Y:AUTO OFF
DISP:TRAC:Y:MIN -10DBM
DISP:TRAC:Y:MAX -110DBM
```

Manual operation: See "Defining Min and Max Values" on page 37

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum
<Value>

This command defines the value at the top of the y-axis.

Suffix:
<n> Window
<w> irrelevant
<t> irrelevant

Parameters:
<Value> <numeric value>
Default unit: Depends on the result display.

Example: //Define y-axis level range
```
DISP:TRAC:Y:AUTO OFF
DISP:TRAC:Y:MIN -10DBM
DISP:TRAC:Y:MAX -110DBM
```

Manual operation: See "Defining Min and Max Values" on page 37

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision
<Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

In spectrum displays, for example, this command is not available.

Suffix:
<n> Window
<w> subwindow
Not supported by all applications
<t> irrelevant

Parameters:
<Value> numeric value WITHOUT UNIT (unit according to the result display)
Defines the range per division (total range = 10*<Value>)
*RST: depends on the result display
Default unit: DBM

Example: `DISP:TRAC:Y:PDIV 10`
Sets the grid spacing to 10 units (e.g. dB) per division

Manual operation: See "Range per Division" on page 37

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

Defines the vertical position of the reference level on the display grid (for all traces).

The R&S VSE adjusts the scaling of the y-axis accordingly.

Suffix:
<n> Window
<w> subwindow
Not supported by all applications
<t> irrelevant

Example: `DISP:TRAC:Y:RPOS 50PCT`

Manual operation: See "Reference Position" on page 37

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

Defines the reference value assigned to the reference position in the specified window. Separate reference values are maintained for the various displays.

Suffix:
<n> Window
<w> subwindow
<t> irrelevant

Parameters:
<Value> Default unit: DB

Example: `DISP:TRAC:Y:RVAL 0`
Sets the value assigned to the reference position to 0 Hz

Manual operation: See "Reference Value" on page 37

6.6.2.4 Configuring the attenuation

INPut:ATTenuation <Attenuation>

Defines the total attenuation for RF input.

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Parameters:

<Attenuation>
Range: see data sheet
Increment: 5 dB (with optional electr. attenuator: 1 dB)
*RST: 10 dB (AUTO is set to ON)
Default unit: DB

Example:
```
INP:ATT 30dB
```
Defines a 30 dB attenuation and decouples the attenuation from the reference level.

Manual operation: See "Attenuation Mode / Value " on page 34

INPut:ATTenuation:AUTO <State>

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S VSE determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

Parameters:

<State>
ON | OFF | 0 | 1
*RST: 1

Example:
```
INP:ATT:AUTO ON
```
Couples the attenuation to the reference level.

Manual operation: See "Attenuation Mode / Value " on page 34

INPut:EATT <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 111).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Parameters:

<Attenuation> attenuation in dB

Range: see data sheet
Increment: 1 dB
*RST: 0 dB (OFF)
Default unit: DB

Example:

```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

Manual operation: See "Using Electronic Attenuation " on page 34

INPut:EATT:AUTO <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 1

Example:

```
INP:EATT:AUTO OFF
```

Manual operation: See "Using Electronic Attenuation " on page 34

INPut:EATT:STATe <State>

Turns the electronic attenuator on and off.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:

```
INP:EATT:STAT ON
```

Switches the electronic attenuator into the signal path.

Manual operation: See "Using Electronic Attenuation " on page 34

6.6.3 Triggering measurements

Useful commands for triggering described elsewhere:

- `[SENSe:]FREQuency:CENTer` on page 104

Remote commands exclusive to triggering:

6.6.3.1 Configuring the triggering conditions

TRIGger[:SEQuence]:DTIMe <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

Parameters:

<DropoutTime> Dropout time of the trigger.

Range: 0 s to 10.0 s
*RST: 0 s
Default unit: S

Manual operation: See "Drop-Out Time " on page 40

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the measurement.

Parameters:

<Offset>

*RST: 0 s
Default unit: S

Example:

```
TRIG:HOLD 500us
```

Manual operation: See "Trigger Offset " on page 40

TRIGger[:SEQuence]:IFPower:HOLDoff <Period>

Defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

Parameters:

<Period>
Range: 0 s to 10 s
*RST: 0 s
Default unit: S

Example:
```
TRIG:SOUR EXT
```
Sets an external trigger source.
```
TRIG:IFP:HOLD 200 ns
```
Sets the holding time to 200 ns.

Manual operation: See "Trigger Holdoff " on page 41

TRIGger[:SEQuence]:IFPower:HYSTeresis <Hysteresis>

Defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

Parameters:

<Hysteresis>
Range: 3 dB to 50 dB
*RST: 3 dB
Default unit: DB

Example:
```
TRIG:SOUR IFP
```
Sets the IF power trigger source.
```
TRIG:IFP:HYST 10DB
```
Sets the hysteresis limit value.

Manual operation: See "Hysteresis " on page 41

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

Defines the level the external signal must exceed to cause a trigger event.

Suffix:

<port>
Selects the trigger port.
1 = trigger port 1 (TRIGGER INPUT connector on front panel)
2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)
3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

Parameters:

<TriggerLevel>
Range: 0.5 V to 3.5 V
*RST: 1.4 V
Default unit: V

Example: `TRIG:LEV 2V`

Manual operation: See "Trigger Level " on page 40

TRIGger[:SEQuence]:LEVel:IFPower <TriggerLevel>

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.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.

*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:IFP -30DBM`

TRIGger[:SEQuence]:LEVel:IQPower <TriggerLevel>

Defines the magnitude the I/Q data must exceed 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.

Parameters:

<TriggerLevel> Range: -130 dBm to 30 dBm
*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:IQP -30DBM`

TRIGger[:SEQuence]:LEVel:RFPower <TriggerLevel>

Defines the power level the RF input must exceed 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.

The input signal must be between 500 MHz and 8 GHz.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.

*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:RFP -30dBm`

TRIGger[:SEQuence]:RFPower:HOLDoff <Time>

Parameters:
<Time> Default unit: S

TRIGger[:SEQuence]:SLOPe <Type>

Parameters:
<Type> POSitive | NEGative

POSitive
Triggers when the signal rises to the trigger level (rising edge).

NEGative
Triggers when the signal drops to the trigger level (falling edge).

*RST: POSitive

Example: `TRIG:SLOP NEG`

Manual operation: See "Slope " on page 40

TRIGger[:SEQuence]:SOURce <Source>

Selects the trigger source.

Note that the availability of trigger sources depends on the connected instrument.

Note on external triggers:

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure that this situation is avoided in your remote control programs.

Parameters:
<Source>

IMMediate
Free Run

EXTernal
Trigger signal from the "Trigger Input" connector.

MAGNitude
For (offline) input from a file, rather than an instrument.
The trigger level is specified by `TRIGger[:SEQuence]:LEVel:MAPower`.

MAIT
For trigger information stored as markers in an `.iqx` file.

MANual
Only available for a connected R&S RTP:
Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can use the more complex trigger settings available on an R&S RTP.

*RST: IMMediate

Example: `TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Manual operation: See "Trigger Source" on page 38
See "Free Run " on page 39
See "External Trigger 1/2/3/4" on page 39
See "External Channel 3 " on page 39
See "IF Power " on page 39
See "I/Q Power " on page 39
See "RF Power " on page 40

TRIGger[:SEQuence]:OSCilloscope:COUPling <CoupType>

Configures the coupling of the external trigger to the oscilloscope.

Parameters:

<CoupType> Coupling type

DC
Direct connection with 50 Ω termination, passes both DC and AC components of the trigger signal.

CDLimit
Direct connection with 1 MΩ termination, passes both DC and AC components of the trigger signal.

AC
Connection through capacitor, removes unwanted DC and very low-frequency components.

*RST: DC

[SENSe:]MSRA:CAPTure:OFFSet <Offset>

This setting is only available for secondary applications in MSRA mode, not for the MSRA primary application. It has a similar effect as the trigger offset in other measurements.

Parameters:

<Offset> This parameter defines the time offset between the capture buffer start and the start of the extracted secondary application data. The offset must be a positive value, as the secondary application can only analyze data that is contained in the capture buffer.

Range: 0 to <Record length>
*RST: 0
Default unit: S

TRIGger[:SEQuence]:LEVel:MAPower <TriggerLevel>

Defines the power level that must be exceeded to cause a trigger event for (offline) input from a file.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.

Default unit: DBM

Example:
```
TRIG:LEV:MAP -30DBM
```

TRIGger[:SEQuence]:MAPower:HOLDoff <Period>

Defines the holding time before the next trigger event for (offline) input from a file.

Parameters:

<Period>
Range: 0 s to 10 s
*RST: 0 s
Default unit: S

Example:
```
TRIG:SOUR MAGN
```
Sets an offline magnitude trigger source.
```
TRIG:MAP:HOLD 200 ns
```
Sets the holding time to 200 ns.

Manual operation: See "Trigger Holdoff " on page 41

TRIGger[:SEQuence]:MAPower:HYSTeresis <Hysteresis>

Defines the trigger hysteresis for the (offline) magnitude trigger source (used for input from a file).

Parameters:

<Hysteresis>
Range: 3 dB to 50 dB
*RST: 3 dB
Default unit: DB

Example:
```
TRIG:SOUR MAP
```
Sets the (offline) magnitude trigger source.
```
TRIG:MAP:HYST 10DB
```
Sets the hysteresis limit value.

Manual operation: See "Hysteresis " on page 41

6.6.3.2 Configuring the trigger output

The following commands are required to send the trigger signal to one of the variable "TRIGGER INPUT/OUTPUT" connectors on the connected instrument.

OUTPut<up>:TRIGger<tp>:DIRection <Direction>

Selects the trigger direction for trigger ports that serve as an input as well as an output.

Suffix:
<up> irrelevant

<tp>

Parameters:
<Direction> INPut | OUTPut

INPut
Port works as an input.

OUTPut
Port works as an output.

*RST: INPut

OUTPut<up>:TRIGger<tp>:LEVel <Level>

Defines the level of the (TTL compatible) signal generated at the trigger output.

Works only if you have selected a user-defined output with `OUTPut<up>:TRIGger<tp>:OTYPe`.

Suffix:
<up> 1..n

<tp> Selects the trigger port to which the output is sent.

Parameters:
<Level>

HIGH
5 V

LOW
0 V

*RST: LOW

Example:
```
OUTP:TRIG2:LEV HIGH
```

OUTPut<up>:TRIGger<tp>:OTYPe <OutputType>

Selects the type of signal generated at the trigger output.

Suffix:
<up> 1..n

<tp> Selects the trigger port to which the output is sent.

Parameters:
<OutputType>

DEVice
Sends a trigger signal when the R&S VSE has triggered internally.

TARMed
Sends a trigger signal when the trigger is armed and ready for an external trigger event.

UDEFined
Sends a user-defined trigger signal. For more information, see `OUTPut<up>:TRIGger<tp>:LEVel`.

*RST: DEVice

OUTPut<up>:TRIGger<tp>:PULSe:IMMediate

Generates a pulse at the trigger output.

Suffix:
<up> Selects the trigger port to which the output is sent.

<tp> 1..n

OUTPut<up>:TRIGger<tp>:PULSe:LENGth <Length>

Defines the length of the pulse generated at the trigger output.

Suffix:
<up> 1..n

<tp> Selects the trigger port to which the output is sent.

Parameters:
<Length> Pulse length in seconds.
Default unit: S

Example:
```
OUTP:TRIG2:PULS:LENG 0.02
```

6.6.4 Configuring data aquisition

[SENSe:]SWEep:TIME <Time>

Defines the measurement time. It automatically decouples the time from any other settings.

Parameters:

<Time> refer to data sheet

*RST: depends on current settings (determined automatically)

Default unit: S

Manual operation: See "Capture Time" on page 42

[SENSe:]RLENgth?

Returns the record length set up for current measurement settings.

Return values:

<SampleCount> <numeric value>

Example: `SENS:RLEN?`

Usage: Query only

[SENSe:]CAPTure:PRESet <ChannelNumber>

Selects the HRP UWB Channel.

Parameters:

<ChannelNumber> C0 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15

Example: `SENSe:CAPTure:PRESet C0`

Manual operation: See "Channel" on page 42

[SENSe:]CAPTure:FSET

Sets the center frequency to the channel's frequency.

Example: `SENSe:CAPTure:FSET`

Usage: Event

Manual operation: See "Channel" on page 42

[SENSe:]CAPTure:DEFault <DefaultValues>

Toggles the default values between on/off.

Parameters:

<DefaultValues> ON | OFF

Example: `SENSe:CAPTure:DEFault ON`

Manual operation: See "Default Values" on page 42

[SENSe:]CAPTure:OVERsampling <OVFactor>

Sets the oversampling factor.

Parameters:
<OVFactor> OV4 | OV6 | OV8 | OV10 | OV12

Example: `SENSe:CAPTure:OVERsampling OV4`

Manual operation: See "Sample Rate" on page 42

[SENSe:]SRATe <SampleRate>

Returns the sample rate set up for current measurement settings.

Parameters:
<SampleRate> <numeric value>

Example: `SENS:SRAT?`

Manual operation: See "Sample Rate" on page 42

TRACe:IQ:WBANd[:STATe] <State>

Determines whether the wideband provided by bandwidth extension options is used or not (if installed).

Parameters:
<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Manual operation: See "Maximum Bandwidth" on page 42

TRACe:IQ:WBANd:MBWidth <Limit>

Defines the maximum analysis bandwidth. Any value can be specified; the next higher fixed bandwidth is used.

The available fixed values depend on the connected instrument and the installed bandwidth extension options.

Manual operation: See "Maximum Bandwidth" on page 42

[SENSe:]CAPTure:LENGth:CHIPs?

Returns the capture length in chips.

Example: `SENSe:CAPTure:LENGth:CHIPs?`

Usage: Query only

Manual operation: See "Capture Length" on page 43

6.6.5 Configuring burst/sync

[SENSe:]DETect:REFerence <Reference>

Sets the reference level to be used for setting the burst detection threshold.

Parameters:
<Reference> ABSolute | NOISe | PEAK | RLEVel
*RST: NOISe

Example: `SENSe:DETect:REFerence PEAK`

Manual operation: See "Reference" on page 43

[SENSe:]DETect:THReshold <Level>

Sets the detection threshold in dB/dBm relative to the burst detection reference level.

Parameters:
<Level> <numeric value>
Default unit: dB

Example: `SENSe:DETect:THReshold -10`

Manual operation: See "Threshold" on page 44

[SENSe:]DETect:BURSt:LENGth:MINimum <Minimum>

Defines the minimum burst length.

Parameters:
<Minimum> <numeric value>

Example: `SENSe:DETect:BURS:LENG:MIN 0.0001`

Manual operation: See "Min Burst Length" on page 44

[SENSe:]DETect:BURSt:LENGth:MAXimum <Maximum>

Defines the maximum burst length.

Parameters:
<Maximum> <numeric value>

Example: `SENSe:DETect:BURS:LENG:MAX 0.0001`

Manual operation: See "Max Burst Length" on page 44

[SENSe:]DETect:OFF:TIME:MAXimum <Maximum>

Defines the maximum allowed off time within a burst.

Parameters:
<Maximum> <numeric value>

Example: `SENSe:DETect:OFF:TIME:MAX 0.0001`

Manual operation: See "Max Off Time within Burst" on page 44

[SENSe:]DETect:EVALuation:OFFSet <Offset>

Sets the offset of the beginning of the detected burst to where to start detection within SYNC section.

Parameters:
<Offset> <numeric value>

Example: `SENSe:DETect:EVAL:OFFS 0.00001`

Manual operation: See "Evaluation Offset" on page 44

6.6.6 Configuring demodulation

[SENSe:]DEMod:MODE <Mode>

Defines the demodulation mode (the demodulation standard).

Parameters:
<Mode> HRP | BPRF | HPRF
*RST: HRP

Example: `SENSe:DEMod:MODE HRP`

Manual operation: See "Mode" on page 45

[SENSe:]DEMod:PHRRate <PHRRate>

Selects PHY Mode/Rate modes.

Parameters:
<PHRRate> BMLP | BMHP | HMLR | HMHR

Example: `SENSe:DEMod:PHRRate BMLP`

Manual operation: See "PHY Data Rate Mode" on page 46

[SENSe:]DEMod:PAYLoad:MAX <PayloadMax>

Selects the maximum payload size.

Parameters:
<PayloadMax> S0 | S1 | S2

Example: `SENSe:DEMod:PAYLoad:MAX S0`

Manual operation: See "HPRF Payload Size" on page 46

[SENSe:]DEMod:STS:FORMat <STSFormat>

Sets the STS format.

Parameters:
<STSFormat> F0 | F1 | F2 | F3

Example: `SENSe:DEMod:STS:FORMat F0`

Manual operation: See "Packet Configuration" on page 45

[SENSe:]DEMod:STS:LENGth <STSFormat>

Sets the STS Length.

Parameters:
<STSFormat> L16 | L32 | L64 | L128 | L256

Example: `SENSe:DEMod:STS:LENGth L16`

Manual operation: See "Active Segment Length" on page 46

[SENSe:]DEMod:STS:SEGMents <STSSegments>

Sets the STS segments.

Parameters:
<STSSegments> S1 | S2 | S3 | S4

Example: `SENSe:DEMod:STS:SEGMents S1`

Manual operation: See "Active Segments" on page 46

[SENSe:]DEMod:MAC:FCS <MAC FCS>

Enable FCS check of payload either with 2 octet or with 4 octet format.

Parameters:

<MAC FCS>

OFF
OFF

O2
2 Octets

O4
4 Octets

Example: `SENSe:DEMod:MAC:FCS O2`

Manual operation: See "MAC FCS" on page 46

[SENSe:]DEMod:STS:GAP <STS Gap>

Gap between payload and STS section in packet configuration 2.

Parameters:

<STS Gap> <numeric value>

Example: `SENSe:DEMod:STS:GAP 25`

Manual operation: See "Gap (x4 chips)" on page 46

6.6.7 Configuring evaluation range

[SENSe:]EVALuation:PACKet:GROup <Group>

Sets the default group to be analyzed for all displays.

Parameters:

<Group>

Example: `SENSe:EVALuation:PACKet:GRO 2`

Manual operation: See "Default Group and Selected Packet" on page 47

[SENSe:]EVALuation:PACKet:NUMBer <Packet>

Sets the number of the packet within its class, referring to packets in the current capture buffer.

Parameters:
<Packet> <numeric value>

Example: `SENSe:EVALuation:PACKet:NUMBer 5`

Manual operation: See "Default Group and Selected Packet" on page 47

[SENSe:]EVALuation:STATistics:COUNt <Count>

Sets the number of packets to capture.

Parameters:
<Count> <numeric value>

Example: `SENSe:EVALuation:STATistics:COUNt 10`

Manual operation: See "Count" on page 47

[SENSe:]EVALuation:PACKet:COUNt?

Returns the number of packets analyzed.

Example: `SENSe:EVALuation:PACKet:COUNt?`

Usage: Query only

Manual operation: See "Count" on page 47

[SENSe:]EVALuation:STATistics:RANGe <StaticsticsRange>

Sets the type of range used for evaluating packets.

Parameters:
<StaticsticsRange> CAPTure | COUNt

Example: `SENSe:EVALuation:STATistics:RANGe CAPTure`

Manual operation: See "Range" on page 47

[SENSe:]EVALuation:STATistics:GROup <Group>

Sets the statistics group to be analyzed.

Parameters:
<Group>

Example: `SENSe:EVALuation:STATistics:GRO 4`

Manual operation: See "Group" on page 47

[SENSe:]AVERage<n>:COUNt <SweepCount>

Defines the number of sweeps that are used to average traces. This setting is not window-specific.

Suffix:
<n> irrelevant

Parameters:
<SweepCount> <numeric value>

[SENSe:]AVERage<n>:STATe<t> <AverageMode>

Turns averaging for a particular trace in a particular window on and off.

Suffix:
<n> Window

<t> Trace

Parameters:
<AverageMode> ON | OFF | 1 | 0

[SENSe:]AVERage<n>:TYPE <AverageMode>

Selects the trace averaging mode. This setting is not window-specific.

Suffix:
<n> irrelevant

Parameters:
<AverageMode> LINear | POWer | VIDeo

[SENSe:]EVALuation:FILTer<n>:DELete

Deletes the specified packet filter.

Suffix:
<n> 1..n

Example: `SENSe:EVALuation:FILT4:DEL`

Usage: Event

[SENSe:]EVALuation:FILTer<n>:NAME <FilterName>

Creates a new packet filter or changes the name of an existing filter.

Suffix:
<n> 1..n

Parameters:
<FilterName>

Example: `SENSe:EVALuation:FILT4:NAME "Even Packets"`

[SENSe:]EVALuation:FILTer<n>:SET <Packets>

Sets the packets for the specified packet filter.

Suffix:
<n> 1..n

Parameters:
<Packets>

Example: `SENSe:EVALuation:FILT4:SET 1,5,6,7`

6.6.8 Configuring results

SENSe[:WINDow<n>]:DISPlay:RWConfig <Config>

Sets the result config configuration to default or user.

Suffix:
<n> 1..n
Window

Parameters:
<Config> DEFault | USER

Example: `SENS:WIND2:DISP:RWC USER`

SENSe[:WINDow<n>]:DISPlay:RWConfig:CONFigure <Configure>

Sets the configuration setting for this window.

Suffix:
<n> 1..n
Window

Parameters:
<Configure> DEFault | USER

Example: `SENS:WIND2:DISP:CONF:CONF USER`

SENSe[:WINDow<n>]:DISPlay:RWConfig:GROup <Group>

Sets the Group for this window and for any windows this window is linked to.

Suffix:
<n> 1..n
Window

Parameters:
<Group>

Example: `SENS:WIND2:DISP:RWC:GRO 3`

SENSe[:WINDow<n>]:DISPlay:RWConfig:LINK <Links>

Links a list of windows to this window. If a window exists in another set of linked windows, they are removed from that set.

Suffix:
<n> 1..n
Window

Parameters:
<Links>

Example: `SENS:WIND2:DISP:RWC:LINK '1,3,4'`

SENSe[:WINDow<n>]:DISPlay:RWConfig:PACKet <Packet>

Sets the packet for this window and for any other windows this window is linked to.

Suffix:
<n> 1..n
Window

Parameters:
<Packet> <numeric value>

Example: `SENS:WIND2:DISP:RWC:PACK 3`

SENSe[:WINDow<n>]:DISPlay:CONFig:BINS <Bins>

Sets the number of bins for the histogram trace results.

Suffix:
<n> 1..n
Window

Parameters:
<Bins> <numeric value>

Example: `SENS:WIND2:DISP:CONF:BINS 21`

SENSe[:WINDow<n>]:DISPlay:CONFig:SCALe <Scale>

Sets the X scale for the histogram trace results.

Suffix:
<n> 1..n
Window

Parameters:
<Scale> <numeric value>
Default unit: s

Example: `SENS:WIND2:DISP:CONF:SCAL 0.001`

6.7 Configuring standard traces

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE <Mode>

Selects the trace mode. If necessary, the selected trace is also activated.

Suffix:
<n> Window

<w> subwindow
Not supported by all applications

<t> Trace

Parameters:
<Mode>

WRITe
(default:) Overwrite mode: the trace is overwritten by each sweep.

AVERage
The average is formed over several sweeps. The "Sweep/Average Count" determines the number of averaging procedures.

MAXHold
The maximum value is determined over several sweeps and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is greater than the previous one.

MINHold
The minimum value is determined from several measurements and displayed. The R&S VSE saves the sweep result in the trace memory only if the new value is lower than the previous one.

VIEW
The current contents of the trace memory are frozen and displayed.

BLANk
Hides the selected trace.

*RST: Trace 1: WRITe, Trace 2-6: BLANk

Example:
```
INIT:CONT OFF
```
Switching to single sweep mode.
```
SWE:COUN 16
```
Sets the number of measurements to 16.
```
DISP:TRAC3:MODE WRIT
```
Selects clear/write mode for trace 3.
```
INIT;*WAI
```
Starts the measurement and waits for the end of the measurement.

Manual operation: See "Trace Mode" on page 52

[SENSe:][WINDow<n>:]DETector<t>[:FUNCtion] <Detector>

Sets and queries the detector for the selected result display.

Suffix:
<n> Window

<t> Trace

Parameters:
<Detector> NEGative | POSitive | NONE | AVERage

Manual operation: See "Detector" on page 52

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data to a file.

Suffix:
<n> 1..n
Window

Setting parameters:
<FileName> String containing the path and file name.

Example:
//Export all traces in all windows to the specified file.
```
FORM:DEXP:TRAC ALL
MMEM:STOR:TRAC 0,'C:\TraceResults'
```
//Export all traces in window 2 to the specified file.
```
FORM:DEXP:TRAC SING
MMEM:STOR2:TRAC 0,'C:\TraceResults'
```
//Export the second trace in window 2 to the specified file.
```
MMEM:STOR2:TRAC 2,'C:\TraceResults'
```

Usage: Setting only

Manual operation: See "Selecting data to export" on page 53
See "Export Trace" on page 53

FORMat:DEXPort:HEADer <State>

If enabled, additional instrument and measurement settings are included in the header of the export file for result data. If disabled, only the pure result data from the selected traces and tables is exported.

Trace data resulting from encrypted file input cannot be queried.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See "Include Instrument & Measurement Settings " on page 53

FORMat:DEXPort:DSEParator <Separator>

Selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator> POINt | COMMa

COMMa
Uses a comma as decimal separator, e.g. *4,05*.

POINt
Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator. Default is POINt.

Example: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

Manual operation: See "Decimal Separator " on page 53

FORMat:DEXPort:TRACes <TracesToExport>

This command selects the data to be included in a data export file.

Setting parameters:

<TracesToExport> **SINGle**
Exports a a single trace only.

ALL
Exports all traces in all windows in the current application.

*RST: SINGle

Example: //Export all traces
`FORM:DEXP:TRAC ALL`

6.8 Working with markers

The following commands are necessary to work with markers.

6.8.1 Using markers

Note that the suffix at `CALCulate` has an effect only if you query the characteristics of a marker. If you set a marker, you can ignore the suffix because the markers are linked to each other over all measurement windows and will always be on the same frequency.

CALCulate<n>:MARKer<m>:AOFF

Turns off all markers.

Suffix:

<n> Window

<m> Marker

Example: `CALC:MARK:AOFF`
Switches off all markers.

CALCulate<n>:MARKer<m>[:STATe] <State>

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:MARK3 ON`
Switches on marker 3.

CALCulate<n>:MARKer<m>:TRACe <Trace>

Selects the trace the marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:
<n> Window

<m> Marker

Parameters:
<Trace>

Example: //Assign marker to trace 1
```
CALC:MARK3:TRAC 2
```

CALCulate<n>:MARKer<m>:X <Position>

Moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:
<n> Window

<m> Marker

Parameters:
<Position> Numeric value that defines the marker position on the x-axis. The unit depends on the result display.

Range: The range depends on the current x-axis range.
Default unit: Hz

Example:
```
CALC:MARK2:X 1.7MHz
```
Positions marker 2 to frequency 1.7 MHz.

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

Queries the result at the position of the specified marker.

Suffix:
<n> 1..n

<m> 1..n

Return values:
<Result> Default unit: DBM

Usage: Query only

6.8.2 Using delta markers

Note that the suffix at CALCulate has an effect only if you query the characteristics of a marker. If you set a marker, you can ignore the suffix because the markers are linked to each other over all measurement windows and will always be on the same frequency.

CALCulate<n>:DELTamarker<m>:AOFF

Turns off *all* delta markers.

Suffix:
<n> Window

<m> irrelevant

Example: CALC:DELT:AOFF
Turns off all delta markers.

CALCulate<n>:DELTamarker<m>:MREFerence <Reference>

Selects a reference marker for a delta marker other than marker 1.

Suffix:
<n> Window

<m> Marker

Parameters:
<Reference>

Example: CALC:DELT3:MREF 2
Specifies that the values of delta marker 3 are relative to marker 2.

CALCulate<n>:DELTamarker<m>[:STATe] <State>

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Suffix:
<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CALC:DELT2 ON`
Turns on delta marker 2.

CALCulate<n>:DELTamarker<m>:TRACe <Trace>

Selects the trace a delta marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:

<n> Window

<m> Marker

Parameters:

<Trace> Trace number the marker is assigned to.

Example: `CALC:DELT2:TRAC 2`
Positions delta marker 2 on trace 2.

CALCulate<n>:DELTamarker<m>:X <Position>

Moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

Suffix:

<n> Window

<m> Marker

Example: `CALC:DELT:X?`
Outputs the absolute x-value of delta marker 1.

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

Queries the result at the position of the specified delta marker.

Suffix:

<n> 1..n

<m> 1..n

Return values:

<Result> Result at the position of the delta marker.
The unit is variable and depends on the one you have currently set.

Default unit: DBM

Usage: Query only

6.8.3 Configuring markers

DISPlay[:WINDow<n>]:MINFo[:STATe] <State>

Turns the marker information in all diagrams on and off.

Suffix:

<n> irrelevant

Parameters:

<State> **ON | 1**
Displays the marker information in the diagrams.

OFF | 0
Hides the marker information in the diagrams.

*RST: 1

Example: `DISP:MINF OFF`
Hides the marker information.

Manual operation: See "Marker Info " on page 54

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

Turns the marker table on and off.

Suffix:

<n> irrelevant

Parameters:

<DisplayMode> **ON | 1**
Turns on the marker table.

OFF | 0
Turns off the marker table.

AUTO
Turns on the marker table if 3 or more markers are active.

*RST: AUTO

Example: `DISP:MTAB ON`
Activates the marker table.

Manual operation: See "Marker Table Display " on page 54

6.8.4 Positioning markers

If you are using more than one window, the application performs the peak search in the window that you have selected with the suffix at `CALCulate` only. Because the markers are linked, the frequency position of the marker in the other windows is adjusted accordingly, even if it means that the marker is on a peak in the selected window only.

CALCulate<n>:MARKer<m>:MAXimum:LEFT

Moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:MARKer<m>:MAXimum:NEXT

Moves a marker to the next positive peak.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

Moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

Moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:
<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MINimum:LEFT

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

Moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:
<n> Window

<m> Marker

CALCulate<n>:MARKer<m>:MINimum:RIGHt

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window

<m> Marker

6.8.5 Positioning delta markers

If you are using more than one window, the application performs the peak search in the window that you have selected with the suffix at `CALCulate` only. Because the markers are linked, the frequency position of the marker in the other windows is adjusted accordingly, even if it means that the marker is on a peak in the selected window only.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

Moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

Moves a marker to the next positive peak value.

Suffix:

<n> 1..n
Window

<m> 1..n
Marker

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

Moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

Moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

Moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:
<n> Window
<m> Marker

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window
<m> Marker

List of Remote Commands (HRP UWB)

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