

R&S®FSW-K7

Analog Demodulation Measurement Option

User Manual



1173.9240.02 – 17

This manual applies to the following R&S®FSW models with firmware version 2.00 and higher:

- R&S®FSW8 (1312.8000K08)
- R&S®FSW13 (1312.8000K13)
- R&S®FSW26 (1312.8000K26)
- R&S®FSW43 (1312.8000K43)
- R&S®FSW50 (1312.8000K50)
- R&S®FSW67 (1312.8000K67)

The following firmware options are described:

- R&S FSW-K7 (1313.1339.02)

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

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

© 2014 Rohde & Schwarz GmbH & Co. KG

Mühldorfstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

E-mail: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

Subject to change – Data without tolerance limits is not binding.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of the owners.

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

Contents

1	Preface	7
1.1	About this Manual.....	7
1.2	Documentation Overview.....	8
1.3	Conventions Used in the Documentation.....	9
2	Welcome to the Analog Demodulation Application	11
2.1	Starting the Analog Demodulation Application.....	11
2.2	Understanding the Display Information.....	12
3	Measurements and Result Displays	15
4	Measurement Basics	26
4.1	Demodulation Process - Circuit Description.....	26
4.2	Demodulation Bandwidth.....	28
4.3	Sample Rate, Measurement Time and Trigger Offset.....	29
4.4	AF Triggers.....	31
4.5	AF Filters.....	32
4.6	Time Domain Zoom.....	32
4.7	Receiving Data Input and Providing Data Output.....	34
4.8	Analog Demodulation in MSRA/MSRT Operating Mode.....	48
5	Configuration	50
5.1	Default Settings for Analog Demodulation.....	50
5.2	Configuration According to Digital Standards.....	51
5.3	Configuration Overview.....	53
5.4	Input and Frontend Settings.....	55
5.5	Trigger Configuration.....	94
5.6	Data Acquisition.....	101
5.7	Demodulation Display.....	106
5.8	Demodulation.....	106
5.9	Output Settings.....	121
5.10	Automatic Settings.....	126
6	Analysis	129
6.1	Trace Settings.....	129

6.2	Trace / Data Export Configuration.....	133
6.3	Marker Settings.....	134
6.4	Marker Search Settings and Positioning Functions.....	139
6.5	Marker Function Configuration.....	142
6.6	Marker Peak List Configuration.....	145
6.7	Limit Line Settings and Functions.....	147
6.8	Zoom Functions.....	153
6.9	Analysis in MSRA/MSRT Mode.....	154
7	I/Q Data Import and Export.....	156
7.1	Import/Export Functions.....	156
7.2	How to Export and Import I/Q Data.....	158
8	How to Perform Measurements in the Analog Demodulation Application.....	161
9	Measurement Example: Demodulating an FM Signal.....	163
10	Optimizing and Troubleshooting the Measurement.....	169
11	Remote Commands for Analog Demodulation Measurements....	170
11.1	Introduction.....	171
11.2	Common Suffixes.....	175
11.3	Activating Analog Demodulation Measurements.....	176
11.4	Configuring the Measurement.....	180
11.5	Capturing Data and Performing Sweeps.....	277
11.6	Configuring the Result Display.....	282
11.7	Retrieving Results.....	289
11.8	Analyzing Results.....	299
11.9	Importing and Exporting I/Q Data and Results.....	340
11.10	Commands for Compatibility.....	341
11.11	Programming Example.....	342
A	Reference.....	345
A.1	Predefined Standards and Settings.....	345
A.2	I/Q Data File Format (iq-tar).....	347
	List of Remote Commands (AnalogDemod).....	353

Index.....361

1 Preface

1.1 About this Manual

This Analog Demodulation User Manual provides all the information **specific to the application**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S FSW 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 Analog Demodulation Application**
Introduction to and getting familiar with the application
- **Measurements and Result Displays**
Details on supported measurements and their result types
- **Measurement Basics**
Background information on basic terms and principles in the context of the measurement
- **Configuration + Analysis**
A concise description of all functions and settings available to configure measurements and analyze results with their corresponding remote control command
- **I/Q Data Import and Export**
Description of general functions to import and export raw I/Q (measurement) data
- **How to Perform Measurements in the Analog Demodulation Application**
The basic procedure to perform each measurement and step-by-step instructions for more complex tasks or alternative methods
- **Measurement Examples**
Detailed measurement examples to guide you through typical measurement scenarios and allow you to try out the application immediately
- **Optimizing and Troubleshooting the Measurement**
Hints and tips on how to handle errors and optimize the measurement configuration
- **Remote Commands for Analog Demodulation Measurements**
Remote commands required to configure and perform Analog Demodulation measurements in a remote environment, sorted by tasks
(Commands required to set up the environment or to perform common tasks on the instrument are provided in the main R&S FSW 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 Documentation Overview

The user documentation for the R&S FSW consists of the following parts:

- Printed Getting Started manual
- Online Help system on the instrument
- Documentation CD-ROM with:
 - Getting Started
 - User Manuals for base unit and firmware applications
 - Service Manual
 - Release Notes
 - Data sheet and product brochures

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. Online help is available using the  icon on the toolbar of the R&S FSW.

Web Help

The web help provides online access to the complete information on operating the R&S FSW and all available options, without downloading. The content of the web help corresponds to the user manuals for the latest product version. The web help is available from the R&S FSW product page at <http://www.rohde-schwarz.com/product/FSW.html> > Downloads > Web Help.

Getting Started

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and handling are described. Safety information is also included.

The Getting Started manual in various languages is also available for download from the Rohde & Schwarz website, on the R&S FSW product page at <http://www2.rohde-schwarz.com/product/FSW.html>.

User Manuals

User manuals are provided for the base unit and each additional (firmware) application.

The user manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the user manuals, all instrument functions are described in detail. Furthermore, they provide a complete description of the remote control commands with programming examples.

The user manual for the base unit provides basic information on operating the R&S FSW in general, and the Spectrum application in particular. Furthermore, the software functions that enhance the basic functionality for various applications are described here. An introduction to remote control is provided, as well as information on maintenance, instrument interfaces and troubleshooting.

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

All user manuals are also available for download from the Rohde & Schwarz website, on the R&S FSW product page at <http://www2.rohde-schwarz.com/product/FSW.html>.

Service Manual

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

Release Notes

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

The most recent release notes are also available for download from the Rohde & Schwarz website, on the R&S FSW product page at <http://www2.rohde-schwarz.com/product/FSW.html> > Downloads > Firmware.

1.3 Conventions Used in the Documentation

1.3.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

1.3.2 Conventions for Procedure Descriptions

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

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

2 Welcome to the Analog Demodulation Application

The R&S FSW-K7 AM/FM/PM measurement demodulator option converts the R&S FSW into an analog modulation analyzer for amplitude-, frequency- or phase-modulated signals. It measures not only characteristics of the useful modulation, but also factors such as residual FM or synchronous modulation.

The digital signal processing in the R&S FSW, used in the Spectrum application for digital IF filters, is also ideally suited for demodulating AM, FM, or PM signals. The firmware option R&S FSW-K7 provides the necessary measurement functions.

The R&S FSW Analog Demodulation application features:

- AM, FM, and PM demodulation, with various result displays:
 - Modulation signal versus time
 - Spectrum of the modulation signal (FFT)
 - RF signal power versus time
 - Spectrum of the RF signal
- Determining maximum, minimum and average or current values in parallel over a selected number of measurements
- Maximum accuracy and temperature stability due to sampling (digitization) already at the IF and digital down-conversion to the baseband (I/Q)
- Error-free AM to FM conversion and vice versa, without deviation errors, frequency response or frequency drift at DC coupling

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

All functions not discussed in this manual are the same as in the base unit and are described in the R&S FSW User Manual. The latest version is available for download at the product homepage

(<http://www2.rohde-schwarz.com/product/FSW.html>).

Installation

You can find detailed installation instructions in the R&S FSW Getting Started manual or in the Release Notes.

2.1 Starting the Analog Demodulation Application

Analog Demodulation is a separate application on the R&S FSW.

To activate the Analog Demodulation application

1. Press the MODE key on the front panel of the R&S FSW.

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

2. Select the "Analog Demodulation" item.



The R&S FSW opens a new measurement channel for the Analog Demodulation application.


The measurement is started immediately with the default settings. It can be configured in the Analog Demodulation "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu (see [chapter 5.3, "Configuration Overview"](#), on page 53).

Multiple Measurement Channels and Sequencer Function

When you activate an application, a new measurement channel is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application.

The number of channels that can be configured at the same time depends on the available memory on the instrument.

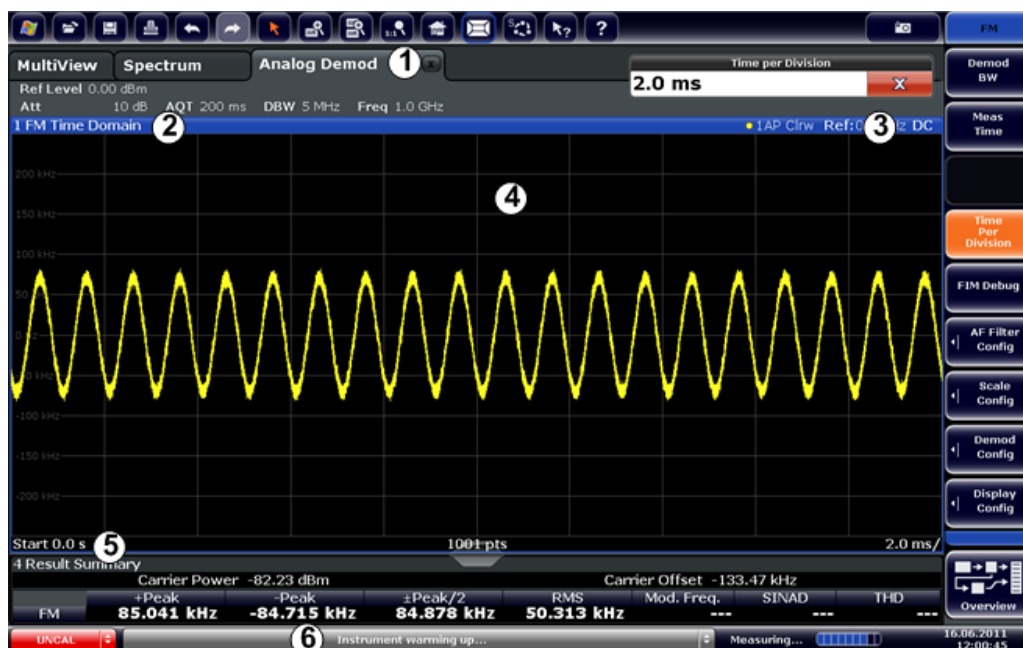
Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.

If activated, the measurements configured in the currently active channels are performed one after the other in the order of the tabs. The currently active measurement is indicated by a  symbol in the tab label. The result displays of the individual channels are updated in the tabs (as well as the "MultiView") as the measurements are performed. Sequential operation itself is independent of the currently *displayed* tab.

For details on the Sequencer function see the R&S FSW User Manual.

2.2 Understanding the Display Information

The following figure shows a measurement diagram during an Analog Demodulation measurement. 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+3 = Window title bar with diagram-specific (trace) information
- 4 = Diagram area
- 5 = Diagram footer with diagram-specific information, depending on result display
- 6 = Instrument status bar with error messages, progress bar and date/time display



MSRA/MSRT operating mode

In MSRA/MSRT operating mode, additional tabs and elements are available. A colored background of the screen behind the measurement channel tabs indicates that you are in MSRA/MSRT operating mode.

For details on the MSRA operating mode see the R&S FSW MSRA User Manual. For details on the MSRT operating mode see the R&S FSW Realtime Spectrum Application and MSRT Operating Mode User Manual.

Channel bar information

In the Analog Demodulation application, the R&S FSW shows the following settings:

Table 2-1: Information displayed in the channel bar in the Analog Demodulation application

Ref Level	Reference level
m.+el.Att	Mechanical and electronic RF attenuation
Offset	Reference level offset
AQT	Measurement time for data acquisition.
RBW	Resolution bandwidth
DBW	Demodulation bandwidth
Freq	Center frequency for the RF signal

Window title bar information

For each diagram, the header provides the following information:



Fig. 2-1: Window title bar information in the Analog Demodulation application

- 1 = Window number
- 2 = Modulation type
- 3 = Trace color
- 4 = Trace number
- 5 = Detector
- 6 = Trace mode
- 7 = Reference value (at the defined reference position)
- 8 = AF coupling (AC/DC), only in AF time domains, if applicable
- 9 = Results are selected for demodulation output

Diagram footer information

The diagram footer (beneath the diagram) contains the following information, depending on the evaluation:

RF Spectrum		
CF: Center frequency of input signal	Sweep points	Span: measured span

RF Time domain		
CF: Center frequency of input signal	Sweep points	Time per division

AF Spectrum		
AF CF: center frequency of demodulated signal	Sweep points	AF Span: evaluated span

AF Time domain		
CF: Center frequency of input signal	Sweep points	Time per division

For most modes, the number of sweep points shown in the display are indicated in the diagram footer. In zoom mode, the (rounded) number of currently displayed points are indicated.

Status bar information

Global instrument settings, the instrument status and any irregularities are indicated in the status bar beneath the diagram. Furthermore, the progress of the current operation is displayed in the status bar.

3 Measurements and Result Displays

The data that was measured by the R&S FSW can be evaluated using various different methods. In the Analog Demodulation application, up to six evaluation methods can be displayed simultaneously in separate windows. The results can be displayed as absolute deviations or relative to a reference value or level.



The abbreviation "AF" (for Audio Frequency) refers to the demodulated AM, FM or PM signal.

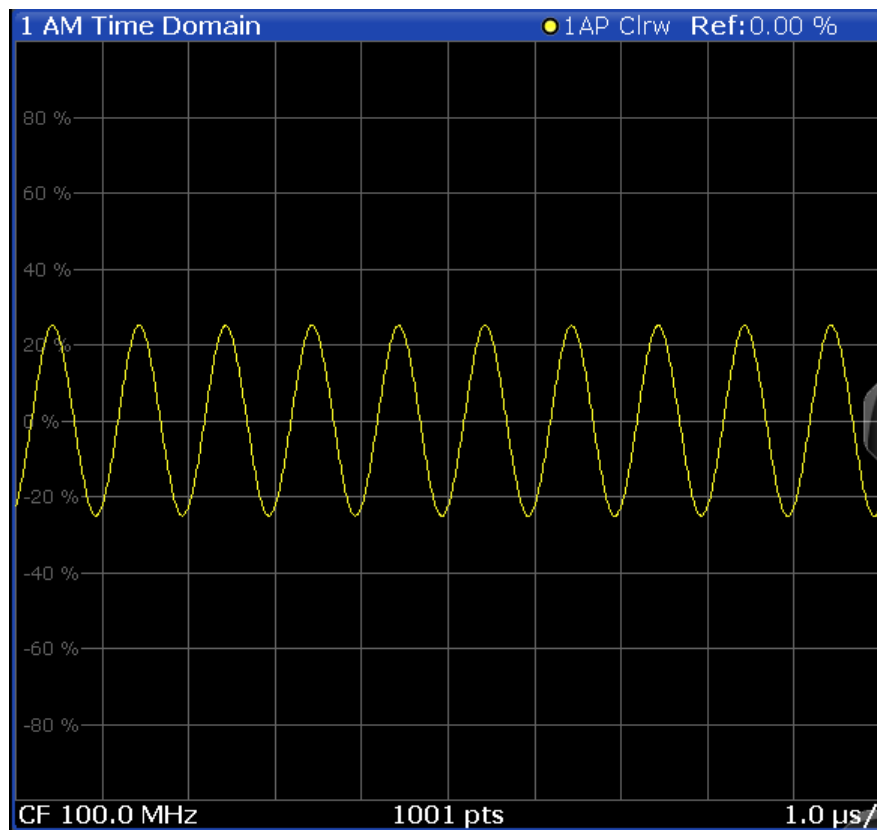
Basis for evaluation

All evaluations are based on the I/Q data set acquired during the measurement. The spectrum of the modulated signal to be evaluated is determined by the demodulation bandwidth. However, it can be restricted to a limited span ("AF Span") if only part of the signal is of interest. Furthermore, the time base for evaluations in the time domain can be restricted to analyze a smaller extract in more detail, see [chapter 4.6, "Time Domain Zoom"](#), on page 32.

AM Time Domain.....	15
FM Time Domain.....	16
PM Time Domain.....	17
AM Spectrum.....	18
FM Spectrum.....	19
PM Spectrum.....	20
RF Time Domain.....	21
RF Spectrum.....	22
Result Summary.....	23
Marker Table.....	24
Marker Peak List.....	25

AM Time Domain

Displays the modulation depth of the demodulated AM signal (in %) versus time.



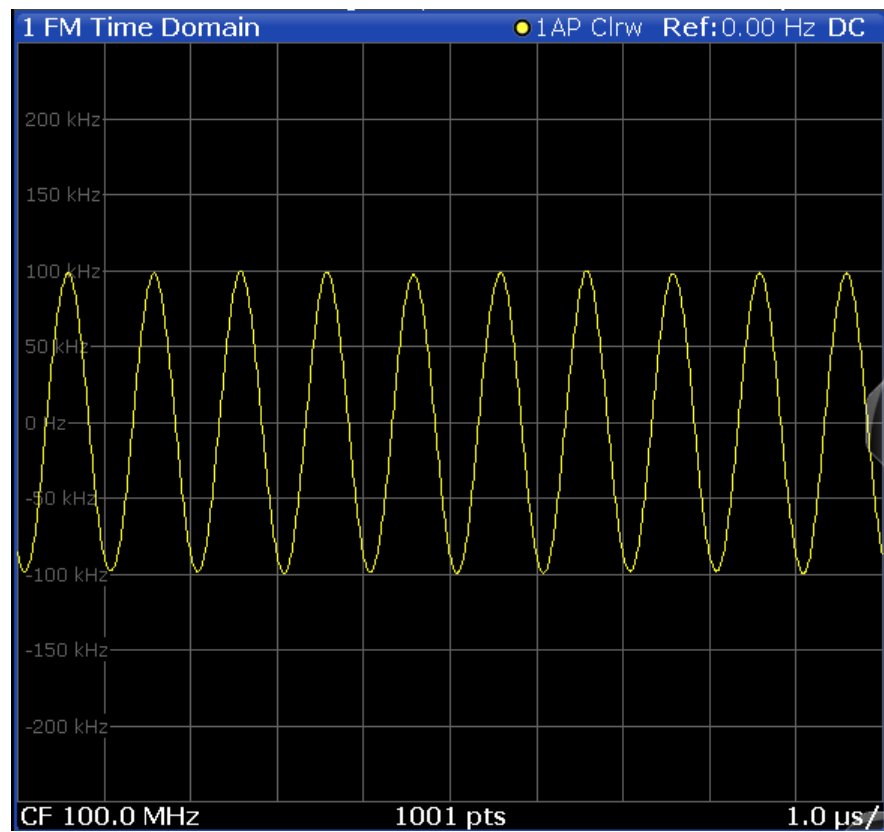
Remote command:

```
LAY:ADD? '1',RIGH,'XTIM:AM:REL'
```

(See [LAYout:ADD\[:WINDow\]?](#) on page 284)

FM Time Domain

Displays the frequency spectrum of the demodulated FM signal versus time.



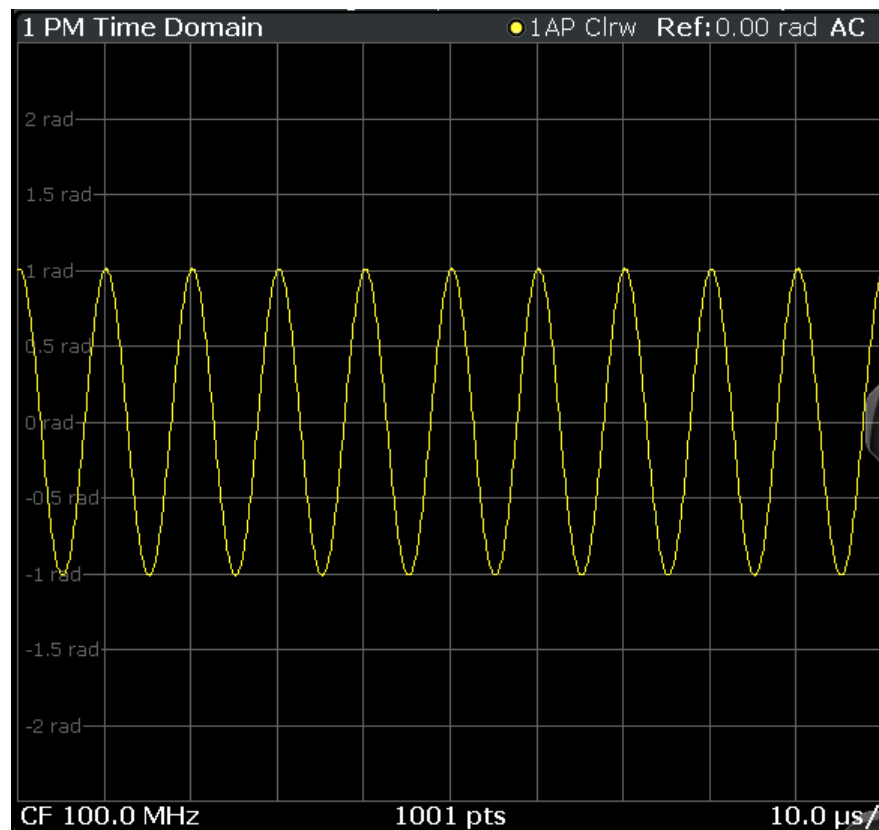
Remote command:

```
LAY:ADD? '1',RIGH,'XTIM:FM'
```

(See [LAYout:ADD\[:WINDOW\]?](#) on page 284)

PM Time Domain

Displays the phase deviations of the demodulated PM signal (in rad or °) versus time.



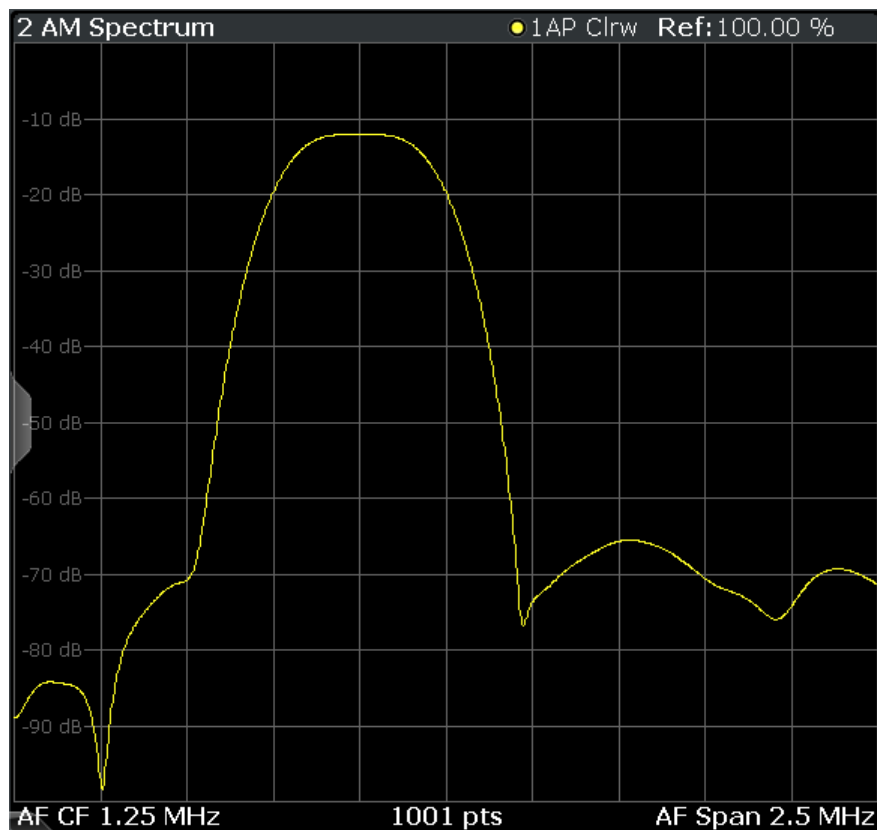
Remote command:

```
LAY:ADD? '1',RIGH,'XTIM:PM'
```

(See [LAYout:ADD\[:WINDOW\]?](#) on page 284)

AM Spectrum

Displays the modulation depth of the demodulated AM signal (in % or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



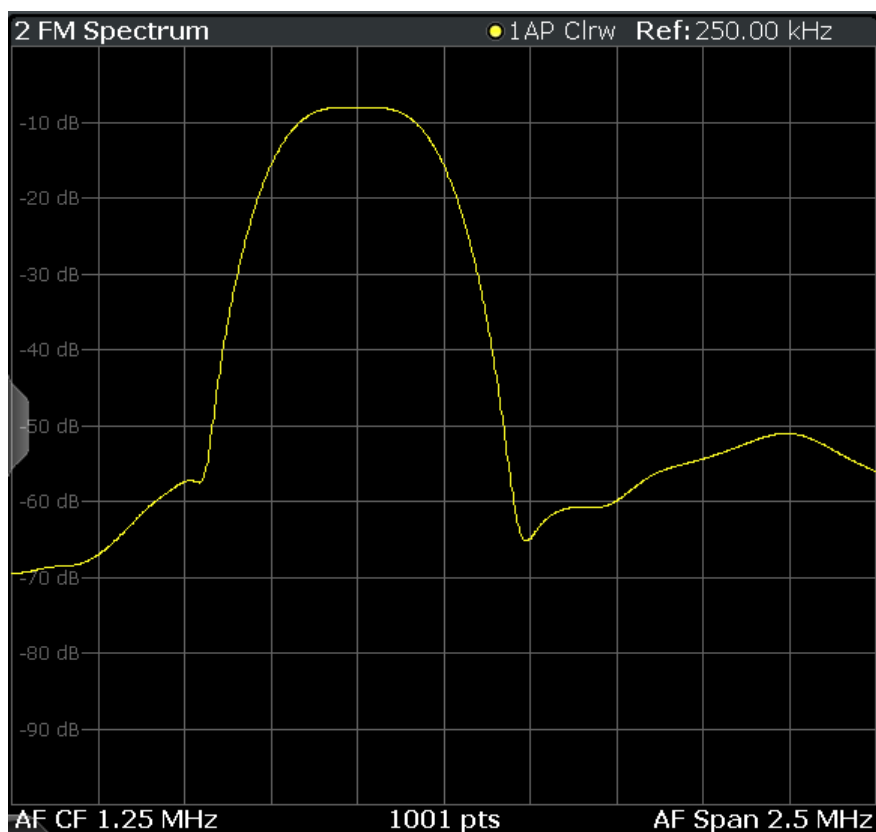
Remote command:

```
LAY:ADD? '1',RIGH,'XTIME:AM:REL:AFSPepectrum1'
```

(see [LAYout:ADD\[:WINDow\]?](#) on page 284)

FM Spectrum

Displays the frequency deviations of the demodulated FM signal (in Hz or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



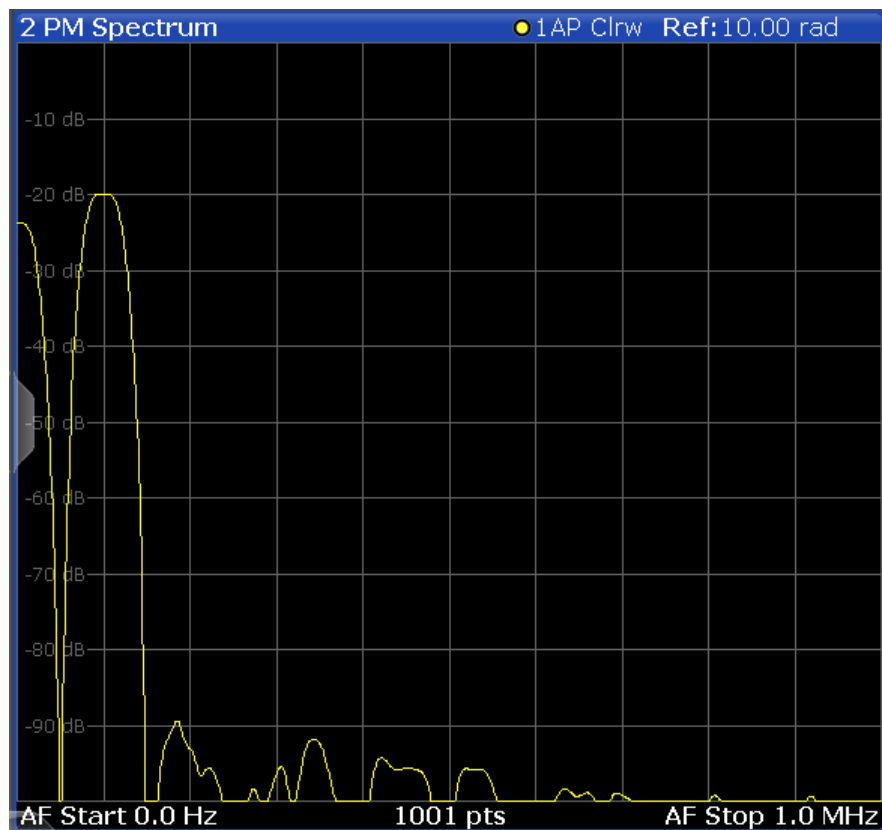
Remote command:

```
LAY:ADD? '1',RIGH,'XTIME:FM:AFSPpectrum1'
```

(see [LAYout:ADD\[:WINDow\]?](#) on page 284)

PM Spectrum

Displays the phase deviations of the demodulated PM signal (in rad, ° or dB) versus AF span. The spectrum is calculated from the demodulated AM signal in the time domain via FFT.



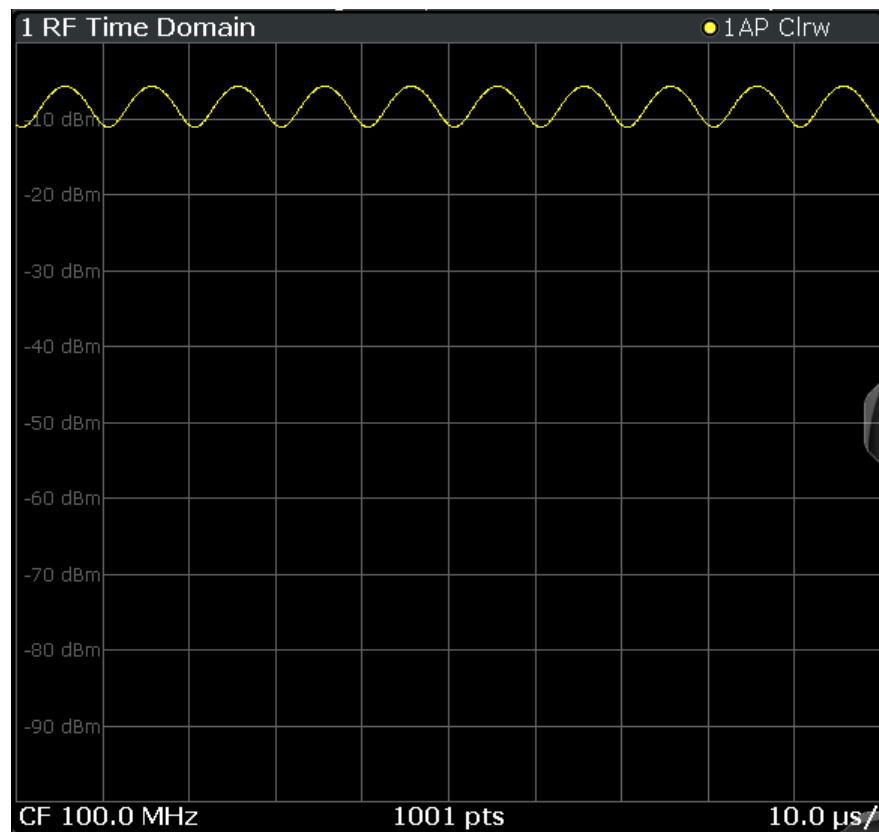
Remote command:

```
LAY:ADD? '1',RIGH,'XTIME:PM:AFSPpectrum1'
```

(see [LAYout:ADD\[:WINDow\]?](#) on page 284)

RF Time Domain

Displays the RF power of the input signal versus time. The level values represent the magnitude of the I/Q data set.



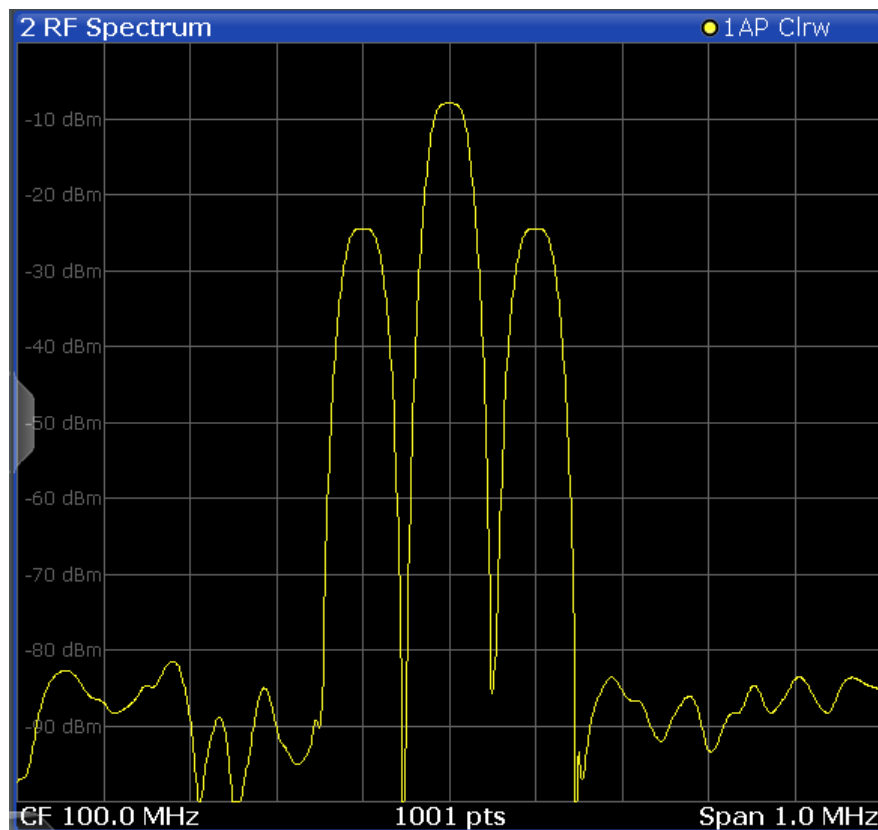
Remote command:

```
LAY:ADD? '1',RIGH,'XTIM:AM'
```

(see [LAYout:ADD\[:WINDow\]?](#) on page 284)

RF Spectrum

Displays the spectrum of the input signal. In contrast to the Spectrum application, the frequency values are determined using FFT from the recorded I/Q data set.



Remote command:

```
LAY:ADD? '1',RIGH,'XTIM:SPECTRUM'
```

(see [LAYout:ADD\[:WINDow\]?](#) on page 284)

Result Summary

The result summary displays the results of the demodulation functions for all windows in a table.

Result Summary						
Carrier Power	-7.17 dBm	Carrier Offset	-4.48 Hz	Mod Depth	25.18 %	
AM	+Peak 25.201 %	-Peak -25.167 %	±Peak/2 25.184 %	RMS 17.543 %	Mod. Freq. 1.0001 MHz	SINAD 53.116 dB
						THD -58.491 dB

For each demodulation, the following information is provided:

Table 3-1: Result summary description

Label	Description
+Peak	Positive peak (maximum)
-Peak	Negative peak (minimum)
+/-Peak/2	Average of positive and negative peaks
RMS	Root Mean Square value
Mod Freq	Modulation frequency

Label	Description
SINAD	<p>Signal-to-noise-and-distortion (Calculated only if AF Spectrum is displayed)</p> <p>Measures the ratio of the total power to the power of noise and harmonic distortions. The noise and harmonic power is calculated inside the AF spectrum span. The DC offset is removed before the calculation.</p> $SINAD[dB] = 20 \cdot \log \left[\frac{\text{total power}}{\text{noise + distortion power}} \right]$
THD	<p>Total harmonic distortion The ratio of the harmonics to the fundamental and harmonics. All harmonics inside the AF spectrum span are considered up to the tenth harmonic. (Calculated only if AF Spectrum is displayed)</p> $THD[dB] = 20 \cdot \log \left[\frac{\sqrt{\sum_{i=2}^{\infty} U_i^2}}{\sqrt{\sum_{i=1}^{\infty} U_i^2}} \right]$

In addition, the following general information for the input signal is provided:

- Carrier Power: the power of the carrier without modulation
- Carrier Offset: the deviation of the calculated carrier frequency to the ideal carrier frequency
- Modulation Depth (AM or RF Time Domain only): the difference in amplitude the carrier signal is modulated with

Remote command:

LAY:ADD? '1', RIGH, RSUM, see [LAYout:ADD\[:WINDow\]?](#) on page 284

Results:

[CALCulate:MARKer:FUNction:ADEMod:PM\[:RESult<t>\]?](#) on page 294

Marker Table

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

This table may be displayed automatically if configured accordingly (see "[Marker Table Display](#)" on page 138).

2 Marker						
Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	13.197 GHz	-25.87 dBm	Count	13.19705
D1	N1	1	-7.942 GHz	-49.41 dB		
D2	N1	2	-3.918 GHz	-21.90 dB		
D3	N1	3	4.024 GHz	-21.99 dB		

Remote command:

LAY:ADD? '1', RIGH, MTAB, see [LAYout:ADD\[:WINDow\]?](#) on page 284

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 301

[CALCulate<n>:MARKer<m>:Y?](#) on page 302

Marker Peak List

The marker peak list determines the frequencies and levels of peaks in the spectrum or time domain. How many peaks are displayed can be defined, as well as the sort order. In addition, the detected peaks can be indicated in the diagram. The peak list can also be exported to a file for analysis in an external application.

You can define search and sort criteria to influence the results of the analysis (see [chapter 6.4.1, "Marker Search Settings"](#), on page 139).

2 Marker Peak List		
No	Stimulus	Response
1	64.400000 MHz	-30.352 dBm
2	128.400000 MHz	-51.896 dBm
3	192.300000 MHz	-40.227 dBm
4	257.200000 MHz	-60.699 dBm
5	320.200000 MHz	-44.273 dBm
6	384.100000 MHz	-53.494 dBm
7	448.100000 MHz	-47.460 dBm
8	513.000000 MHz	-55.603 dBm

Remote command:

LAY:ADD? '1',RIGH, PEAK, see [LAYout:ADD\[:WINDow\]?](#) on page 284

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 301

[CALCulate<n>:MARKer<m>:Y?](#) on page 302

4 Measurement Basics

Some background knowledge on basic terms and principles used in Analog Demodulation measurements is provided here for a better understanding of the required configuration settings.

- [Demodulation Process - Circuit Description](#).....26
- [Demodulation Bandwidth](#)..... 28
- [Sample Rate, Measurement Time and Trigger Offset](#)..... 29
- [AF Triggers](#)..... 31
- [AF Filters](#).....32
- [Time Domain Zoom](#).....32
- [Receiving Data Input and Providing Data Output](#)..... 34
- [Analog Demodulation in MSRA/MSRT Operating Mode](#).....48

4.1 Demodulation Process - Circuit Description

The software demodulator runs on the main processor of the analyzer. The demodulation process is shown in [figure 4-1](#). All calculations are performed simultaneously with the same I/Q data set. Magnitude (= amplitude) and phase of the complex I/Q pairs are determined. The frequency result is obtained from the differential phase.

For details on general I/Q data processing in the R&S FSW, refer to the reference part of the I/Q Analysis remote control description in the R&S FSW User Manual.

Demodulation Process - Circuit Description

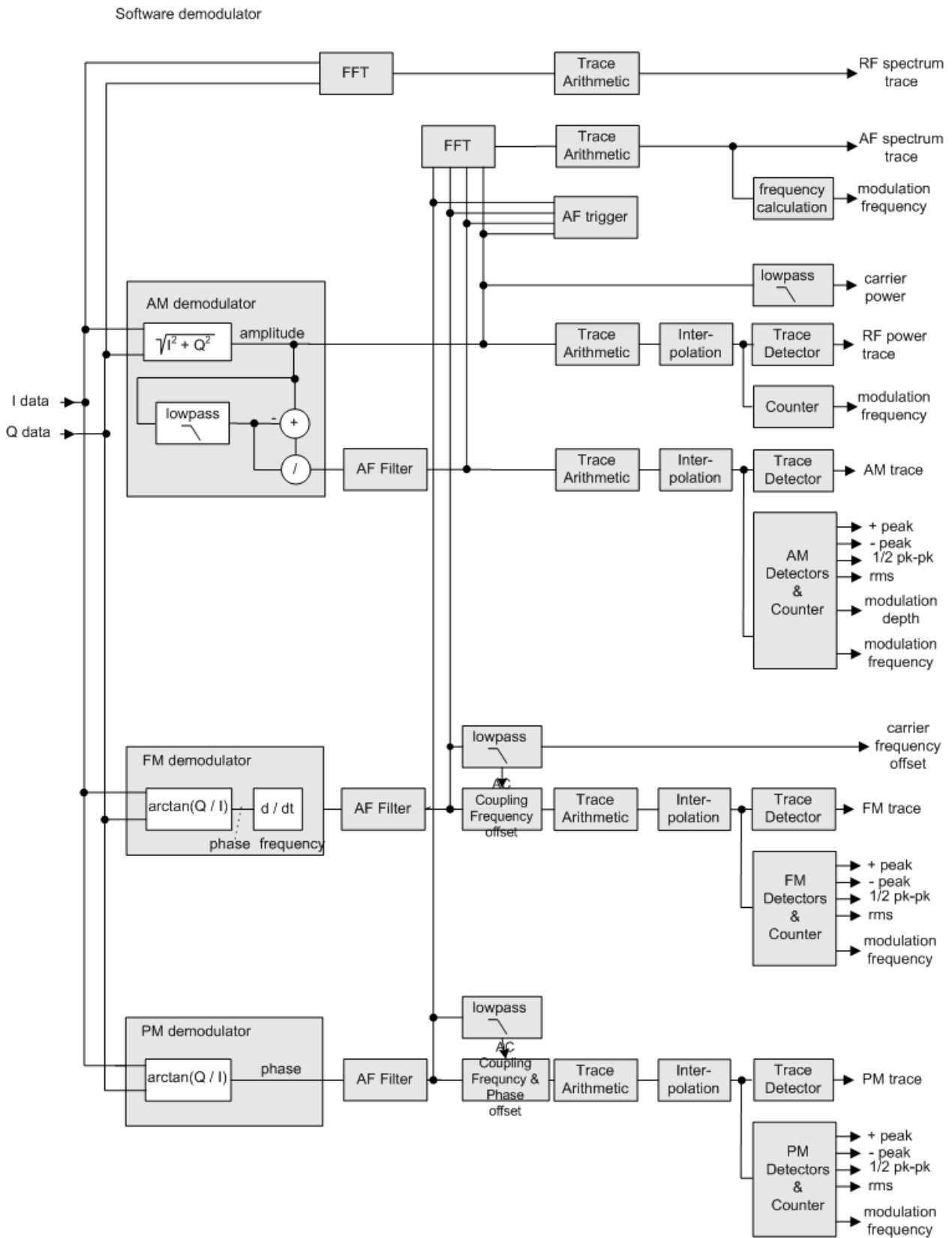


Fig. 4-1: Block diagram of software demodulator

The AM DC, FM DC and PM DC raw data of the demodulators is fed into the "Trace Arithmetic" block that combines consecutive data sets. Possible trace modes are: Clear Write, Max Hold, Min Hold and Average. The output data of the "Trace Arithmetic" block can be read via remote control ([SENS:]ADEM:<evaluation>:RES?, see [SENSe:]ADEMod:AM[:ABSolute][:TDOMain]:RESult? on page 290.

The collected measured values are evaluated by the selected detector. The result is displayed on the screen and can be read out via remote control.

In addition, important parameters are calculated:

- A counter determines the modulation frequency for AM, FM, and PM.
- average power = carrier power (RF power)
- average frequency = carrier frequency offset (FM)
- The modulation depth or the frequency or phase deviation; the deviations are determined from the trace data

AC coupling is possible with FM and PM display.

4.2 Demodulation Bandwidth

The demodulation bandwidth determines the span of the signal that is demodulated. It is not the 3 dB bandwidth of the filter but the useful bandwidth which is distortion-free with regard to phase and amplitude.

Therefore the following formulas apply:

- AM: demodulation bandwidth $\geq 2 \times$ modulation frequency
- FM: demodulation bandwidth $\geq 2 \times$ (frequency deviation + modulation frequency)
- PM: demodulation bandwidth $\geq 2 \times$ modulation frequency \times (1 + phase deviation)



If the center frequency of the analyzer is not set exactly to the signal frequency, the demodulation bandwidth must be increased by the carrier offset, in addition to the requirement described above. This also applies if FM or PM AC coupling has been selected.

In general, the demodulation bandwidth should be as narrow as possible to improve the S/N ratio. The residual FM caused by noise floor and phase noise increases dramatically with the bandwidth, especially with FM.

For help on determining the adequate demodulation bandwidth see "[Determining the demodulation bandwidth](#)" on page 169. A practical example is described in [chapter 9](#), "[Measurement Example: Demodulating an FM Signal](#)", on page 163.

4.3 Sample Rate, Measurement Time and Trigger Offset

The maximum demodulation bandwidths that can be obtained during the measurement, depending on the sample rate, are listed in the tables below for different demodulation filter types. The allowed value range of the measurement time and trigger offset depends on the selected demodulation bandwidth and demodulation filter. If the AF filter or the AF trigger are not active, the measurement time increases by 20 %.



A maximum of 24 million samples can now be captured, assuming sufficient memory is available; thus the new maximum measurement time has also increased, according to the following formula:

$$\text{Meas.time}_{\text{max}} = \text{Sample count}_{\text{max}} / \text{sample rate}$$

The minimum trigger offset is (-Meas.time_{max})

Table 4-1: Sample Rate, Measurement Time and Trigger Offset using a flat demodulation filter

Demod. band-width	Sample rate	Measurement time		Trigger offset	
		Min.	Max.	Min.	Max.
500 MHz ⁶⁾	600 MHz	1.66 ns	40 ms	-40 ms	0.3495 s
320 MHz ⁵⁾	400 MHz	2.5 ns	60 ms	-60 ms	0.5243 s
160 MHz ⁴⁾	200 MHz	5 ns	120 ms	-120 ms	1.0486 s
80 MHz ³⁾	128 MHz	7.8125 ns	187.5 ms	-187.5 ms	1.6384 s
40 MHz ²⁾	64 MHz	15.625 ns	375 ms	-375 ms	3.2768 s
28 MHz ¹⁾	64 MHz	15.625 ns	375 ms	-375 ms	3.2768 s
18 MHz	32 MHz	31.25 ns	750 ms	-750 ms	6.5536 s
10 MHz	32 MHz	31.25 ns	750 ms	-750 ms	6.5536 s
8 MHz	16 MHz	62.5 ns	1.5 ms	-1.5 ms	13.1072 s
5 MHz	8 MHz	125 ns	3 ms	-3 ms	26.2144 s
3 MHz	4 MHz	250 ns	6 ms	-6 ms	52.4288 s
1.6 MHz	2 MHz	500 ns	12 ms	-12 ms	104.8576 s
800 kHz	1 MHz	1 µs	24 ms	-24 ms	209.7152 s
400 kHz	500 kHz	2 µs	48 ms	-48 ms	419.4304 s
200 kHz	250 kHz	4 µs	96 s	-96 s	838.8608 s
100 kHz	125 kHz	8 µs	192 s	-192 s	1677.7216 s
50 kHz	62.5 kHz	16 µs	384 s	-384 s	3355.4432 s
25 kHz	31.25 kHz	32 µs	768 s	-768 s	6710.8864 s
12.5 kHz	15.625 kHz	64 µs	1536 s	-1536 s	13421.7728 s
6.4 kHz	7.8125 kHz	128 µs	3072 s	-3072 s	26843.5456 s

Sample Rate, Measurement Time and Trigger Offset

Demod. band-width	Sample rate	Measurement time		Trigger offset	
		Min.	Max.	Min.	Max.
3.2 kHz	3.90625 kHz	256 µs	6144 s	-6144 s	53687.0912 s
1.6 kHz	1.953125 kHz	512 µs	12288 s	-12288 s	107374.1824 s
800 Hz	976.5625 Hz	1.024 ms	24576 s	-24576 s	214748.3648 s
400 Hz	488.28125 Hz	2.048 ms	49152 s	-49152 s	429496.7296 s
200 Hz	244.140625 Hz	4.096 ms	98304 s	-98304 s	858993.4592 s
100 Hz	122.0703125 Hz	8.192 ms	196608 s	-196608 s	1717986.918 s
<p>1) only available with option B28</p> <p>2) only available with option B40</p> <p>3) only available with option B80</p> <p>4) only available with option B160</p> <p>5) only available with option B320</p> <p>6) only available with option B500</p>					

Table 4-2: Sample Rate, Measurement Time and Trigger Offset using a Gaussian demodulation filter

Demod. band-width	Sample rate	Measurement time		Trigger offset	
		Min.	Max.	Min.	Max.
160 MHz* ⁵⁾	640 MHz	1.5625 ns	37.5 ms	-37.5 ms	0.32768 s
80 MHz* ⁴⁾	320 MHz	3.125 ns	75 ms	-75 ms	0.65536 s
40 MHz* ⁴⁾	160 MHz	6.25 ns	150 ms	-150 ms	1.310719993 s
28 MHz* ²⁾	112 MHz	8.929 ns	214.286 ms	-214.286 ms	1.872457134 s
18 MHz* ²⁾	72 MHz	13.88 ns	333.333 ms	-333.333 ms	2.912711097 s
10 MHz	40 MHz	25 ns	600 ms	-600 ms	5.242879975 s
8 MHz	32 MHz	31.25 ns	750 ms	-750 ms	6.553599969 s
5 MHz	12 MHz	83.33 ns	2 s	-2 s	10.48575995 s
3 MHz	10.666 MHz	93.75 ns	2.25 s	-2.25 s	17.47626667 s
1.6 MHz	6.4 MHz	156.25 ns	3.75 s	-3.75 s	32.76799984 s
800 kHz	3.2 MHz	312.5 ns	7.5 s	-7.5 s	65.53599969 s
400 kHz	1.6 MHz	625 ns	15 s	-15 s	131.0719994 s
200 kHz	800 kHz	1.25 µs	30 s	-30 s	262.1439988 s
100 kHz	400 kHz	2.5 µs	60 s	-60 s	524.2879975 s
<p>* Gaussian filter curve is limited by I/Q bandwidth</p> <p>2) only available with option B40</p> <p>4) only available with option B160 or higher</p> <p>5) only available with option B320 (not B500)</p>					

Demod. band-width	Sample rate	Measurement time		Trigger offset	
		Min.	Max.	Min.	Max.
50 kHz	200 kHz	5 us	120 s	-120 s	1048.575995 s
25 kHz	100 kHz	10 us	240 s	-240 s	2097.15199 s
12.5 kHz	50 kHz	20 us	480 s	-480 s	4194.30398 s
6.4 kHz	25.6 kHz	39.0625 us	937.5 s	-937.5 s	8191.999961 s
3.2 kHz	12.8 kHz	78.125 us	1875 s	-1875 s	16383.99992 s
1.6 kHz	6.4 kHz	156.25 us	3750 s	-3750 s	32767.99984 s
800 Hz	3.2 kHz	312.5 us	7500 s	-7500 s	65535.99969 s
400 Hz	1.6 kHz	625 us	15000 s	-15000 s	131071.9994 s
200 Hz	800 Hz	1.25 ms	30000 s	-30000 s	262143.9988 s
100 Hz	400 Hz	2.5 ms	60000 s	-60000 s	524287.9975 s

* Gaussian filter curve is limited by I/Q bandwidth
²⁾ only available with option B40
⁴⁾ only available with option B160 or higher
⁵⁾ only available with option B320 (not B500)

Large numbers of samples

Principally, the R&S FSW can handle up to 1.6 million samples. However, when 480 001 samples are exceeded, all traces that are not currently being displayed in a window are deactivated to improve performance. The traces can only be activated again when the samples are reduced.



Effects of measurement time on the stability of measurement results

Despite amplitude and frequency modulation, the display of carrier power and carrier frequency offset is stable.

This is achieved by a digital filter which sufficiently suppresses the modulation, provided, however, that the measurement time is $\geq 3 \times 1 / \text{modulation frequency}$, i.e. that at least three periods of the AF signal are recorded.

The mean carrier power for calculating the AM is also calculated with a digital filter that returns stable results after a measurement time of $\geq 3 \times 1 / \text{modulation frequency}$, i.e. at least three cycles of the AF signal must be recorded before a stable AM can be shown.

4.4 AF Triggers

The Analog Demodulation option allows triggering to the demodulated signal. The display is stable if a minimum of five modulation periods are within the recording time.

Triggering is always DC-coupled. Therefore triggering is possible directly to the point where a specific carrier level, phase or frequency is exceeded or not attained.

4.5 AF Filters

Additional filters applied after demodulation help filter out unwanted signals, or correct pre-emphasized input signals. A CCITT filter allows you to evaluate the signal by simulating the characteristics of human hearing.

4.6 Time Domain Zoom

For evaluations in the time domain, the demodulated data for a particular time span can be extracted and displayed in more detail using the "Time Domain Zoom" function. This is useful if the measurement time is very large and thus each sweep point represents a large time span. The time domain zoom function distributes the available sweep points only among the time span defined by the zoom area length. The time span displayed per division of the diagram is decreased. Thus, the display of the extracted time span becomes more precise.

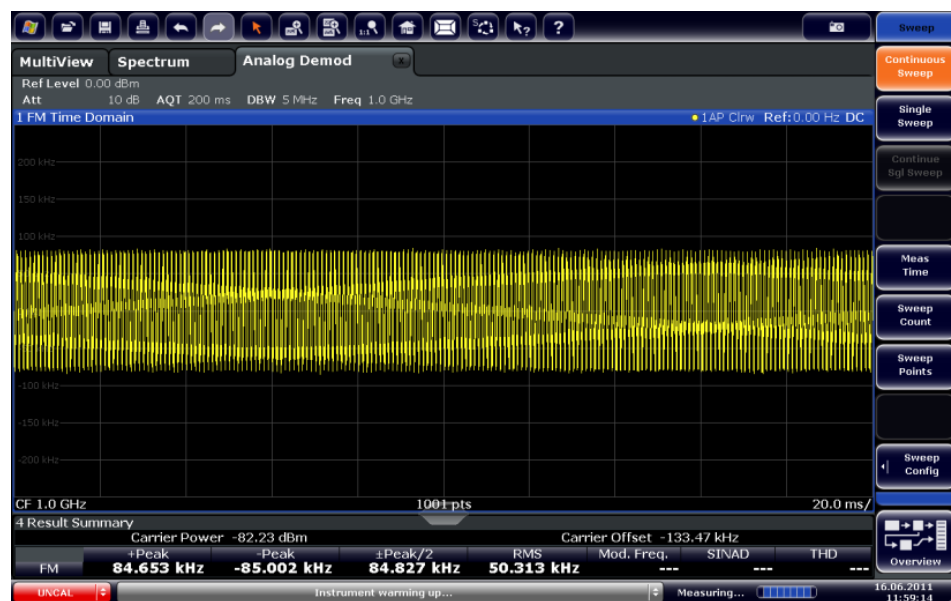


Fig. 4-2: FM time domain measurement with a very long measurement time

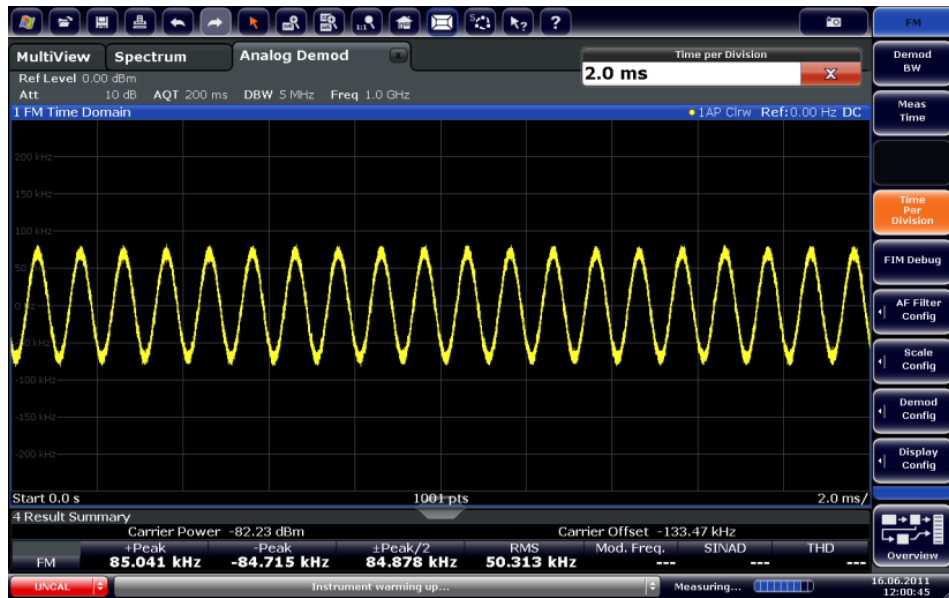
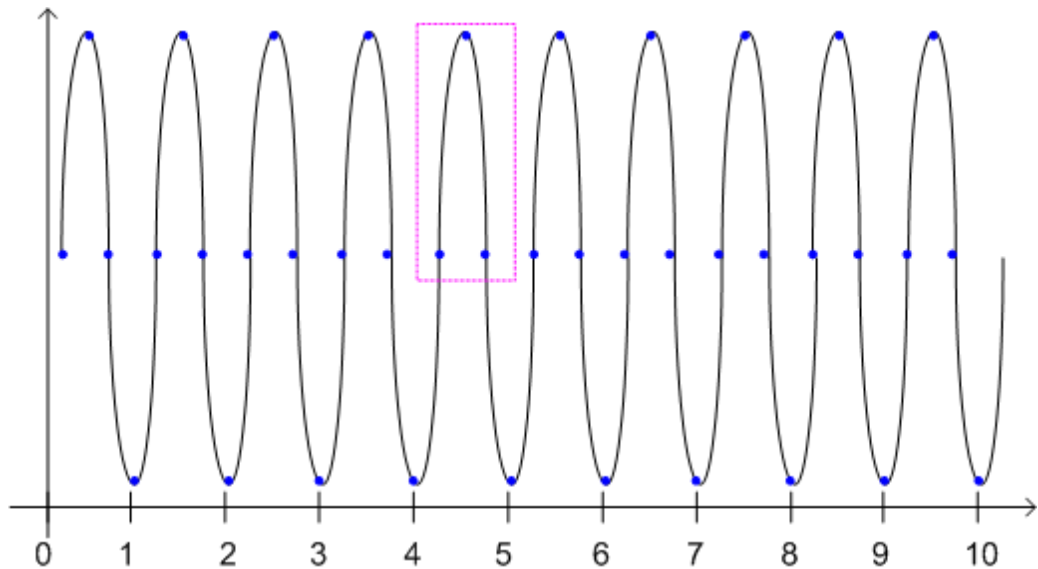
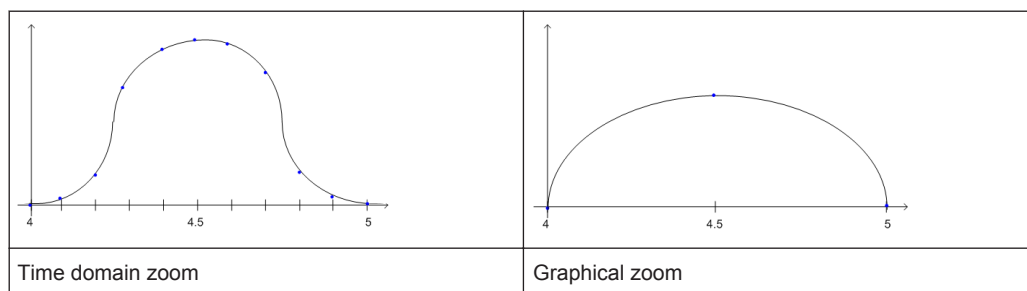


Fig. 4-3: FM time domain measurement with time domain zoom

The time domain zoom area affects not only the diagram display, but the entire evaluation for the current window.

In contrast to the time domain zoom, the graphical zoom is available for all diagram evaluations. However, the graphical zoom is useful only if more measured values than trace points are available. The (time) span represented by each measurement point remains the same.





4.7 Receiving Data Input and Providing Data Output

The R&S FSW can analyze signals from different input sources and provide various types of output (such as noise or trigger signals).

4.7.1 RF Input Protection

The RF input connector of the R&S FSW must be protected against signal levels that exceed the ranges specified in the data sheet. Therefore, the R&S FSW is equipped with an overload protection mechanism. This mechanism becomes active as soon as the power at the input mixer exceeds the specified limit. It ensures that the connection between RF input and input mixer is cut off.

When the overload protection is activated, an error message is displayed in the status bar ("INPUT OVLD"), and a message box informs you that the RF Input was disconnected. Furthermore, a status bit (bit 3) in the `STAT:QUES:POW` status register is set. In this case you must decrease the level at the RF input connector and then close the message box. Then measurement is possible again. Reactivating the RF input is also possible via the remote command `INPut:ATTenuation:PROTection:RESet`.

4.7.2 RF Input from the Analog Baseband Connector

RF input can not only be taken from the RF INPUT connector on the front panel of the R&S FSW. If the optional Analog Baseband Interface (R&S FSW-B71) is installed and active for input, an RF signal can be input at the BASEBAND INPUT I connector and redirected from there to the RF input path. A transducer is activated to compensate for the additional path of the redirected signal. The signal is then processed as usual in the frequency and time domain as for any other RF input.

This is useful, for example, to perform frequency sweep measurements with (single-ended or differential) active probes, which can also be connected to the BASEBAND INPUT I connector.

Frequency sweep measurements on probe input

You can perform RF measurements (measurements in the time or frequency domain) by connecting a probe to the BASEBAND INPUT I connector and switching the input

source to this connector in the RF input configuration (see ["Input Connector"](#) on page 58).

The probe's attenuation is compensated automatically by the R&S FSW using a transducer named "Probe on Baseband Input I". (The probe can only be connected on I, as only input at the I connector can be redirected to the RF path). A comment is assigned that includes the type, name and serial number of the detected probe. The transducer is deleted as soon as the probe is disconnected.

For details on transducers see the General Instrument Setup section in the R&S FSW User Manual.

For more information on the BASEBAND INPUT connector (R&S FSW-B71) see the R&S FSW R&S FSW I/Q Analyzer and I/Q Input User Manual.

4.7.3 Using Probes

As an alternative means of input to the R&S FSW, active probes from Rohde&Schwarz can be connected to the optional BASEBAND INPUT connectors, if the Analog Baseband Interface (option R&S FSW-B71) is installed. These probes allow you to perform voltage measurements very flexibly and precisely on all sorts of devices to be tested, without interfering with the signal.

Connecting probes

Probes are automatically detected when you plug them into the upper BASEBAND INPUT connectors on the front panel of the R&S FSW. The detected information on the probe is displayed in the "Probes" tab of the "Input" dialog box, individually for each connector.

Single-ended and differential probes

Both single-ended and differential probes are supported as input; however, since only one connector is occupied by a probe, the "Input Configuration" setting for the "Analog Baseband" input source must be set to "Single-ended" for all probes (see ["Input configuration"](#) on page 72).

Availability of probe input

Analog baseband input from connected probes can only be analyzed in applications that support I/Q data processing and the Analog Baseband Interface (R&S FSW-B71), such as the I/Q Analyzer, the Analog Demodulation application, or one of the optional applications.

Frequency sweep measurements with probes

Probes can also be used as an alternative method of providing RF input to the R&S FSW. In this case, the probe must be connected to the BASEBAND INPUT I connector, and the input is redirected to the RF input path (see [chapter 4.7.2, "RF Input from the Analog Baseband Connector"](#), on page 34). As opposed to common RF input processing, a transducer is activated before the common process to compensate for the additional path of the redirected signal. Probe signals that are redirected to the **RF**

input path can also be analyzed in the **Spectrum application** of the R&S FSW base unit. Then you can perform RF measurements (measurements in the time or frequency domain) on the input from a probe.

Microbutton action

You can define an action to be performed by the R&S FSW when the probe's microbutton (if available) is pressed. Currently, a single data acquisition via the probe can be performed simply by pressing the microbutton.

Impedance and attenuation

The measured signal from the probe is attenuated internally by the probe's specific attenuation. For probe signals that are redirected to the RF path, the attenuation is compensated using a transducer (see "[Frequency sweep measurements on probe input](#)" on page 34). The reference level is adjusted automatically.

For analog baseband input, the attenuation is compensated without a transducer. In this case, higher levels are available for the full scale level.

A fixed impedance of 50 Ω is used for all probes to convert voltage values to power levels.

4.7.4 Basics on External Generator Control

Some background knowledge on basic terms and principles used for external generator control is provided here for a better understanding of the required configuration settings.



External generator control is only available in the Spectrum, I/Q Analyzer, Analog Demodulation and Noise Figure applications.

- [External Generator Connections](#).....36
- [Overview of Generators Supported by the R&S FSW-B10 Option](#)..... 38
- [Generator Setup Files](#).....40
- [Calibration Mechanism](#).....40
- [Normalization](#)..... 41
- [Reference Trace, Reference Line and Reference Level](#).....42
- [Coupling the Frequencies](#).....43
- [Displayed Information and Errors](#).....46

4.7.4.1 External Generator Connections

The external generator is controlled either via a LAN connection or via the EXT. GEN. CONTROL GPIB interface of the R&S FSW supplied with the R&S FSW-B10 option.

For more information on configuring interfaces see the "Remote Control Interfaces and Protocols" section in the R&S FSW User Manual.

TTL synchronization

In addition, TTL synchronization can be used with some Rohde & Schwarz generators connected via GPIB. The TTL interface is included in the AUX CONTROL connector of the R&S FSW-B10 option.



Using the TTL interface allows for considerably higher measurement rates than pure GPIB control, because the frequency stepping of the R&S FSW is directly coupled with the frequency stepping of the generator. For details see [chapter 4.7.4.7, "Coupling the Frequencies"](#), on page 43.

In [figure 4-4](#) the TTL connection is illustrated using an SMU generator, for example.

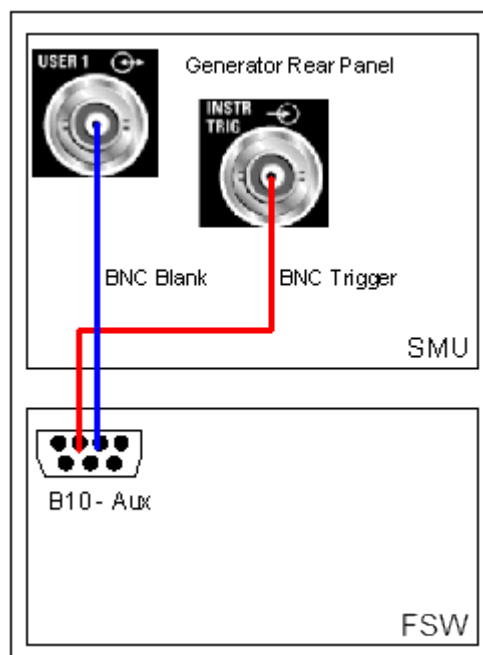


Fig. 4-4: TTL connection for an SMU generator

The external generator can be used to calibrate the data source by performing either transmission or reflection measurements.

Transmission Measurement

This measurement yields the transmission characteristics of a two-port network. The external generator is used as a signal source. It is connected to the input connector of the DUT. The input of the R&S FSW is fed from the output of the DUT. A calibration can be carried out to compensate for the effects of the test setup (e.g. frequency response of connecting cables).

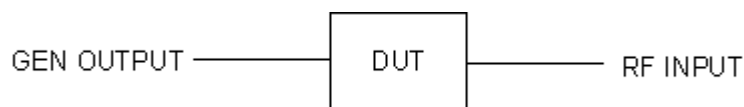


Fig. 4-5: Test setup for transmission measurement

Reflection Measurement

Scalar reflection measurements can be carried out using a reflection-coefficient measurement bridge.

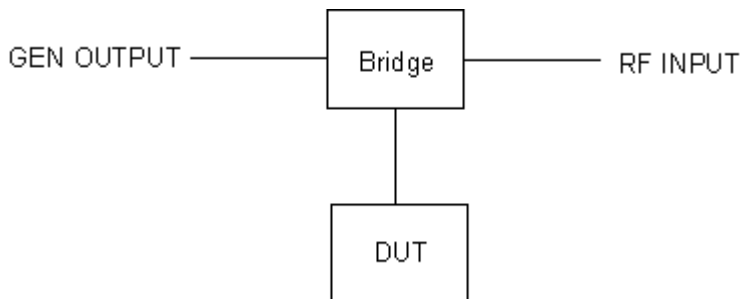


Fig. 4-6: Test setup for reflection measurement

Generated signal input

In order to use the functions of the external generator, an appropriate generator must be connected and configured correctly. In particular, the generator output must be connected to the RF input of the R&S FSW.

External reference frequency

In order to enhance measurement accuracy, a common reference frequency should be used for both the R&S FSW and the generator. If no independent 10 MHz reference frequency is available, it is recommended that you connect the reference output of the generator with the reference input of the R&S FSW and that you enable usage of the external reference on the R&S FSW via "SETUP" > "Reference" > "External Reference".

For more information on external references see the "Instrument Setup" section in the R&S FSW User Manual.

Connection errors

If no external generator is connected, if the connection address is not correct, or the generator is not ready for operation, an error message is displayed (e.g. "Ext. Generator TCP/IP Handshake Error!", see [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46).

4.7.4.2 Overview of Generators Supported by the R&S FSW-B10 Option

Generator type	TTL support	Generator type	TTL support
SGS100A12	X	SMP02	X
SMA01A ¹⁾	X	SMP03	X
1) Requires firmware version V2.10.x or higher 2) Requires firmware version V1.10.x or higher 3) Requires the option SMR-B11			

Receiving Data Input and Providing Data Output

Generator type	TTL support	Generator type	TTL support
SMA100A3	X	SMP04	X
SMA100A6	X	SMP22	X
SMB100A1	X	SMR20	-
SMB100A12	X	SMR20B11 ³⁾	X
SMB100A2	X	SMR27	X
SMB100A20	X	SMR27B11 ³⁾	X
SMB100A3	X	SMR30	X
SMB100A40	X	SMR30B11 ³⁾	X
SMBV100A3	X	SMR40	X
SMBV100A6	X	SMR40B11 ³⁾	X
SMC100A1	-	SMR50	X
SMC100A3	-	SMR50B11 ³⁾	X
SME02	X	SMR60	X
SME03	X	SMR60B11 ³⁾	X
SME06	X	SMT02	-
SMF100A	X	SMT03	-
SMF22	X	SMT06	-
SMF22B2	X	SMU02	X
SMF43	X	SMU02B31 ²⁾	X
SMF43B2	X	SMU03 ²⁾	X
SMG	-	SMU03B31 ²⁾	X
SMGL	-	SMU04 ²⁾	X
SMGU	-	SMU04B31 ²⁾	X
SMH	-	SMU06 ²⁾	X
SMHU	-	SMU06B31 ²⁾	X
SMIQ02	X	SMV03	-
SMIQ02B	X	SMW03	-
SMIQ02E	-	SMW06	-
SMIQ03	X	SMX	-
SMIQ03B	X	SMY01	-
1) Requires firmware version V2.10.x or higher 2) Requires firmware version V1.10.x or higher 3) Requires the option SMR-B11			

Generator type	TTL support	Generator type	TTL support
SMIQ03E	-	SMY02	-
SMIQ04B	X	HP8254A	-
SMIQ06B	X	HP8257D	-
SMJ03	X	HP8340A	-
SMJ06	X	HP8648	-
SML01	-	HP ESG-A Series 1000A, 2000A, 3000A, 4000A	-
SML02	-	HP ESG B Sereies	-
SML03	-	HP ESG-D SERIES E4432B	-
1) Requires firmware version V2.10.x or higher 2) Requires firmware version V1.10.x or higher 3) Requires the option SMR-B11			

4.7.4.3 Generator Setup Files

For each signal generator type to be controlled by the R&S FSW a generator setup file must be configured and stored on the R&S FSW. The setup file defines the frequency and power ranges supported by the generator, as well as information required for communication. For the signal generators listed in [chapter 4.7.4.2, "Overview of Generators Supported by the R&S FSW-B10 Option"](#), on page 38, default setup files are provided. If necessary, these files can be edited or duplicated for varying measurement setups or other instruments.

The existing setup files can be displayed in an editor in read-only mode directly from the "External Generator" configuration dialog box. From there, they can be edited and stored under a different name, and are then available on the R&S FSW.

(For details see the R&S FSW User Manual).

4.7.4.4 Calibration Mechanism

A common measurement setup includes a signal generator, a device under test (DUT), and a signal and spectrum analyzer. Therefore, it is useful to measure the attenuation or gain caused by the cables and connectors from the signal generator and the signal analyzer in advance. The known level offsets can then be removed from the measurement results in order to obtain accurate information on the DUT.

Calculating the difference between the currently measured power and a reference trace is referred to as *calibration*. Thus, the measurement results from the controlled external generator - including the inherent distortions - can be used as a reference trace to calibrate the measurement setup.

The inherent frequency and power level distortions can be determined by connecting the R&S FSW to the signal generator. The R&S FSW sends a predefined list of frequencies to the signal generator (see also [chapter 4.7.4.7, "Coupling the Frequencies"](#),

on page 43). The signal generator then sends a signal with the specified level at each frequency in the predefined list. The R&S FSW measures the signal and determines the level offsets to the expected values.

Saving calibration results

A reference dataset for the calibration results is stored internally as a table of value pairs (frequency/level), one for each sweep point. The measured offsets can then be used as calibration factors for subsequent measurement results.

The calibration can be performed using either transmission or reflection measurements. The selected type of measurement used to determine the reference trace is included in the reference dataset.

4.7.4.5 Normalization

Once the measurement setup has been calibrated and the reference trace is available, subsequent measurement results can be corrected according to the calibration factors, if necessary. This is done by subtracting the reference trace from the measurement results. This process is referred to as *normalization* and can be activated or deactivated as required. If normalization is activated, "NOR" is displayed in the channel bar, next to the indication that an external generator is being used ("Ext.Gen"). The normalized trace from the calibration sweep is a constant 0 dB line, as $\langle \text{calibration trace} \rangle - \langle \text{reference trace} \rangle = 0$.

As long as the same settings are used for measurement as for calibration, the normalized measurement results should not contain any inherent frequency or power distortions. Thus, the measured DUT values are very accurate.

Approximate normalization

As soon as any of the calibration measurement settings are changed, the stored reference trace will no longer be identical to the new measurement results. However, if the measurement settings do not deviate too much, the measurement results can still be normalized *approximately* using the stored reference trace. This is indicated by the "APX" label in the channel bar (instead of "NOR").

This is the case if one or more of the following values deviate from the calibration settings:

- coupling (RBW, VBW, SWT)
- reference level, RF attenuation
- start or stop frequency
- output level of external generator
- detector (max. peak, min. peak, sample, etc.)
- frequency deviation at a maximum of 1001 points within the set sweep limits (corresponds to a doubling of the span)

Differences in level settings between the reference trace and the current instrument settings are taken into account automatically. If the span is reduced, a linear interpolation of the intermediate values is applied. If the span increases, the values at the left or

right border of the reference dataset are extrapolated to the current start or stop frequency, i.e. the reference dataset is extended by constant values.

Thus, the instrument settings can be changed in a wide area without giving up normalization. This reduces the necessity to carry out a new normalization to a minimum.

If approximation becomes too poor, however, normalization is aborted and an error message is displayed (see [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46).

The normalized trace in the display

The normalized reference trace is also displayed in the spectrum diagram, by default at the top of the diagram (= 100% of the window height). It is indicated by a red line labeled "NOR", followed by the current reference value. However, it can be shifted vertically to reflect an attenuation or gain caused by the measured DUT (see also ["Shifting the reference line \(and normalized trace\)"](#) on page 43).

Restoring the calibration settings

If the measurement settings no longer match the instrument settings with which the calibration was performed (indicated by the "APX" or no label next to "Ext.TG" in the channel bar), you can restore the calibration settings, which are stored with the reference dataset on the R&S FSW.

Storing the normalized reference trace as a transducer factor

The (inverse) normalized reference trace can also be stored as a *transducer factor* for use in other R&S FSW applications that do not support external generator control. The normalized trace data is converted to a transducer with unit dB and stored in a file with the specified name and the suffix `.trd` under `c:\r_s\instr\trd`. The frequency points are allocated in equidistant steps between the start and stop frequency.

This is useful, for example, to determine the effects of a particular device component and then remove these effects from a subsequent measurement which includes this component.

For an example see the "External Generator Control: Measurement Examples" section in the R&S FSW User Manual.



Note that the *normalized* measurement data is stored, not the original *reference* trace! Thus, if you store the normalized trace directly after calibration, without changing any settings, the transducer factor will be 0 dB for the entire span (by definition of the normalized trace).

4.7.4.6 Reference Trace, Reference Line and Reference Level

Reference trace

The calibration results are stored internally on the R&S FSW as a *reference trace*. For each measured sweep point the offset to the expected values is determined. If normali-

zation is activated, the offsets in the reference trace are removed from the current measurement results to compensate for the inherent distortions.

Reference line

The reference line is defined by the [Reference Value](#) and [Reference Position](#) in the "External Generator" > "Source Calibration" settings. It is similar to the [Reference Level](#) defined in the "Amplitude" settings. However, as opposed to the reference *level*, this reference *line* only affects the y-axis scaling in the diagram, it has no effect on the expected input power level or the hardware settings.

The reference line determines the range and the scaling of the y-axis, just as the reference level does.

The normalized reference trace (0 dB directly after calibration) is displayed on this reference line, indicated by a red line in the diagram. By default, the reference line is displayed at the top of the diagram. If you shift the reference line, the normalized trace is shifted, as well.

Shifting the reference line (and normalized trace)

You can shift the reference line - and thus the normalized trace - in the result display by changing the [Reference Position](#) or the [Reference Value](#).

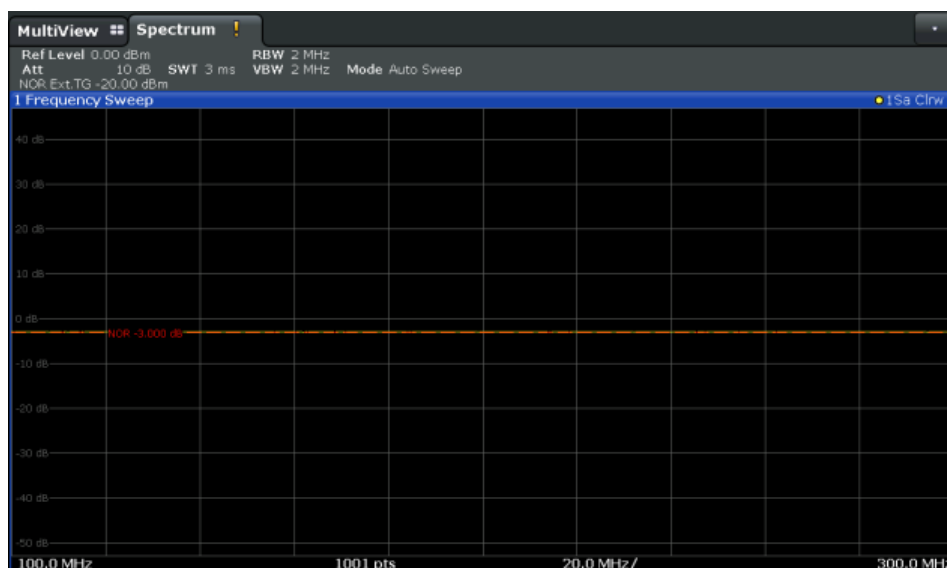


Fig. 4-7: Shifted reference line

If the DUT inserts a gain or an attenuation in the measurement, this effect can be reflected in the result display on the R&S FSW. To reflect a power offset in the measurement trace, change the [Reference Value](#).

4.7.4.7 Coupling the Frequencies

As described in [chapter 4.7.4.5, "Normalization"](#), on page 41, normalized measurement results are very accurate *as long as the same settings are used as for calibration*. Although approximate normalization is possible, it is important to consider the required

frequencies for calibration in advance. The frequencies and levels supported by the connected signal generator are provided for reference with the interface configuration.

Two different methods are available to define the frequencies for calibration, that is to couple the frequencies of the R&S FSW with those of the signal generator:

- **Manual coupling:** a single frequency is defined
- **Automatic coupling:** a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSW; the RF frequency range covers the currently defined span of the R&S FSW (unless limited by the range of the signal generator)

Automatic coupling

If automatic coupling is used, the output frequency of the generator (source frequency) is calculated as follows:

$$\text{Source Freq} = \text{RF} \cdot \frac{\text{Numerator}}{\text{Denominator}} + \text{Offset}$$

Output frequency of the generator (4 - 1)

where:

$F_{\text{Generator}}$ = output frequency of the generator

F_{Analyzer} = current frequency at the RF input of the R&S FSW

Numerator = multiplication factor for the current analyzer frequency

Denominator = division factor for the current analyzer frequency

F_{Offset} = frequency offset for the current analyzer frequency, for example for frequency-converting measurements or harmonics measurements

The value range for the offset depends on the selected generator. The default setting is 0 Hz. Offsets other than 0 Hz are indicated by the "FRQ" label in the channel bar (see also [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46).

Swept frequency range

The F_{Analyzer} values for the calibration sweep start with the start frequency and end with the stop frequency defined in the "Frequency" settings of the R&S FSW. The resulting output frequencies ([Result Frequency Start](#) and [Result Frequency Stop](#)) are displayed in the "External Generator" > "Measurement Configuration" for reference.

If the resulting frequency range exceeds the allowed ranges of the signal generator, an error message is displayed (see [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46) and the [Result Frequency Start](#) and [Result Frequency Stop](#) values are corrected to comply with the range limits.



The calibration sweep nevertheless covers the entire span defined by the R&S FSW; however, no input is received from the generator outside the generator's defined limits.

TTL synchronization

Some Rohde & Schwarz signal generators support TTL synchronization when connected via GPIB. The TTL interface is included in the AUX CONTROL connector of the R&S FSW-B10 option.

When pure GPIB connections are used between the R&S FSW and the signal generator, the R&S FSW sets the generator frequency for each frequency point individually via GPIB, and only when the setting procedure is finished, the R&S FSW can measure the next sweep point.

For generators with a TTL interface, the R&S FSW sends a list of the frequencies to be set to the generator before the beginning of the first sweep. Then the R&S FSW starts the sweep and the next frequency point is selected by both the R&S FSW and the generator using the TTL handshake line "TRIGGER". The R&S FSW can only measure a value when the generator signals the end of the setting procedure via the "BLANK" signal.

Using the TTL interface allows for considerably higher measurement rates than pure GPIB control, because the frequency stepping of the R&S FSW is directly coupled with the frequency stepping of the generator.

Reverse sweep

The frequency offset for automatic coupling can be used to sweep in the reverse direction. To do so, define a negative offset in the external generator measurement configuration. (Note that the frequency is defined as the unsigned value of the equation, thus a negative frequency is not possible.)

Example: Example for reverse sweep

$$F_{\text{AnalyzerStart}} = 100 \text{ MHz}$$

$$F_{\text{AnalyzerStop}} = 200 \text{ MHz}$$

$$F_{\text{Offset}} = -300 \text{ MHz}$$

$$\text{Numerator} = \text{Denominator} = 1$$

$$\rightarrow F_{\text{GeneratorStart}} = 200 \text{ MHz}$$

$$\rightarrow F_{\text{GeneratorStop}} = 100 \text{ MHz}$$

If the offset is adjusted so that the sweep of the generator crosses the minimum generator frequency, a message is displayed in the status bar ("Reverse Sweep via min. Ext. Generator Frequency!").

Example: Example for reverse sweep via minimum frequency

$$F_{\text{AnalyzerStart}} = 100 \text{ MHz}$$

$$F_{\text{AnalyzerStop}} = 200 \text{ MHz}$$

$$F_{\text{Offset}} = -150 \text{ MHz}$$

$$F_{\text{min}} = 20 \text{ MHz}$$

$$\text{Numerator} = \text{Denominator} = 1$$

$$\rightarrow F_{\text{GeneratorStart}} = 50 \text{ MHz}$$

$$\rightarrow F_{\text{GeneratorStop}} = 50 \text{ MHz via } F_{\text{min}}$$

4.7.4.8 Displayed Information and Errors**Channel bar**

If external generator control is active, some additional information is displayed in the channel bar.

Label	Description
EXT TG: <source power>	External generator active; signal sent with <source power> level
LVL	Power Offset (see " Source Offset " on page 76)
FRQ	Frequency Offset (see " (Automatic) Source Frequency (Numerator/Denominator/Offset) " on page 77)
NOR	Normalization on; No difference between reference setting and measurement
APX (approximation)	Normalization on; Deviation from the reference setting occurs
-	Aborted normalization or no calibration performed yet

Error and status messages

The following status and error messages may occur during external generator control.

Message	Description
"Ext. Generator GPIB Handshake Error!" / "Ext. Generator TCPIP Handshake Error!" / "Ext. Generator TTL Handshake Error!"	Connection to the generator is not possible, e.g. due to a cable damage or loose connection or wrong address.
"Ext. Generator Limits Exceeded!"	The allowed frequency or power ranges for the generator were exceeded.
"Reverse Sweep via min. Ext. Generator Frequency!"	Reverse sweep is performed; frequencies are reduced to the minimum frequency, then increased again; see " Reverse sweep " on page 45
"Ext. Generator File Syntax Error!"	Syntax error in the generator setup file (see chapter 4.7.4.3, "Generator Setup Files" , on page 40)

Message	Description
"Ext. Generator Command Error!"	Missing or wrong command in the generator setup file (see chapter 4.7.4.3, "Generator Setup Files" , on page 40)
"Ext. Generator Visa Error!!"	Error with Visa driver provided with installation (very unlikely)

NOTICE

Overloading

At a reference level of -10 dBm and at an external generator output level of the same value, the R&S FSW operates without overrange reserve. That means the R&S FSW is in danger of being overloaded if a signal is applied whose amplitude is higher than the reference level. In this case, either the message "RF OVLD" for overload or "IF OVLD" for exceeded display range (clipping of the trace at the upper diagram border = overrange) is displayed in the status line.

Overloading can be avoided as follows:

- Reducing the output level of the external generator ("[Source Power](#)" on page 76 in "External Generator > Measurement Configuration")
- Increasing the reference level ([Reference Level](#) in the "Amplitude" menu)

4.7.5 Input from Noise Sources

The R&S FSW provides a connector (NOISE SOURCE CONTROL) with a voltage supply for an external noise source. By switching the supply voltage for an external noise source on or off in the firmware, you can activate or deactivate the device as required.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the R&S FSW itself, for example when measuring the noise level of an amplifier.

In this case, you can first connect an external noise source (whose noise power level is known in advance) to the R&S FSW and measure the total noise power. From this value you can determine the noise power of the R&S FSW. Then when you measure the power level of the actual DUT, you can deduct the known noise level from the total power to obtain the power level of the DUT.

The noise source is controlled in the "Output" settings, see "[Noise Source](#)" on page 122

4.7.6 Receiving and Providing Trigger Signals

Using one of the variable TRIGGER INPUT/OUTPUT connectors of the R&S FSW, the R&S FSW can use a signal from an external reference as a trigger to capture data. Alternatively, the internal trigger signal used by the R&S FSW can be output for use by

other connected devices. Using the same trigger on several devices is useful to synchronize the transmitted and received signals within a measurement.

For details on the connectors see the R&S FSW "Getting Started" manual.

External trigger as input

If the trigger signal for the R&S FSW is provided by an external reference, the reference signal source must be connected to the R&S FSW and the trigger source must be defined as "External" on the R&S FSW.

Trigger output

The R&S FSW can send output to another device either to pass on the internal trigger signal, or to indicate that the R&S FSW itself is ready to trigger.

The trigger signal can be output by the R&S FSW automatically, or manually by the user. If it is sent automatically, a high signal is output when the R&S FSW has triggered due to a sweep start ("Device Triggered"), or when the R&S FSW is ready to receive a trigger signal after a sweep start ("Trigger Armed").

Manual triggering

If the trigger output signal is initiated manually, the length and level (high/low) of the trigger pulse is also user-definable. Note, however, that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.



Providing trigger signals as output is described in detail in the R&S FSW User Manual.

4.8 Analog Demodulation in MSRA/MSRT Operating Mode

The Analog Demodulation application can also be used to analyze data in MSRA or MSRT operating mode. The main difference between the two modes is that in MSRA mode, an I/Q analyzer performs data acquisition, while in MSRT mode, a realtime measurement is performed to capture data.

In MSRA/MSRT operating mode, only the MSRA/MSRT Master actually captures data; the data acquisition settings for an Analog Demodulation application channel in MSRA/MSRT mode configure the **analysis interval**, not an actual data capture from the input signal.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for Analog Demodulation.

The currently used analysis interval (in seconds, related to measurement start) is indicated in the window header for each result display.

Analysis line

A frequent question when analyzing multi-standard signals is how each data channel is correlated (in time) to others. Thus, an analysis line has been introduced. The analysis line is a common time marker for all MSRA applications. It can be positioned in any MSRA application or the MSRA Master and is then adjusted in all other applications. Thus, you can easily analyze the results at a specific time in the measurement in all applications and determine correlations.

If the marked point in time is contained in the analysis interval of the application, the line is indicated in all time-based result displays, such as time, symbol, slot or bit diagrams. By default, the analysis line is displayed, however, it can be hidden from view manually. In all result displays, the "AL" label in the window title bar indicates whether or not the analysis line lies within the analysis interval or not:

- **orange "AL"**: the line lies within the interval
- **white "AL"**: the line lies within the interval, but is not displayed (hidden)
- **no "AL"**: the line lies outside the interval



For details on the MSRA operating mode see the R&S FSW MSRA User Manual. For details on the MSRT operating mode see the R&S FSW Realtime Spectrum Application and MSRT Operating Mode User Manual.

5 Configuration

Analog demodulation measurements require a special application on the R&S FSW, which you activate using the MODE key on the front panel.

When you activate an Analog Demodulation application the first time, a set of parameters is passed on from the currently active application (see [chapter 5.1, "Default Settings for Analog Demodulation"](#), on page 50). After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

When you activate the Analog Demodulation application, a Analog Demodulation measurement for the input signal is started automatically with the default configuration. It can be configured in the Analog Demodulation "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu.



The main configuration settings and dialog boxes are also available via the "Analog Demod" menu which is displayed when you press the MEAS CONFIG key.

The remote commands required to perform these tasks are described in [chapter 11, "Remote Commands for Analog Demodulation Measurements"](#), on page 170.

Predefined settings

For commonly performed measurements, standard setup files are provided for quick and easy configuration. Simply load an existing standard settings file and, if necessary, adapt the measurement settings to your specific requirements.

For an overview of predefined standards and settings see [chapter A.1, "Predefined Standards and Settings"](#), on page 345.

• Default Settings for Analog Demodulation	50
• Configuration According to Digital Standards	51
• Configuration Overview	53
• Input and Frontend Settings	55
• Trigger Configuration	94
• Data Acquisition	101
• Demodulation Display	106
• Demodulation	106
• Output Settings	121
• Automatic Settings	126

5.1 Default Settings for Analog Demodulation

When you activate the Analog Demodulation application the first time, a set of parameters is passed on from the currently active application:

- center frequency and frequency offset
- reference level and reference level offset

- attenuation
- preamplification
- signal source and digital I/Q input settings
- input coupling
- external mixer

After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

Apart from these settings, the following default settings are activated directly after the Analog Demodulation application is activated, or after a [Preset Channel](#):

Table 5-1: Default settings for Analog Demodulation channels

Parameter	Value
Sweep mode	CONTINUOUS
Trigger settings	FREE RUN
Trigger offset	0
Demodulation BW	5 MHz
Measurement time	62.5 µs
Demodulation filter	Flat
AF filters	none
Sample rate	8 MHz
Sweep points	1001
Squelch state	off
Squelch level	-20.0 dBm
Usable I/Q Bandwidth	12.228 MHz
Traces	1: Clr/Wrte, Auto Peak detector; 2-6: blank
Limit check	off
Evaluations	Window 1: FM Time Domain Window 2: Result Summary

5.2 Configuration According to Digital Standards

Various predefined settings files for common digital standards are provided for use with the Analog Demodulation application. In addition, you can create your own settings files for user-specific measurements.

For details on which settings are defined and an overview of predefined standards see [chapter A.1, "Predefined Standards and Settings"](#), on page 345.

Digital standard settings are available via the "Digital Standards" softkey in the MEAS menu or the "Overview".

Setup Standard.....	52
L Selecting the Storage Location - Drive/ Path/ Files.....	52
L File Name.....	52
L Load Standard.....	53
L Save Standard.....	53
L Delete Standard.....	53
L Restore Standard Files.....	53

Setup Standard

Opens a file selection dialog box to select a predefined setup file. The predefined settings are configured in the R&S FSW Analog Demodulation application. This allows for quick and easy configuration for commonly performed measurements.

Selecting the Storage Location - Drive/ Path/ Files ← Setup Standard

Select the storage location of the settings file on the instrument or an external drive.

The "Drive" indicates the internal (C:) or any connected external drives (e.g. a USB storage device).

The "Path" contains the drive and the complete file path to the currently selected folder.

The "Files" list contains all subfolders and files of the currently selected path.

The default storage location for the settings files is: C:/FSW/user/predefined/AdemodPredefined.

Note: Saving instrument settings in secure user mode.

In secure user mode all data is stored to volatile memory, and is only available during the current instrument session. As soon as the power is switched off on the R&S FSW, the data is cleared.

To store settings 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 FSW User Manual.

File Name ← Setup Standard

Contain the name of the data file without the path or extension.

For details on the file name and location see the "Data Management" topic in the R&S FSW User Manual.

Note: Secure user mode. In secure user mode, settings that are to be stored on the instrument are stored to volatile memory. 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 FSW User Manual.

Load Standard ← Setup Standard

Loads the selected measurement settings file.

Remote command:

[SENSe:]ADEMod:PRESet[:STANdard] on page 180

Save Standard ← Setup Standard

Saves the current measurement settings for a specific standard as a file with the defined name.

Remote command:

[SENSe:]ADEMod:PRESet:STORe on page 181

Delete Standard ← Setup Standard

Deletes the selected standard. Standards predefined by Rohde & Schwarz can also be deleted. A confirmation query is displayed to avoid unintentional deletion of the standard.

Note: Restoring predefined standard files. The standards predefined by Rohde & Schwarz available at the time of delivery can be restored using the "Restore Standards" softkey.

(See "Restore Standard Files" on page 53).

Restore Standard Files ← Setup Standard

Restores the standards predefined by Rohde & Schwarz available at the time of delivery.

Note that this function will overwrite customized standards that have the same name as predefined standards.

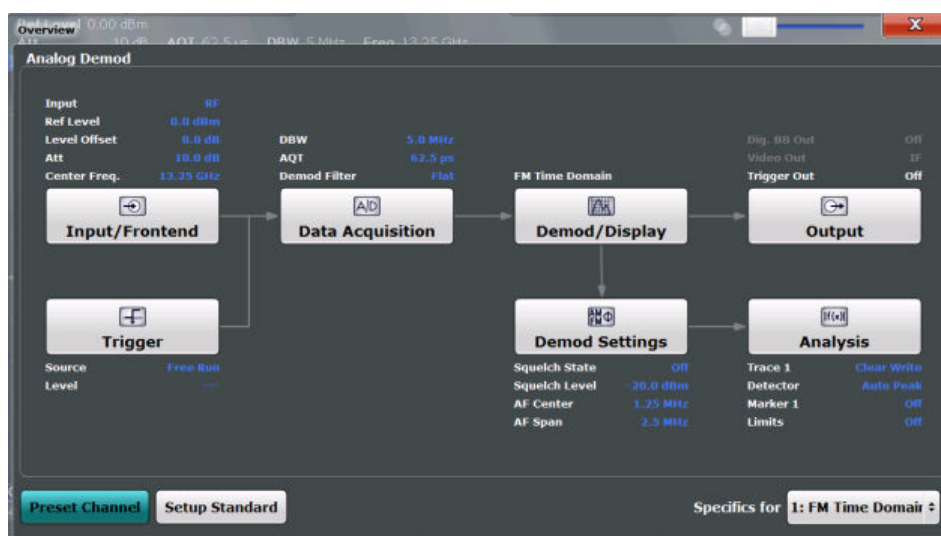
Remote command:

[SENSe:]ADEMod:PRESet:RESTore on page 181

5.3 Configuration Overview



Throughout the measurement 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 at the bottom of all softkey menus.



In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire Analog Demodulation measurement channel from input over processing to output and analysis by stepping through the dialog boxes as indicated in the "Overview".

In particular, the "Overview" provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

1. Input/Frontend
See [chapter 5.4, "Input and Frontend Settings"](#), on page 55
2. Trigger
See [chapter 5.5, "Trigger Configuration"](#), on page 94
3. Data Acquisition
See [chapter 5.6, "Data Acquisition"](#), on page 101
4. Demod/Display
See [chapter 5.7, "Demodulation Display"](#), on page 106
5. Demodulation Settings
See [chapter 5.8, "Demodulation"](#), on page 106
6. Analysis
See [chapter 6, "Analysis"](#), on page 129
7. (Optionally:) Outputs
See [chapter 5.9.1, "Output Settings"](#), on page 121

To configure settings

- ▶ Select any button in the "Overview" to open the corresponding dialog box. Select a setting in the channel bar (at the top of the measurement channel tab) to change a specific setting.

Preset Channel

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

Note that the PRESET key on the front panel restores the entire instrument to its default values and thus closes **all measurement channels** on the R&S FSW (except for the default Spectrum application channel)!

For details see [chapter 5.1, "Default Settings for Analog Demodulation"](#), on page 50.

Remote command:

`SYSTem:PRESet:CHANnel[:EXECute]` on page 179

Setup Standard

Opens a file selection dialog box to select a predefined setup file. See ["Setup Standard"](#) on page 52.

Specifics for

The measurement channel may contain several windows for different results. Thus, the settings indicated in the "Overview" and configured in the dialog boxes vary depending on the selected window.

Select an active window from the "Specifics for" selection list that is displayed in the "Overview" and in all window-specific configuration dialog boxes.

The "Overview" and dialog boxes are updated to indicate the settings for the selected window.

5.4 Input and Frontend Settings

The source and characteristics of the input signal to be demodulated are configured in the "Input and Frontend Settings" dialog box.

For background information on working with power sensors, see the R&S FSW User Manual.

► To display this dialog box, do one of the following:

- Select the "Input/Frontend" button in the Analog Demodulation "Overview"
- Select the INPUT/OUTPUT key and then the "Input Source Config" softkey.
- Select the INPUT/OUTPUT key and then the "Power Sensor Config" softkey.

● Input Source Settings	55
● Power Sensor	81
● Amplitude	85
● Frequency	92

5.4.1 Input Source Settings

The input source determines which data the R&S FSW will analyze.

Input settings can be configured in the "Input" dialog box.

Some settings are also available in the "Amplitude" tab of the "Amplitude" dialog box.

Since the Digital I/Q input and the Analog Baseband input use the same digital signal path, both cannot be used simultaneously. When one is activated, established connections for the other are disconnected. When the second input is deactivated, connections to the first are re-established. This may cause a short delay in data transfer after switching the input source.

External mixers are not supported in MSRA/MSRT mode.

- [Radio Frequency Input](#)..... 56
- [External Mixer Settings](#)..... 58
- [Digital I/Q Input Settings](#)..... 69
- [Analog Baseband Input Settings](#)..... 71
- [Probe Settings](#)..... 72
- [External Generator Control Settings](#)..... 73

5.4.1.1 Radio Frequency Input

The default input source for the R&S FSW is "Radio Frequency", i.e. the signal at the RF INPUT connector on the front panel of the R&S FSW. If no additional options are installed, this is the only available input source.



- [Radio Frequency State](#)..... 56
- [Input Coupling](#)..... 56
- [Impedance](#)..... 57
- [High-Pass Filter 1...3 GHz](#)..... 57
- [YIG-Preselector](#)..... 57
- [Input Connector](#)..... 58

Radio Frequency State

Activates input from the RF INPUT connector.

Remote command:

`INPut:SElect` on page 184

Input Coupling

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

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17) or from the Analog Baseband Interface (R&S FSW-B71).

AC coupling blocks any DC voltage from the input signal. This is the default setting to prevent damage to the instrument. Very low frequencies in the input signal may 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:COUPling` on page 182

Impedance

The reference impedance for the measured levels of the R&S FSW can be set to 50 Ω or 75 Ω .

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

This value also affects the unit conversion (see "Reference Level" on page 86).

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17) or from the Analog Baseband Interface (R&S FSW-B71). For analog baseband input, an impedance of 50 Ω is always used.

Remote command:

`INPut:IMPedance` on page 183

High-Pass Filter 1...3 GHz

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 R&S FSW in order to measure the harmonics for a DUT, for example.

This function requires option R&S FSW-B13.

(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 filter.)

Remote command:

`INPut:FILTer:HPASs[:STATe]` on page 183

YIG-Preselector

Activates or deactivates the YIG-preselector.

An internal YIG-preselector at the input of the R&S FSW ensures that image frequencies are rejected. However, this is only possible for a restricted bandwidth. In order to use the maximum bandwidth for signal analysis you can deactivate the YIG-preselector at the input of the R&S FSW, which may lead to image-frequency display.

Note that the YIG-preselector is active only on frequencies greater than 8 GHz. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

Remote command:

`INPut:FILTer:YIG[:STATe]` on page 183

Input Connector

Determines whether the RF input data is taken from the RF INPUT connector (default) or the optional BASEBAND INPUT I connector. This setting is only available if the Analog Baseband Interface (R&S FSW-B71) is installed and active for input. It is not available for the R&S FSW67.

For more information on the Analog Baseband Interface (R&S FSW-B71) see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

`INPut:CONNector` on page 182

5.4.1.2 External Mixer Settings

The external mixer is configured in the "External Mixer" tab of the "Input" dialog box which is available when you do one of the following, if the R&S FSW-B21 option is installed:

- Press the INPUT/OUTPUT key, then select the "External Mixer Config" softkey.
- From the "Overview", select "Input", then switch to the "External Mixer" tab under "Input Source".

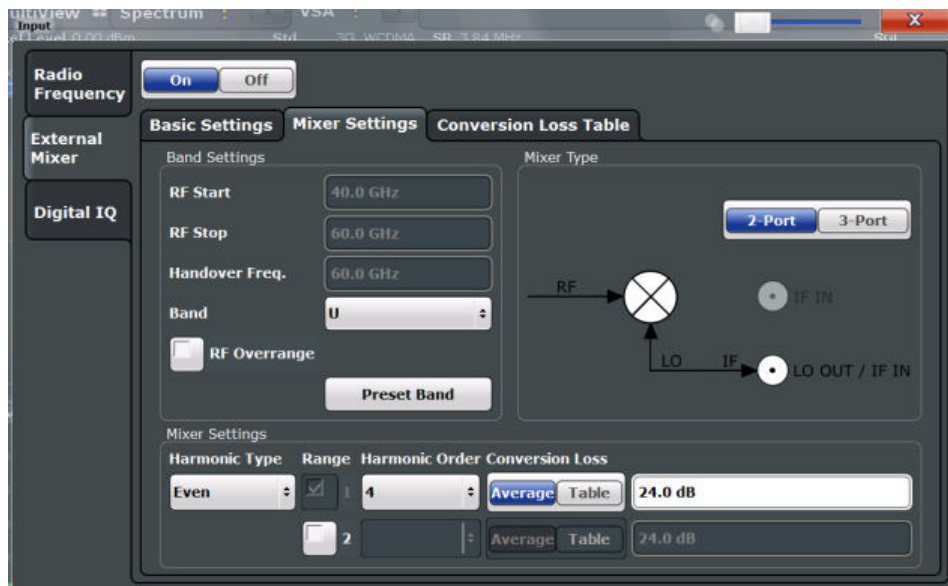
Note that external mixers are not supported in MSRA/MSRT mode.

For details on using external mixers see the R&S FSW User Manual.

• Mixer Settings	58
• Basic Settings	62
• Managing Conversion Loss Tables	64
• Creating and Editing Conversion Loss Tables	65

Mixer Settings

In this tab you configure the band and specific mixer settings.



External Mixer State.....59

RF Start / RF Stop.....59

Handover Freq.....60

Band.....60

RF Overrange.....60

Preset Band.....60

Mixer Type.....60

Mixer Settings (Harmonics Configuration).....60

- └ Harmonic Type.....61
- └ Range 1/2.....61
- └ Harmonic Order.....61
- └ Conversion loss.....61

External Mixer State

Activates or deactivates the external mixer for input. If activated, "ExtMix" is indicated in the channel bar of the application, together with the used band (see "Band" on page 60).

Remote command:

[SENSe:]MIXer[:STATe] on page 185

RF Start / RF Stop

Displays the start and stop frequency of the selected band (read-only).

The frequency range for the user-defined band is defined via the harmonics configuration (see "Range 1/2" on page 61).

For details on available frequency ranges see table 11-2.

Remote command:

[SENSe:]MIXer:FREquency:START? on page 187

[SENSe:]MIXer:FREquency:STOP? on page 187

Handover Freq.

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

Remote command:

`[SENSe:]MIXer:FREQuency:HANDOver` on page 187

Band

Defines the waveguide band or user-defined band to be used by the mixer.

The start and stop frequencies of the selected band are displayed in the "RF Start" and "RF Stop" fields.

For a definition of the frequency range for the pre-defined bands, see [table 11-2](#)).

The mixer settings for the user-defined band can be selected freely. The frequency range for the user-defined band is defined via the harmonics configuration (see "[Range 1/2](#)" on page 61).

Remote command:

`[SENSe:]MIXer:HARMonic:BAND[:VALue]` on page 188

RF Overrange

If enabled, the frequency range is not restricted by the band limits ("RF Start" and "RF Stop"). In this case, the full LO range of the selected harmonics is used.

Remote command:

`[SENSe:]MIXer:RFOVerrange[:STATe]` on page 191

Preset Band

Restores the presettings for the selected band.

Note: changes to the band and mixer settings are maintained even after using the PRESET function. This function allows you to restore the original band settings.

Remote command:

`[SENSe:]MIXer:HARMonic:BAND:PRESet` on page 188

Mixer Type

The R&S FSW option B21 supports the following external mixer types:

"2 Port" LO and IF data use the same port

"3 Port" LO and IF data use separate ports

Remote command:

`[SENSe:]MIXer:PORTs` on page 191

Mixer Settings (Harmonics Configuration)

The harmonics configuration determines the frequency range for user-defined bands (see "[Band](#)" on page 60).

Harmonic Type ← Mixer Settings (Harmonics Configuration)

Defines if only even, only odd, or even and odd harmonics can be used for conversion. Depending on this selection, the order of harmonic to be used for conversion changes (see "Harmonic Order" on page 61). Which harmonics are supported depends on the mixer type.

Remote command:

[SENSe:]MIXer:HARMonic:TYPE on page 189

Range 1/2 ← Mixer Settings (Harmonics Configuration)

Enables the use of a second harmonic to cover the band's frequency range.

For each range you can define which harmonic to use and how the Conversion loss is handled.

Remote command:

[SENSe:]MIXer:HARMonic:HIGH:STATe on page 189

Harmonic Order ← Mixer Settings (Harmonics Configuration)

Defines which of the available harmonic orders of the LO is used to cover the frequency range.

By default, the lowest order of the specified harmonic type is selected that allows conversion of input signals in the whole band. If due to the LO frequency the conversion is not possible using one harmonic, the band is split.

For the band "USER", the order of harmonic is defined by the user. The order of harmonic can be between 2 and 61, the lowest usable frequency being 26.5 GHz.

Remote command:

[SENSe:]MIXer:HARMonic[:LOW] on page 189

[SENSe:]MIXer:HARMonic:HIGH[:VALue] on page 189

Conversion loss ← Mixer Settings (Harmonics Configuration)

Defines how the conversion loss is handled. The following methods are available:

"Average" Defines the average conversion loss for the entire range in dB.

"Table" Defines the conversion loss via the table selected from the list. Pre-defined conversion loss tables are often provided with the external mixer and can be imported to the R&S FSW. Alternatively, you can define your own conversion loss tables. Imported tables are checked for compatibility with the current settings before being assigned. Conversion loss tables are configured and managed in the [Managing Conversion Loss Tables](#) tab. For details on conversion loss tables, see the External Mixer description in the R&S FSW User Manual. For details on importing tables, see ["Import Table"](#) on page 65.

Remote command:

Average for range 1:

`[SENSe:]MIXer:LOSS[:LOW]` on page 190

Table for range 1:

`[SENSe:]MIXer:LOSS:TABLE[:LOW]` on page 190

Average for range 2:

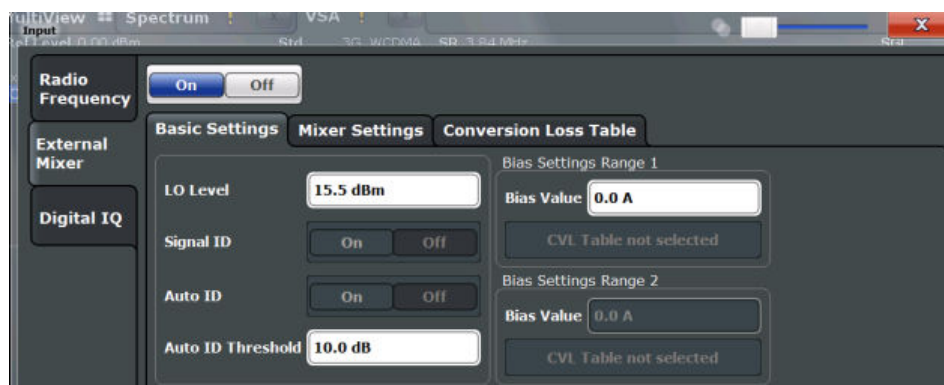
`[SENSe:]MIXer:LOSS:HIGH` on page 190

Table for range 2:

`[SENSe:]MIXer:LOSS:TABLE:HIGH` on page 190

Basic Settings

The basic settings concern general use of an external mixer. They are only available if the [External Mixer State](#) is "On".



LO Level	62
Signal ID	63
Auto ID	63
Auto ID Threshold	63
Bias Settings	63
↳ Write to <CVL table name>	64

LO Level

Defines the LO level of the external mixer's LO port. Possible values are from 13.0 dBm to 17.0 dBm in 0.1 dB steps. Default value is 15.5 dB.

Remote command:

`[SENSe:]MIXer:LOPower` on page 185

Signal ID

Activates or deactivates visual signal identification. Two sweeps are performed alternately. Trace 1 shows the trace measured on the upper side band (USB) of the LO (the test sweep), trace 2 shows the trace measured on the lower side band (LSB), i.e. the reference sweep.

Note that automatic signal identification is only available for measurements that perform frequency sweeps (not in vector signal analysis or the I/Q Analyzer, for instance).

Mathematical functions with traces and trace copy cannot be used with the Signal ID function.

Remote command:

[\[SENSe:\]MIXer:SIGNal](#) on page 186

Auto ID

Activates or deactivates automatic signal identification.

Auto ID basically functions like [Signal ID](#). However, the test and reference sweeps are converted into a single trace by a comparison of maximum peak values of each sweep point. The result of this comparison is displayed in trace 3 if "Signal ID" is active at the same time. If "Signal ID" is not active, the result can be displayed in any of the traces 1 to 3. Unwanted mixer products are suppressed in this calculated trace.

Note that automatic signal identification is only available for measurements that perform frequency sweeps (not in vector signal analysis or the I/Q Analyzer, for instance).

Remote command:

[\[SENSe:\]MIXer:SIGNal](#) on page 186

Auto ID Threshold

Defines the maximum permissible level difference between test sweep and reference sweep to be corrected during automatic comparison ("[Auto ID](#)" on page 63 function). The input range is between 0.1 dB and 100 dB. Values of about 10 dB (i.e. default setting) generally yield satisfactory results.

Remote command:

[\[SENSe:\]MIXer:THReshold](#) on page 186

Bias Settings

Define the bias current for each range, which is required to set the mixer to its optimum operating point. It corresponds to the short-circuit current. The bias current can range from -10 mA to 10 mA. The actual bias current is lower because of the forward voltage of the mixer diode(s).

The trace is adapted to the settings immediately so you can check the results. To store the bias setting in the currently selected conversion loss table, select the [Write to <CVL table name>](#) button.

Remote command:

[\[SENSe:\]MIXer:BIAS\[:LOW\]](#) on page 185

[\[SENSe:\]MIXer:BIAS:HIGH](#) on page 185

Write to <CVL table name> ← Bias Settings

Stores the bias setting in the currently selected "Conversion loss table" for the range (see "[Managing Conversion Loss Tables](#)" on page 64). If no conversion loss table is selected yet, this function is not available ("CVL Table not selected").

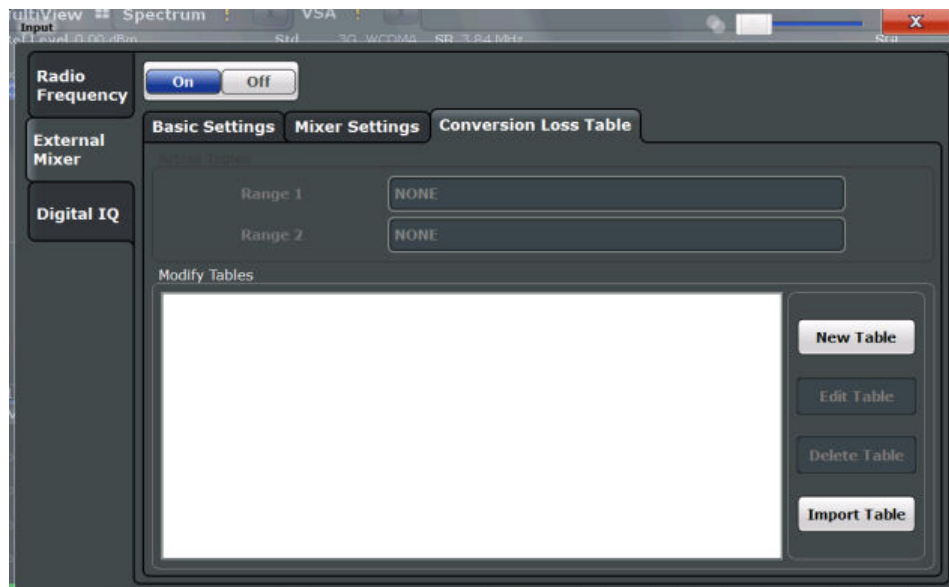
Remote command:

[SENSe:]CORRection:CVL:BIAS on page 192

Managing Conversion Loss Tables

In this tab you configure and manage conversion loss tables. Conversion loss tables consist of value pairs that describe the correction values for conversion loss at certain frequencies. The correction values for frequencies between the reference points are obtained via interpolation.

The currently selected table for each range is displayed at the top of the dialog box. All conversion loss tables found in the instrument's C:\r_s\instr\user\cvl\ directory are listed in the "Modify Tables" list.



New Table	64
Edit Table	65
Delete Table	65
Import Table	65

New Table

Opens the "Edit Conversion loss table" dialog box to configure a new conversion loss table. For details on table configuration see "[Creating and Editing Conversion Loss Tables](#)" on page 65.

Remote command:

[SENSe:]CORRection:CVL:SElect on page 195

Edit Table

Opens the "Edit Conversion loss table" dialog box to edit the selected conversion loss table. For details on table configuration see "[Creating and Editing Conversion Loss Tables](#)" on page 65.

Remote command:

`[SENSe:]CORRection:CVL:SElect` on page 195

Delete Table

Deletes the currently selected conversion loss table after you confirm the action.

Remote command:

`[SENSe:]CORRection:CVL:CLEAR` on page 192

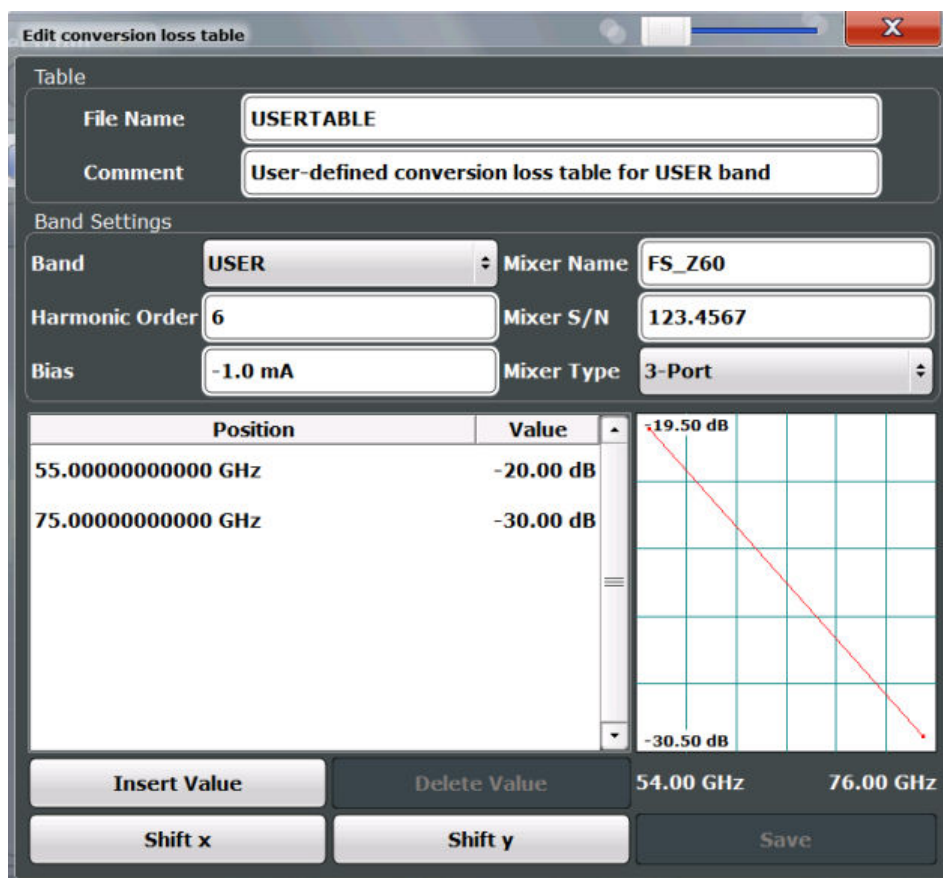
Import Table

Imports a stored conversion loss table from any directory and copies it to the instrument's `C:\r_s\instr\user\cvl\` directory. It can then be assigned for use for a specific frequency range (see "[Conversion loss](#)" on page 61).

Creating and Editing Conversion Loss Tables

Conversion loss tables can be defined and edited in the "Edit conversion loss table" dialog box which is displayed when you select the "New Table" button in the "External Mixer > Conversion loss table" settings.

A preview pane displays the current configuration of the conversion loss function as described by the position/value entries.



File Name..... 66

Comment..... 67

Band..... 67

Harmonic Order..... 67

Bias..... 67

Mixer Name..... 67

Mixer S/N..... 67

Mixer Type..... 68

Position/Value..... 68

Insert Value..... 68

Delete Value..... 68

Shift x..... 68

Shift y..... 68

Save..... 68

File Name

Defines the name under which the table is stored in the C:\r_s\instr\user\cvl\ directory on the instrument. The name of the table is identical with the name of the file (without extension) in which the table is stored. This setting is mandatory. The .ACL extension is automatically appended during storage.

Remote command:

[SENSe:]CORRection:CVL:SElect on page 195

Comment

An optional comment that describes the conversion loss table. The comment can be freely defined by the user.

Remote command:

[\[SENSe:\]CORRection:CVL:COMMeNt](#) on page 193

Band

The waveguide or user-defined band for which the table is to be applied. This setting is checked against the current mixer setting before the table can be assigned to the range.

For a definition of the frequency range for the pre-defined bands, see [table 11-2](#)).

Remote command:

[\[SENSe:\]CORRection:CVL:BAND](#) on page 191

Harmonic Order

The harmonic order of the range for which the table is to be applied. This setting is checked against the current mixer setting before the table can be assigned to the range.

Remote command:

[\[SENSe:\]CORRection:CVL:HARMONic](#) on page 194

Bias

The bias current which is required to set the mixer to its optimum operating point. It corresponds to the short-circuit current. The bias current can range from -10 mA to 10 mA. The actual bias current is lower because of the forward voltage of the mixer diode(s).

Tip: You can also define the bias interactively while a preview of the trace with the changed setting is displayed, see "[Bias Settings](#)" on page 63.

Remote command:

[\[SENSe:\]CORRection:CVL:BIAS](#) on page 192

Mixer Name

Specifies the name of the external mixer for which the table is to be applied. This setting is checked against the current mixer setting before the table can be assigned to the range.

Remote command:

[\[SENSe:\]CORRection:CVL:MIXer](#) on page 194

Mixer S/N

Specifies the serial number of the external mixer for which the table is to be applied.

This setting is checked against the current mixer setting before the table can be assigned to the range.

Remote command:

[\[SENSe:\]CORRection:CVL:SNUMber](#) on page 195

Mixer Type

Specifies whether the external mixer for which the table is to be applied is a two-port or three-port type. This setting is checked against the current mixer setting before the table can be assigned to the range.

Remote command:

[SENSe:]CORRection:CVL:PORTs on page 194

Position/Value

Each position/value pair defines the correction value for conversion loss for a specific frequency. The reference values must be entered in order of increasing frequencies. A maximum of 50 reference values can be entered. To enter a new value pair, select the "Position/Value" table, or select the [Insert Value](#) button.

Correction values for frequencies between the reference values are obtained by interpolation. Linear interpolation is performed if the table contains only two values. If it contains more than two reference values, spline interpolation is carried out. Outside the frequency range covered by the table the conversion loss is assumed to be the same as that for the first and last reference value.

The current configuration of the conversion loss function as described by the position/value entries is displayed in the preview pane to the right of the table.

Remote command:

[SENSe:]CORRection:CVL:DATA on page 193

Insert Value

Inserts a new position/value entry in the table.

If the table is empty, a new entry at 0 Hz is inserted.

If entries already exist, a new entry is inserted above the selected entry. The position of the new entry is selected such that it divides the span to the previous entry in half.

Delete Value

Deletes the currently selected position/value entry.

Shift x

Shifts all positions in the table by a specific value. The value can be entered in the edit dialog box. The conversion loss function in the preview pane is shifted along the x-axis.

Shift y

Shifts all conversion loss values by a specific value. The value can be entered in the edit dialog box. The conversion loss function in the preview pane is shifted along the y-axis.

Save

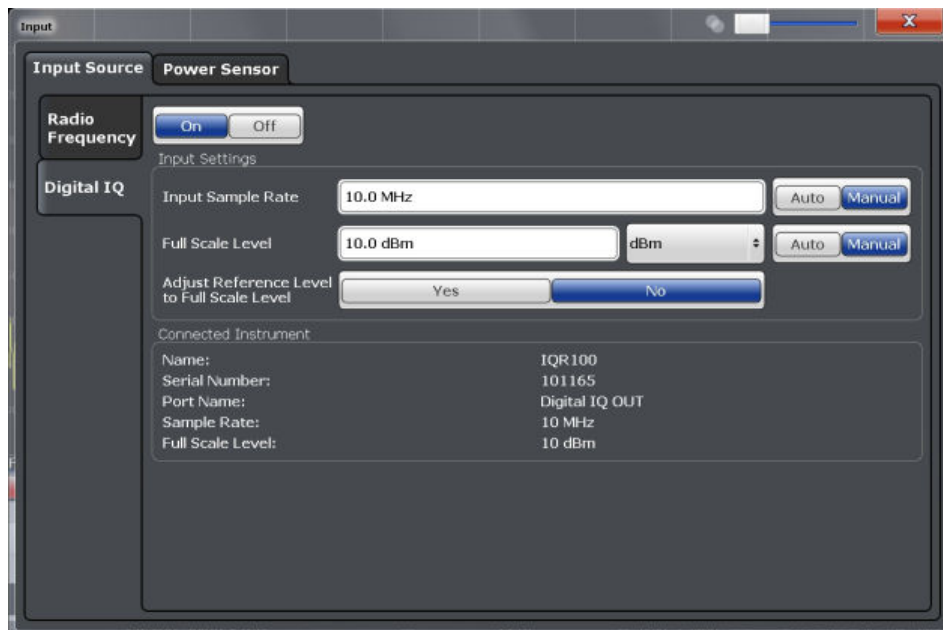
The conversion loss table is stored under the specified name in the

C:\r_s\instr\user\cvl\ directory of the instrument.

5.4.1.3 Digital I/Q Input Settings

The following settings and functions are available to provide input via the Digital Baseband Interface (R&S FSW-B17) in the applications that support it.

They can be configured via the INPUT/OUTPUT key, in the "Input" dialog box.



For more information see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Digital I/Q Input State.....	69
Input Sample Rate.....	69
Full Scale Level.....	70
Adjust Reference Level to Full Scale Level.....	70
Connected Instrument.....	70
DigIConf.....	70

Digital I/Q Input State

Enables or disable the use of the "Digital IQ" input source for measurements. "Digital IQ" is only available if the Digital Baseband Interface (R&S FSW-B17) is installed.

Remote command:

`INPut:SElect` on page 184

Input Sample Rate

Defines the sample rate of the digital I/Q signal source. This sample rate must correspond with the sample rate provided by the connected device, e.g. a generator.

If "Auto" is selected, the sample rate is adjusted automatically by the connected device.

The allowed range is from 100 Hz to 10 GHz.

Remote command:

[INPut:DIQ:SRATe](#) on page 205

[INPut:DIQ:SRATe:AUTO](#) on page 206

Full Scale Level

The "Full Scale Level" defines the level and unit that should correspond to an I/Q sample with the magnitude "1".

If "Auto" is selected, the level is automatically set to the value provided by the connected device.

Remote command:

[INPut:DIQ:RANGe\[:UPPer\]](#) on page 205

[INPut:DIQ:RANGe\[:UPPer\]:UNIT](#) on page 205

[INPut:DIQ:RANGe\[:UPPer\]:AUTO](#) on page 204

Adjust Reference Level to Full Scale Level

If enabled, the reference level is adjusted to the full scale level automatically if any change occurs.

Remote command:

[INPut:DIQ:RANGe:COUPling](#) on page 205

Connected Instrument

Displays the status of the Digital Baseband Interface connection.

If an instrument is connected, the following information is displayed:

- Name and serial number of the instrument connected to the Digital Baseband Interface
- Used port
- Sample rate of the data currently being transferred via the Digital Baseband Interface
- Level and unit that corresponds to an I/Q sample with the magnitude "1" ([Full Scale Level](#)), if provided by connected instrument

Remote command:

[INPut:DIQ:CDEvice](#) on page 203

DigIConf

Starts the optional R&S DigIConf application. This softkey is available in the In-/Output menu, but only if the optional software is installed.

Note that R&S DigIConf requires a USB connection (not LAN!) from the R&S FSW to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface (R&S FSW-B17) connection. R&S DigIConf version 2.20.360.86 Build 170 or higher is required.

To return to the R&S FSW application, press any key on the front panel. The R&S FSW application is displayed with the "Input/Output" menu, regardless of which key was pressed.

For details on the R&S DigIConf application, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

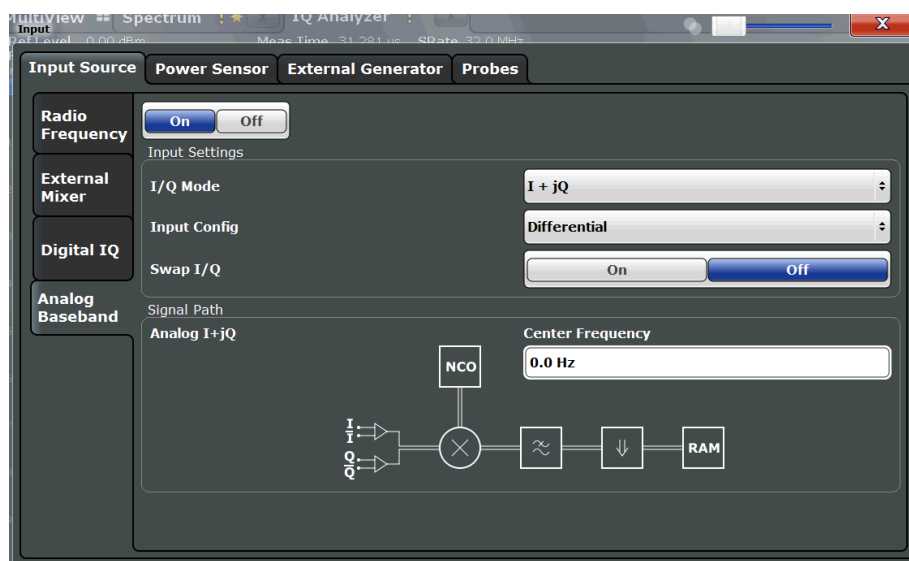
Note: If you close the R&S DigiConf window using the "Close" icon, the window is minimized, not closed.

If you select the "File > Exit" menu item in the R&S DigiConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigiConf" softkey in the R&S FSW once again.

5.4.1.4 Analog Baseband Input Settings

The following settings and functions are available to provide input via the Analog Baseband Interface (R&S FSW-B71) in the applications that support it.

They can be configured via the INPUT/OUTPUT key, in the "Input" dialog box.



For more information on the Analog Baseband Interface (R&S FSW-B71) see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Analog Baseband Input State	71
I/Q Mode	71
Input configuration	72
Center Frequency	72

Analog Baseband Input State

Enables or disable the use of the "Analog Baseband" input source for measurements. "Analog Baseband" is only available if the Analog Baseband Interface (R&S FSW-B71) is installed.

Remote command:

[INPut : SElect](#) on page 184

I/Q Mode

Defines the format of the input signal.

For more information on I/Q data processing modes see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

- "I + jQ" The input signal is filtered and resampled to the sample rate of the application.
Two inputs are required for a complex signal, one for the in-phase component, and one for the quadrature component.
- "I Only / Low IF I" The input signal at the BASEBAND INPUT I connector is filtered and resampled to the sample rate of the application.
If the center frequency is set to 0 Hz, the real baseband signal is displayed without down-conversion (**Real Baseband I**).
If a center frequency greater than 0 Hz is set, the input signal is down-converted with the center frequency (**Low IF I**).
- "Q Only / Low IF Q" The input signal at the BASEBAND INPUT Q connector is filtered and resampled to the sample rate of the application.
If the center frequency is set to 0 Hz, the real baseband signal is displayed without down-conversion (**Real Baseband Q**).
If a center frequency greater than 0 Hz is set, the input signal is down-converted with the center frequency (**Low IF Q**).

Remote command:

[INPut:IQ:TYPE](#) on page 199

Input configuration

Defines whether the input is provided as a differential signal via all 4 Analog Baseband connectors or as a plain I/Q signal via 2 simple-ended lines.

Note: Both single-ended and differential probes are supported as input; however, since only one connector is occupied by a probe, the "Single-ended" setting must be used for all probes.

"Differential" I, Q and inverse I,Q data

"Single Ended" I, Q data only

Remote command:

[INPut:IQ:BALanced\[:STATe\]](#) on page 198

Center Frequency

Defines the center frequency for analog baseband input.

For real-type baseband input (I or Q only), the center frequency is always 0 Hz.

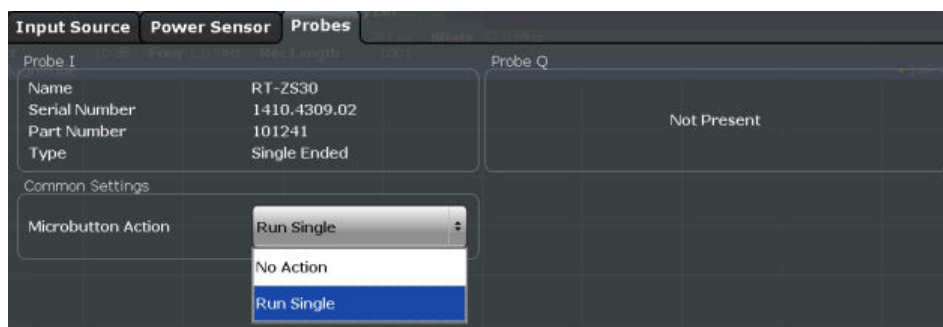
Note: If the analysis bandwidth to either side of the defined center frequency exceeds the minimum frequency (0 Hz) or the maximum frequency (40 MHz/80 MHz), an error is displayed. In this case, adjust the center frequency or the analysis bandwidth.

Remote command:

[\[SENSe:\]FREQuency:CENTer](#) on page 231

5.4.1.5 Probe Settings

Probes are configured in a separate tab on the "Input" dialog box which is displayed when you select the INPUT/OUTPUT key and then "Input Source Config".



For each possible probe connector (Baseband Input I, Baseband Input Q), the detected type of probe, if any, is displayed. The following information is provided for each connected probe:

- Probe name
- Serial number
- R&S part number
- Type of probe ("Differential", "Single Ended")

For more information on using probes with an R&S FSW, see the R&S FSW User Manual.

For general information on the R&S®RTO probes, see the device manuals.

[Microbutton Action](#)..... 73

Microbutton Action

Active R&S probes (except for RT-ZS10E) have a configurable microbutton on the probe head. By pressing this button, you can perform an action on the instrument directly from the probe.

Select the action that you want to start from the probe:

- "Run single" Starts one data acquisition.
- "No action" Prevents unwanted actions due to unintended usage of the microbutton.

Remote command:

[SENSe:] PROBe<p>:SETup:MODE on page 207

5.4.1.6 External Generator Control Settings

The "External Generator" settings are available in the "Input" dialog box if the R&S FSW External Generator Control option (R&S FSW-B10) is installed. For each measurement channel one external generator can be configured. To switch between different configurations define multiple measurement channels.

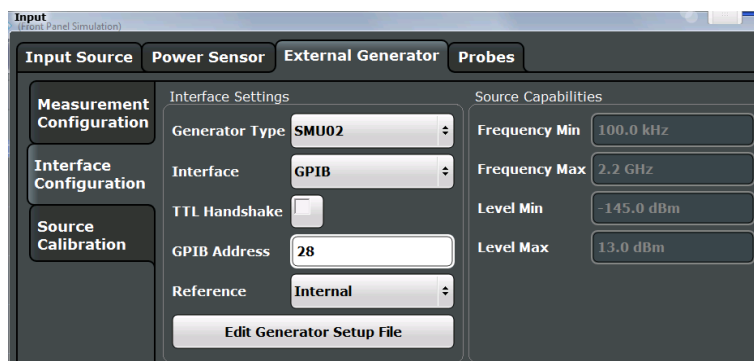
To display this dialog box, press the INPUT/OUTPUT key and then select "External Generator Config".

For more information on external generator control see [chapter 4.7.4, "Basics on External Generator Control"](#), on page 36.

- [Interface Configuration Settings](#).....74
- [Measurement Settings](#).....75
- [Source Calibration Functions](#).....78

Interface Configuration Settings

The interface settings for the connection to the external generator are defined in the "Interface Configuration" subtab of the "External Generator" tab.



For more information on configuring interfaces see the "Remote Control Interfaces and Protocols" section in the R&S FSW User Manual.

- [Generator Type](#).....74
- [Interface](#).....74
- [TTL Handshake](#).....75
- [GPIB Address / TCP/IP Address](#).....75
- [Reference](#).....75
- [Edit Generator Setup File](#).....75
- [Frequency Min. / Frequency Max](#).....75
- [Level Min. / Level Max](#).....75

Generator Type

Selects the generator type and thus defines the generator setup file to use.

For an overview of supported generators see [chapter 4.7.4.2, "Overview of Generators Supported by the R&S FSW-B10 Option"](#), on page 38. For information on generator setup files see [chapter 4.7.4.3, "Generator Setup Files"](#), on page 40.

Remote command:

`SYSTem:COMMunicate:RDEvice:GENerator:TYPE` on page 224

Interface

Type of interface connection used. The following interfaces are currently supported:

- GPIB
- TCP/IP (not by all generators)

For details on which signal generators support which interfaces, see the documentation of the corresponding signal generator.

Remote command:

`SYSTem:COMMunicate:RDEvice:GENerator:INTerface` on page 223

TTL Handshake

If available for the specified generator type, this option activates TTL synchronization via handshake for GPIB connections.

Using the TTL interface allows for considerably higher measurement rates than pure GPIB control, because the frequency stepping of the R&S FSW is directly coupled with the frequency stepping of the generator.

For more information on TTL synchronization see "[TTL synchronization](#)" on page 45.

For an overview of which generators support TTL synchronization see [chapter 4.7.4.2, "Overview of Generators Supported by the R&S FSW-B10 Option"](#), on page 38.

Remote command:

`SYSTem:COMMunicate:RDEvice:GENerator:LINK` on page 224

GPIB Address / TCP/IP Address

For LAN connections: TCP/IP address of the signal generator

For GPIB connections: GPIB address of the signal generator.

Remote command:

`SYSTem:COMMunicate:GPIB:RDEvice:GENerator:ADDRess` on page 223

`SYSTem:COMMunicate:TCPIP:RDEvice:GENerator:ADDRess` on page 224

Reference

Selects the internal R&S FSW or an external frequency reference to synchronize the R&S FSW with the generator (default: internal).

Remote command:

`SOURce:EXTernal:ROSCillator[:SOURce]` on page 223

Edit Generator Setup File

Displays the setup file for the currently selected [Generator Type](#) in read-only mode in an editor.

Although the existing setup files are displayed in read-only mode in the editor, they can be saved under a different name (using "File > SaveAs").

Be careful, however, to adhere to the required syntax and commands. Errors will only be detected and displayed when you try to use the new generator (see also [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46).

For details see [chapter 4.7.4.3, "Generator Setup Files"](#), on page 40.

Frequency Min. / Frequency Max.

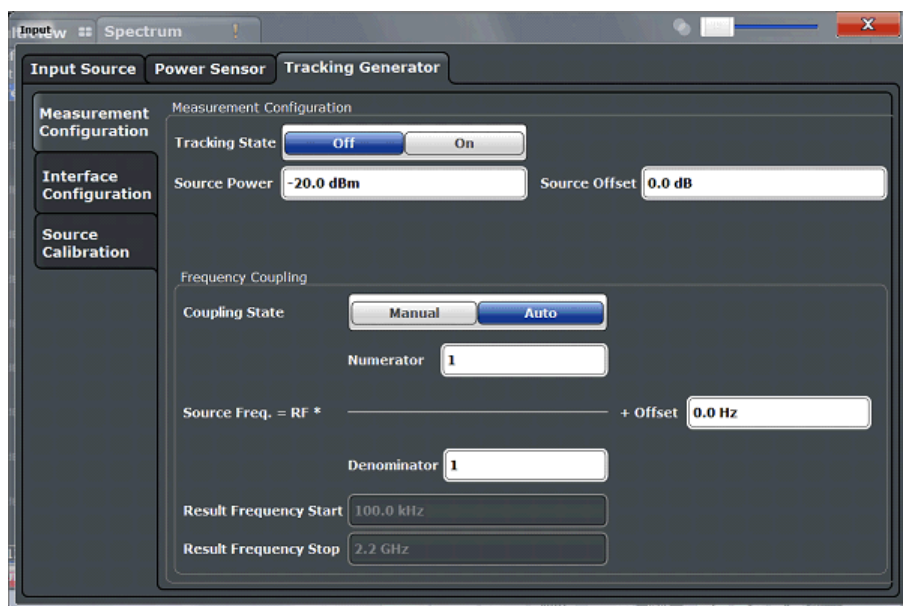
For reference only: Lower and upper frequency limit for the generator.

Level Min. / Level Max.

For reference only: Lower and upper power limit for the generator.

Measurement Settings

The measurement settings for external generator control are configured in the "Measurement Configuration" subtab of the "External Generator" tab.



Source State..... 76

Source Power..... 76

Source Offset..... 76

Source Frequency Coupling..... 77

(Manual) Source Frequency..... 77

(Automatic) Source Frequency (Numerator/Denominator/Offset)..... 77

Result Frequency Start..... 78

Result Frequency Stop..... 78

Source State

Activates or deactivates control of an external generator.

Remote command:

`SOURce:EXTernal[:STATe]` on page 222

Source Power

The output power of the external generator. The default output power is -20 dBm. The range is specified in the data sheet.

Remote command:

`SOURce:EXTernal:POWer[:LEVel]` on page 222

Source Offset

Constant level offset for the external generator. Values from -200 dB to +200 dB in 1 dB steps are allowed. The default setting is 0 dB. Offsets are indicated by the "LVL" label in the channel bar (see also [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46).

With this offset, attenuators or amplifiers at the output connector of the external generator can be taken into account for the displayed output power values on screen or during data entry, for example. Positive offsets apply to an amplifier and negative offsets to an attenuator subsequent to the external generator.

Remote command:

`SOURce:POWer[:LEVel][:IMMediate]:OFFSet` on page 222

Source Frequency Coupling

Defines the frequency coupling mode between the R&S FSW and the generator.

For more information on coupling frequencies see [chapter 4.7.4.7, "Coupling the Frequencies"](#), on page 43.

- | | |
|----------|---|
| "Auto" | Default setting: a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSW (see "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 77); the RF frequency range covers the currently defined span of the R&S FSW (unless limited by the range of the signal generator) |
| "Manual" | The generator uses a single fixed frequency, defined by (Manual) Source Frequency which is displayed when you select "Manual" coupling. |

Remote command:

`SOURce:EXTernal:FREQUENCY:COUPLing[:STATe]` on page 220

(Manual) Source Frequency

Defines the fixed frequency to be used by the generator.

Remote command:

`SOURce:EXTernal:FREQUENCY` on page 220

(Automatic) Source Frequency (Numerator/Denominator/Offset)

With automatic frequency coupling, a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSW.

However, the frequency used by the generator may differ from the input from the R&S FSW. The RF frequency may be multiplied by a specified factor, or a frequency offset can be added, or both.

Note: The input for the generator frequency is not validated, i.e. you can enter any values. However, if the allowed frequency ranges of the generator are exceeded, an error message is displayed on the R&S FSW and the values for [Result Frequency Start](#) and [Result Frequency Stop](#) are corrected to comply with the range limits.

The value range for the offset depends on the selected generator. The default setting is 0 Hz. Offsets \neq 0 Hz are indicated by the "FRQ" label in the channel bar. Negative offsets can be used to define reverse sweeps.

For more information on coupling frequencies and reverse sweeps see [chapter 4.7.4.7, "Coupling the Frequencies"](#), on page 43. For more information on error messages and the channel bar see [chapter 4.7.4.8, "Displayed Information and Errors"](#), on page 46.

Remote command:

`SOURce:EXTernal:FREquency[:FACTor]:DENominator` on page 220

`SOURce:EXTernal:FREquency[:FACTor]:NUMerator` on page 221

`SOURce:EXTernal:FREquency:OFFSet` on page 221

Result Frequency Start

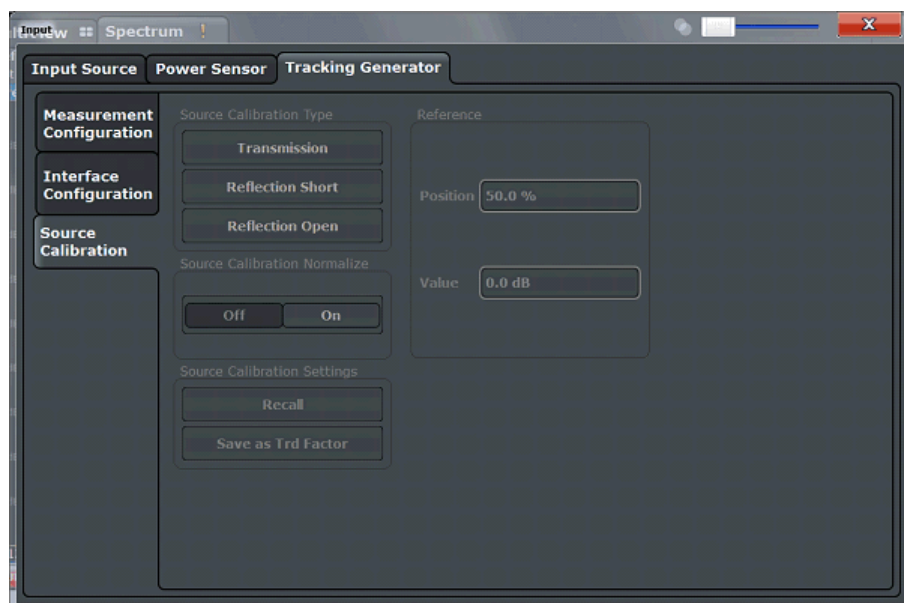
For reference only: The start frequency for the generator, calculated from the configured generator frequency and the start value defined for the R&S FSW.

Result Frequency Stop

For reference only: The stop frequency for the generator, calculated from the configured generator frequency and the stop value defined for the R&S FSW.

Source Calibration Functions

The calibration functions of the external generator are available in the "Source Calibration" subtab of the "External Generator" tab, but *only if external generator control is active* (see ["Source State"](#) on page 76).



Calibrate Transmission	79
Calibrate Reflection Short	79
Calibrate Reflection Open	79
Source Calibration Normalize	79
Recall	79
Save As Trd Factor	80
Reference Position	80
Reference Value	80

Calibrate Transmission

Starts a transmission type measurement to determine a reference trace. This trace is used to calculate the difference for the normalized values.

For details see [chapter 4.7.4.4, "Calibration Mechanism"](#), on page 40.

Remote command:

`[SENSe:]CORRection:MEtHod` on page 226

Calibrate Reflection Short

Starts a short-circuit reflection type measurement to determine a reference trace for calibration.

If both calibrations (open circuit, short circuit) are carried out, the calibration trace is calculated by averaging the two measurements. The order of the two calibration measurements is irrelevant.

Remote command:

`[SENSe:]CORRection:MEtHod` on page 226

Selects the reflection method.

`[SENSe:]CORRection:COLLect[:ACQuire]` on page 225

Starts the sweep for short-circuit calibration.

Calibrate Reflection Open

Starts an open-circuit reflection type measurement to determine a reference trace for calibration.

If both reflection-type calibrations (open circuit, short circuit) are carried out, the reference trace is calculated by averaging the two measurements. The order of the two calibration measurements is irrelevant.

Remote command:

`[SENSe:]CORRection:MEtHod` on page 226

Selects the reflection method.

`[SENSe:]CORRection:COLLect[:ACQuire]` on page 225

Starts the sweep for open-circuit calibration.

Source Calibration Normalize

Switches the normalization of measurement results on or off. This function is only available if the memory contains a reference trace, that is, after a calibration has been performed.

For details on normalization see [chapter 4.7.4.5, "Normalization"](#), on page 41.

Remote command:

`[SENSe:]CORRection[:STATe]` on page 227

Recall

Restores the settings that were used during source calibration. This can be useful if instrument settings were changed after calibration (e.g. center frequency, frequency deviation, reference level, etc).

Remote command:

`[SENSe:]CORRection:RECall` on page 226

Save As Trd Factor

Uses the normalized measurement data to generate a transducer factor. The trace data is converted to a transducer with unit dB and stored in a file with the specified name and the suffix `.trd` under `"c:\r_s\instr\trd"`. The frequency points are allocated in equidistant steps between start and stop frequency. The generated transducer factor can be further adapted using the "Transducer" softkey in the SETUP menu.

For more information on transducers see the "General Instrument Setup > Transducers" section in the R&S FSW User Manual.

This function is only available if [Source Calibration Normalize](#) is switched on.

Note: Note that the *normalized* measurement data is used, not the *reference* trace! Thus, if you store the normalized trace directly after calibration, without changing any settings, the transducer factor will be 0 dB for the entire span (by definition of the normalized trace).

Remote command:

[\[SENSe:\]CORRection:TRANsducer:GENerator](#) on page 227

Reference Position

Defines the position of the [Result Frequency Stop](#) in percent of the total y-axis range. The top of the diagram is 100%, the bottom is 0%. By default, the 0 dB line is displayed at the top of the diagram (100%).

This setting is only available if normalization is on (see "[Source Calibration Normalize](#)" on page 79).

The reference line defined by the reference value and reference position is similar to the [Reference Level](#) defined in the "Amplitude" settings. However, this reference line only affects the y-axis scaling in the diagram, it has no effect on the expected input power level or the hardware settings.

The normalized trace (0 dB directly after calibration) is displayed on this reference line, indicated by a red line in the diagram. If you shift the reference line, the normalized trace is shifted, as well.

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:RPOSition](#) on page 239

Reference Value

Defines the reference value to be displayed at the specified [Result Frequency Start](#).

This setting can be used to shift the reference line and thus the normalized trace, similar to the [Shifting the Display \(Offset\)](#) defined in the "Amplitude" settings shifts the reference level *in the display*.

Shifting the normalized trace is useful, for example, to reflect an attenuation or gain caused by the measured DUT. If you then zoom into the diagram around the normalized trace, the measured trace still remains fully visible.

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:RVALue](#) on page 225

5.4.2 Power Sensor

The R&S FSW can also analyze data from a connected power sensor.

For background information on working with power sensors see the R&S FSW User Manual.

5.4.2.1 Power Sensor Settings

Power sensor settings are available in the "Power Sensor" tab of the "Input" dialog box. Each sensor is configured on a separate tab.



State.....	82
Continuous Value Update.....	82
Select.....	82
Zeroing Power Sensor.....	82
Frequency Manual.....	83
Frequency Coupling.....	83
Unit/Scale.....	83
Meas Time/Average.....	83
Setting the Reference Level from the Measurement (Meas->Ref).....	83
Reference Value.....	84
Use Ref Lev Offset.....	84
Average Count (Number of Readings).....	84
Duty Cycle.....	84
Using the power sensor as an external trigger.....	84
L External Trigger Level.....	84
L Hysteresis.....	85

L Trigger Holdoff.....	85
L Drop-Out Time.....	85
L Slope.....	85

State

Switches the power measurement for all power sensors on or off. Note that in addition to this general setting, each power sensor can be activated or deactivated individually by the [Select](#) setting on each tab. However, the general setting overrides the individual settings.

Remote command:

`[SENSe:] PMETer<p> [:STATe]` on page 215

Continuous Value Update

If activated, the power sensor data is updated continuously during a sweep with a long sweep time, and even after a single sweep has completed.

This function cannot be activated for individual sensors.

If the power sensor is being used as a trigger (see ["Using the power sensor as an external trigger"](#) on page 84), continuous update is not possible; this setting is ignored.

Remote command:

`[SENSe:] PMETer<p>:UPDate [:STATe]` on page 216

Select

Selects the individual power sensor for usage if power measurement is generally activated ([State](#) function).

The detected **serial numbers** of the power sensors connected to the instrument are provided in a selection list. For each of the four available power sensor indexes ("Power Sensor 1"..."Power Sensor 4"), which correspond to the tabs in the configuration dialog, one of the detected serial numbers can be assigned. The physical sensor is thus assigned to the configuration setting for the selected power sensor index.

By default, serial numbers not yet assigned are automatically assigned to the next free power sensor index for which "Auto Assignment" is selected.

Alternatively, you can assign the sensors manually by deactivating the "Auto" option and selecting a serial number from the list.

Remote command:

`[SENSe:] PMETer<p> [:STATe]` on page 215

`SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine` on page 209

`SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO [:STATe]`
on page 209

`SYSTem:COMMunicate:RDEvice:PMETer:COUNT?` on page 209

Zeroing Power Sensor

Starts zeroing of the power sensor.

For details on the zeroing process refer to the R&S FSW User Manual.

Remote command:

`CALibration:PMETer<p>:ZERO:AUTO ONCE` on page 210

Frequency Manual

Defines the frequency of the signal to be measured. The power sensor has a memory with frequency-dependent correction factors. This allows extreme accuracy for signals of a known frequency.

Remote command:

`[SENSe:] PMETer<p>:FREQuency` on page 213

Frequency Coupling

Selects the coupling option. The frequency can be coupled automatically to the center frequency of the instrument or to the frequency of marker 1.

Remote command:

`[SENSe:] PMETer<p>:FREQuency:LINK` on page 213

Unit/Scale

Selects the unit with which the measured power is to be displayed. Available units are dBm, dB, W and %.

If dB or % is selected, the display is relative to the reference value that is defined with either the "Meas -> Ref" setting or the "Reference Value" setting.

Remote command:

`UNIT<n>:PMETer<p>:POWer` on page 216

`UNIT<n>:PMETer<p>:POWer:RATio` on page 216

Meas Time/Average

Selects the measurement time or switches to manual averaging mode. In general, results are more precise with longer measurement times. The following settings are recommended for different signal types to obtain stable and precise results:

"Short"	Stationary signals with high power (> -40dBm), because they require only a short measurement time and short measurement time provides the highest repetition rates.
"Normal"	Signals with lower power or modulated signals
"Long"	Signals at the lower end of the measurement range (<-50 dBm) or Signals with lower power to minimize the influence of noise
"Manual"	Manual averaging mode. The average count is set with the Average Count (Number of Readings) setting.

Remote command:

`[SENSe:] PMETer<p>:MTIME` on page 214

`[SENSe:] PMETer<p>:MTIME:AVERage [:STATe]` on page 215

Setting the Reference Level from the Measurement (Meas->Ref)

Sets the currently measured power as a reference value for the relative display. The reference value can also be set manually via the [Reference Value](#) setting.

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE` on page 211

Reference Value

Defines the reference value for relative measurements in the unit dBm.

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]` on page 211

Use Ref Lev Offset

If activated, takes the reference level offset defined for the analyzer into account for the measured power (see "[Shifting the Display \(Offset\)](#)" on page 87). If deactivated, takes no offset into account.

Remote command:

`[SENSe:] PMETer<p>:ROFFset[:STATe]` on page 215

Average Count (Number of Readings)

Defines the number of readings (averages) to be performed after a single sweep has been started. This setting is only available if manual averaging is selected ([Meas Time/Average](#) setting).

The values for the average count range from 0 to 256 in binary steps (1, 2, 4, 8, ...). For average count = 0 or 1, one reading is performed. The general averaging and sweep count for the trace are independent from this setting.

Results become more stable with extended average, particularly if signals with low power are measured. This setting can be used to minimize the influence of noise in the power sensor measurement.

Remote command:

`[SENSe:] PMETer<p>:MTIMe:AVERage:COUNT` on page 214

Duty Cycle

Sets the duty cycle to a percent value for the correction of pulse-modulated signals and activates the duty cycle correction. With the correction activated, the sensor calculates the signal pulse power from this value and the mean power.

Remote command:

`[SENSe:] PMETer<p>:DCYCLe[:STATe]` on page 212

`[SENSe:] PMETer<p>:DCYCLe:VALue` on page 213

Using the power sensor as an external trigger

If activated, the power sensor creates a trigger signal when a power higher than the defined "External Trigger Level" is measured. This trigger signal can be used as an external power trigger by the R&S FSW.

This setting is only available in conjunction with a compatible power sensor.

For details on using a power sensor as an external trigger, see the R&S FSW User Manual.

Remote command:

`[SENSe:] PMETer<p>:TRIGger[:STATe]` on page 219

`TRIG:SOUR PSE`, see `TRIGger[:SEQuence]:SOURce` on page 250

External Trigger Level ← Using the power sensor as an external trigger

Defines the trigger level for the power sensor trigger.

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

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger:LEVel](#) on page 218

Hysteresis ← Using the power sensor as an external trigger

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.

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger:HYSteresis](#) on page 218

Trigger Holdoff ← Using the power sensor as an external trigger

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:

[\[SENSe:\] PMETer<p>:TRIGger:HOLDoff](#) on page 217

Drop-Out Time ← Using the power sensor as an external trigger

Defines the time the input signal must stay below the trigger level before triggering again.

Slope ← Using the power sensor as an external trigger

Defines whether triggering occurs when the signal rises to the trigger level or falls down to it.

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger:SLOPe](#) on page 218

5.4.3 Amplitude

The amplitude is configured in the "Amplitude" tab of the "Input/Frontend" dialog box. Amplitude settings are identical to the base unit.

For background information on amplitude settings see the R&S FSW User Manual.

► To display this dialog box, do one of the following:

- Select the "Input/Frontend" button in the Analog Demodulation "Overview" and switch to the "Amplitude" tab.
- Select the AMPT key and then the "Amplitude Config" softkey.

Amplitude settings for input from the Analog Baseband interface (R&S FSW-B71) are described in [chapter 5.4.3.2, "Amplitude Settings for Analog Baseband Input"](#), on page 90.

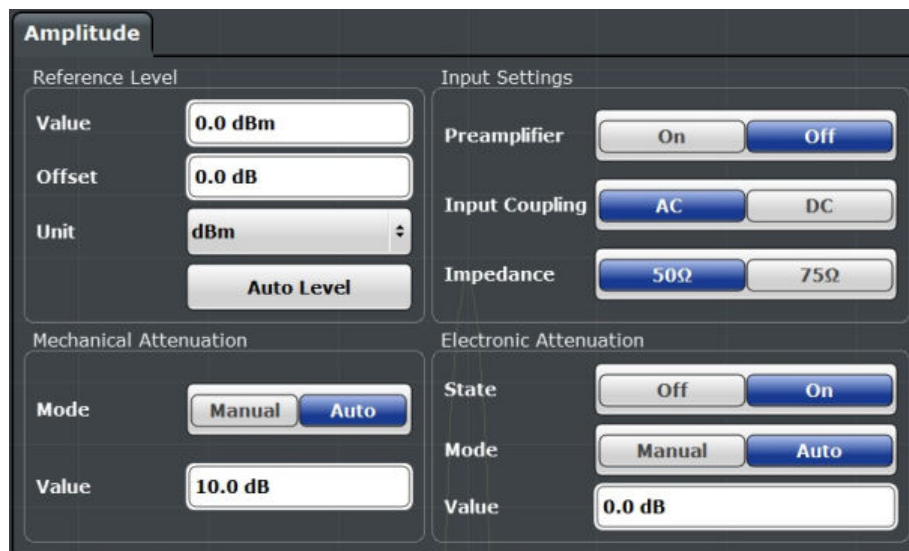
5.4.3.1 Amplitude Settings for RF Input

Amplitude settings can be configured via the AMPT key or in the "Amplitude" dialog box.

To display the "Amplitude" dialog box, do one of the following:

- Select "Amplitude" from the "Overview".
- Select the AMPT key and then the "Amplitude Config" softkey.

The remote commands required to define these settings are described in [chapter 11.4.5, "Configuring the Vertical Axis \(Amplitude, Scaling\)"](#), on page 233.



Reference Level.....	86
L Shifting the Display (Offset).....	87
L Unit.....	87
L Setting the Reference Level Automatically (Auto Level).....	87
Mechanical Attenuation.....	88
L Attenuation Mode / Value.....	88
Using Electronic Attenuation (Option B25).....	88
Input Settings.....	89
L Preamplifier (option B24).....	89
L Input Coupling.....	89
L Impedance.....	90

Reference Level

Defines the expected maximum reference level. Signal levels above this value may not be measured correctly, which is indicated by the "IF OVLD" status display ("OVLD" for analog baseband or digital baseband input).

The reference level is also used to scale power diagrams; the reference level is then used as the maximum on the y-axis.

Since the R&S FSW hardware is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level to ensure an optimum measurement (no compression, good signal-to-noise ratio).

Note that the "Reference Level" value ignores the [Shifting the Display \(Offset\)](#). It is important to know the actual power level the R&S FSW must handle.

Note that for input from the External Mixer (R&S FSW-B21) the maximum reference level also depends on the conversion loss; see the R&S FSW I/Q Analyzer and I/Q Input User Manual for details.

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel` on page 234

Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly.

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

Note, however, that the [Reference Level](#) value ignores the "Reference Level Offset". It is important to know the actual power level the R&S FSW must handle.

To determine the required offset, consider the external attenuation or gain applied to the input signal. A positive value indicates that an attenuation took place (R&S FSW increases the displayed power values), a negative value indicates an external gain (R&S FSW decreases the displayed power values).

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

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet` on page 235

Unit ← Reference Level

The R&S FSW measures the signal voltage at the RF input. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω , see ["Impedance"](#) on page 57), conversion to other units is possible. The following units are available and directly convertible:

- dBm
- dBmV
- dB μ V
- dB μ A
- dBpW
- Volt
- Ampere
- Watt

Remote command:

`INPut:IMPedance` on page 183

`CALCulate<n>:UNIT:POWer` on page 234

Setting the Reference Level Automatically (Auto Level) ← Reference Level

Automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized.

In order to do so, a level measurement is performed to determine the optimal reference level.

This function is only available for the MSRA/MSRT Master, not for the applications. You can change the measurement time for the level measurement if necessary (see ["Changing the Automatic Measurement Time \(MeasTime Manual\)"](#) on page 127).

Remote command:

`[SENSe:]ADJust:LEVel` on page 269

Mechanical Attenuation

Defines the mechanical attenuation for RF input.

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

Attenuation Mode / Value ← Mechanical Attenuation

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). This ensures that the optimum RF attenuation is always used. It is the default setting. By default and when [Using Electronic Attenuation \(Option B25\)](#) is not available, mechanical attenuation is applied.

This function is not available for input from the **Digital Baseband Interface (R&S FSW-B17)**.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB, also using the rotary knob). 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 may lead to hardware damage.

Remote command:

`INPut:ATTenuation` on page 235

`INPut:ATTenuation:AUTO` on page 235

Using Electronic Attenuation (Option B25)

If option R&S FSW-B25 is installed, 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.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

Note: Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) >13.6 GHz.

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 may 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 may be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

Both the electronic and the mechanical attenuation can be varied in 1 dB steps. Other entries are rounded to the next lower integer value.

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 237

`INPut:EATT:AUTO` on page 236

`INPut:EATT` on page 236

Input Settings

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

For details see [chapter 5.4.1, "Input Source Settings"](#), on page 55.

Preamplifier (option B24) ← Input Settings

If option R&S FSW-B24 is installed, a preamplifier can be activated for the RF input signal.

You can use a preamplifier to analyze signals from DUTs with low input power.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

For R&S FSW 26 or higher models, the input signal is amplified by 30 dB if the preamplifier is activated.

For R&S FSW 8 or 13 models, the following settings are available:

"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.

Remote command:

`INPut:GAIN:STATe` on page 237

`INPut:GAIN[:VALue]` on page 237

Input Coupling ← Input Settings

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

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17) or from the Analog Baseband Interface (R&S FSW-B71).

AC coupling blocks any DC voltage from the input signal. This is the default setting to prevent damage to the instrument. Very low frequencies in the input signal may 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:COUPling` on page 182

Impedance ← Input Settings

The reference impedance for the measured levels of the R&S FSW can be set to 50 Ω or 75 Ω.

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

This value also affects the unit conversion (see "Reference Level" on page 86).

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17) or from the Analog Baseband Interface (R&S FSW-B71). For analog baseband input, an impedance of 50 Ω is always used.

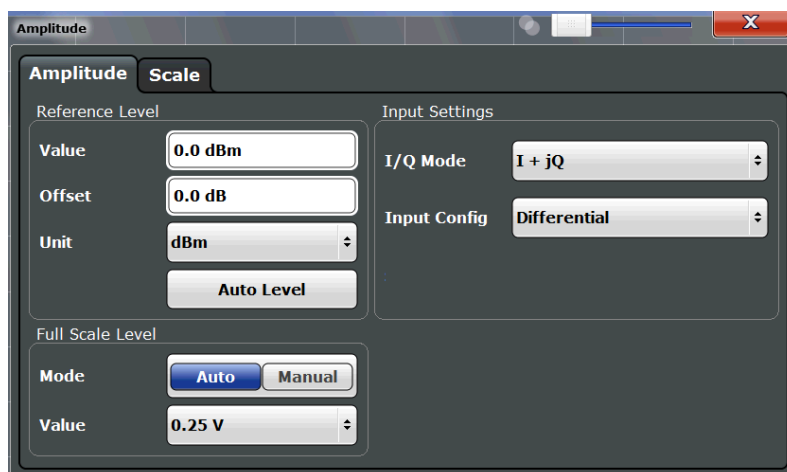
Remote command:

INPut:IMPedance on page 183

5.4.3.2 Amplitude Settings for Analog Baseband Input

The following settings and functions are available to define amplitude settings for input via the Analog Baseband Interface (R&S FSW-B71) in the applications that support it.

They can be configured via the AMPT key or in the "Amplitude" tab of the "Input" dialog box.



The input settings provided here are identical to those in the "Input Source" > "Analog Baseband" tab, see chapter 5.4.1.4, "Analog Baseband Input Settings", on page 71.

For more information on the Analog Baseband Interface (R&S FSW-B71) see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Reference Level..... 91

- L Shifting the Display (Offset)..... 91
- L Unit..... 91
- L Setting the Reference Level Automatically (Auto Level)..... 92

Full Scale Level Mode / Value..... 92

Reference Level

Defines the expected maximum reference level. Signal levels above this value may not be measured correctly, which is indicated by the "IF OVLD" status display ("OVLD" for analog baseband or digital baseband input).

The reference level is also used to scale power diagrams; the reference level is then used as the maximum on the y-axis.

Since the R&S FSW hardware is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level to ensure an optimum measurement (no compression, good signal-to-noise ratio).

Note that the "Reference Level" value ignores the [Shifting the Display \(Offset\)](#). It is important to know the actual power level the R&S FSW must handle.

Note that for input from the External Mixer (R&S FSW-B21) the maximum reference level also depends on the conversion loss; see the R&S FSW I/Q Analyzer and I/Q Input User Manual for details.

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel` on page 234

Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly.

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

Note, however, that the [Reference Level](#) value ignores the "Reference Level Offset". It is important to know the actual power level the R&S FSW must handle.

To determine the required offset, consider the external attenuation or gain applied to the input signal. A positive value indicates that an attenuation took place (R&S FSW increases the displayed power values), a negative value indicates an external gain (R&S FSW decreases the displayed power values).

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

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet` on page 235

Unit ← Reference Level

The R&S FSW measures the signal voltage at the RF input. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω , see ["Impedance"](#) on page 57), conversion to other units is possible. The following units are available and directly convertible:

- dBm
- dBmV
- dB μ V
- dB μ A
- dBpW
- Volt
- Ampere

- Watt

Remote command:

[INPut:IMPedance](#) on page 183

[CALCulate<n>:UNIT:POWer](#) on page 234

Setting the Reference Level Automatically (Auto Level) ← Reference Level

Automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized.

In order to do so, a level measurement is performed to determine the optimal reference level.

This function is only available for the MSRA/MSRT Master, not for the applications.

You can change the measurement time for the level measurement if necessary (see ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 127).

Remote command:

[\[SENSe:\]ADJust:LEVel](#) on page 269

Full Scale Level Mode / Value

The full scale level defines the maximum power you can input at the Baseband Input connector without clipping the signal.

The full scale level can be defined automatically according to the reference level, or manually.

For manual input, the following values can be selected:

- 0.25 V
- 0.5 V
- 1 V
- 2 V

If probes are connected, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.

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

Remote command:

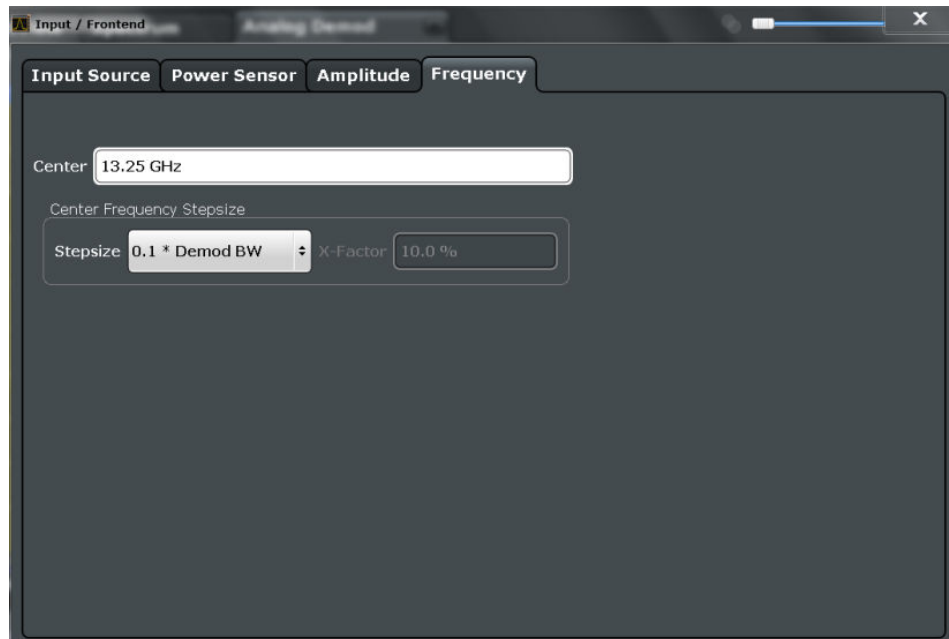
[INPut:IQ:FULLscale:AUTO](#) on page 198

[INPut:IQ:FULLscale\[:LEVel\]](#) on page 199

5.4.4 Frequency

The center frequency of the input signal is configured in the "Frequency" tab of the "Input/Frontend" dialog box.

- ▶ To display this dialog box, do one of the following:
 - Select the "Input/Frontend" button in the Analog Demodulation "Overview" and switch to the "Frequency" tab.
 - Select the FREQ key and then the "Frequency Config" softkey.



Center frequency.....	93
Center Frequency Stepsize.....	93

Center frequency

Defines the normal center frequency of the signal. The allowed range of values for the center frequency depends on the frequency span.

$$\text{span} > 0: \text{span}_{\min}/2 \leq f_{\text{center}} \leq f_{\text{max}} - \text{span}_{\min}/2$$

f_{max} and span_{\min} are specified in the data sheet.

Remote command:

[SENSe:] FREQuency:CENTer on page 231

Center Frequency Stepsize

Defines the step size of the center frequency. The step size can be coupled to the demodulation bandwidth, or it can be manually set to a fixed value.

"0.1 * Demod BW"	Sets the step size for the center frequency to 10 % of the demodulation bandwidth. This is the default setting.
"0.5 * Demod BW"	Sets the step size for the center frequency to 50 % of the demodulation bandwidth.
"X * Demod BW"	Sets the step size for the center frequency to a manually defined factor of the demodulation bandwidth. The "X-Factor" defines the percentage of the demodulation bandwidth. Values between 1 and 100 % in steps of 1 % are allowed. The default setting is 10 %.
"= Center"	Sets the step size to the value of the center frequency and removes the coupling of the step size to the demodulation bandwidth. The used value is indicated in the "Value" field.

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

Remote command:

[SENSe:] FREQuency:CENTer:STEP:LINK on page 232

[SENSe:] FREQuency:CENTer:STEP:LINK:FACTor on page 233

[SENSe:] FREQuency:CENTer:STEP on page 232

5.5 Trigger Configuration

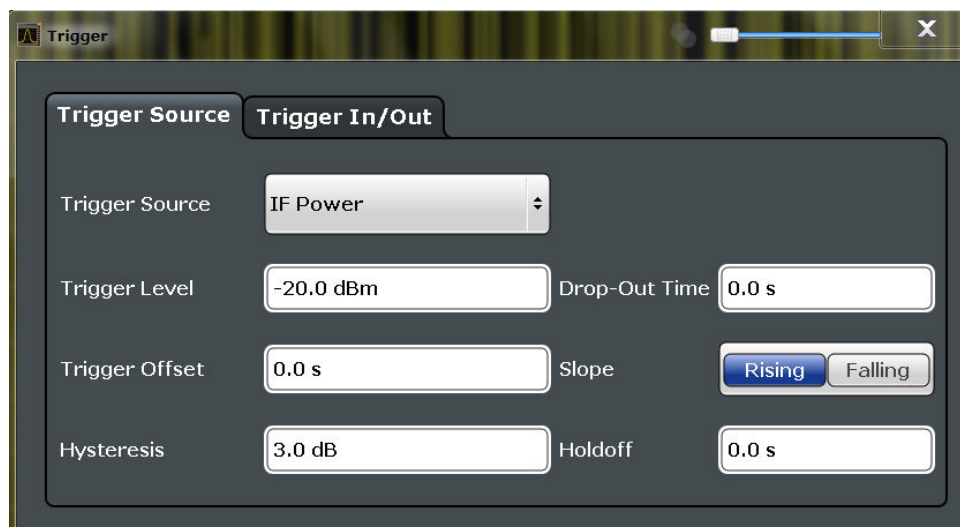
Triggering means to capture the interesting part of the signal. Choosing the right trigger type and configuring all trigger settings correctly allows you to detect various incidents in your demodulated signals.

Optionally, the trigger signal used by the R&S FSW can be output to a connected device, and an external trigger signal from a connected device can be used by the R&S FSW.

Trigger settings are identical to the base unit, except for the available trigger sources. Gating is not available for Analog Demodulation measurements.

For background information on trigger settings, trigger output and working with external triggers, see the R&S FSW User Manual.

The trigger settings are configured in the "Trigger" dialog box.



► To display this dialog box, do one of the following:

- Select the "Trigger" button in the Analog Demodulation "Overview"
- Select the TRIG key and then the "Trigger Config" softkey.

- [Trigger Source Settings](#)..... 95
- [Trigger Input and Output Settings](#)..... 99

5.5.1 Trigger Source Settings

The trigger source settings are configured in the "Trigger Source" tab of the "Trigger" dialog box.

Trigger Source.....	95
L Free Run.....	95
L External Trigger 1/2/3.....	95
L I/Q Power.....	96
L IF Power.....	96
L Baseband Power.....	96
L Digital I/Q.....	97
L FM / AM / PM / RF (Offline).....	97
L Time.....	97
L RF Power.....	98
L Power Sensor.....	98
Trigger Level.....	98
Trigger Offset.....	99
Hysteresis.....	99
Drop-Out Time.....	99
Slope.....	99
Trigger Holdoff.....	99

Trigger Source

In the Analog Demodulation application, the next measurement can be triggered if the selected input signal exceeds the threshold specified using the "Trigger Level" setting (see "Trigger Level" on page 98). Thus, a periodic signal modulated onto the carrier frequency can be displayed. It is recommended that the measurement time covers at least five periods of the audio signal.

Remote command:

`TRIGger [:SEquence] :SOURce` on page 250

Free Run ← Trigger Source

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 250

External Trigger 1/2/3 ← Trigger Source

Data acquisition starts when the TTL signal fed into the specified input connector (on the front or rear panel) meets or exceeds the specified trigger level.

(See "Trigger Level" on page 98).

Note: The "External Trigger 1" softkey automatically selects the trigger signal from the TRIGGER INPUT connector on the front panel.

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

"External Trigger 1"

Trigger signal from the TRIGGER 1 INPUT connector on the front panel.

"External Trigger 2"

Trigger signal from the TRIGGER 2 INPUT/OUTPUT connector on the front panel.

Note: Connector must be configured for "Input" in the "Outputs" configuration (see ["Trigger 2/3"](#) on page 100).

"External Trigger 3"

Trigger signal from the TRIGGER 3 INPUT/ OUTPUT connector on the rear panel.

Note: Connector must be configured for "Input" in the "Outputs" configuration (see ["Trigger 2/3"](#) on page 100).

Remote command:

```
TRIG:SOUR EXT, TRIG:SOUR EXT2
```

```
TRIG:SOUR EXT3
```

See [TRIGger\[:SEquence\]:SOURce](#) on page 250

I/Q Power ← Trigger Source

This trigger source is not available if the optional Digital Baseband Interface (R&S FSW-B17) or Analog Baseband Interface (R&S FSW-B71) is used for input. It is also not available for analysis bandwidths ≥ 160 MHz.

Triggers the measurement when the magnitude of the sampled I/Q data exceeds the trigger threshold.

The trigger bandwidth corresponds to the resolution bandwidth setting for data acquisition (see [chapter 5.6, "Data Acquisition"](#), on page 101).

Remote command:

```
TRIG:SOUR IQP, see TRIGger[:SEquence]:SOURce on page 250
```

IF Power ← Trigger Source

The R&S FSW starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

This trigger source is only available for RF input.

It is not available for input from the Digital Baseband Interface (R&S FSW-B17) or the Analog Baseband Interface (R&S FSW-B71).

For frequency sweeps, the third IF represents the start frequency. The trigger bandwidth at the third IF depends on the RBW and sweep type.

For measurements on a fixed frequency (e.g. zero span or I/Q measurements), the third IF represents the center frequency.

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

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

Remote command:

```
TRIG:SOUR IFP, see TRIGger[:SEquence]:SOURce on page 250
```

Baseband Power ← Trigger Source

Defines triggering on the baseband power (for baseband input via the Digital Baseband Interface R&S FSW-B17 or the Analog Baseband interface R&S FSW-B71)).

For more information on the the Digital Baseband Interface or the Analog Baseband Interface see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

TRIG:SOUR BBP, see [TRIGger\[:SEquence\]:SOURce](#) on page 250

Digital I/Q ← Trigger Source

For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the Digital Baseband Interface (R&S FSW-B17) is available:

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

Note:

If the Digital I/Q enhanced mode is used, i.e. the connected device supports transfer rates up to 200 Msps, only the general purpose bits GP0 and GP1 are available as a Digital I/Q trigger source.

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

(For details on the LVDS connector see the R&S FSW I/Q Analyzer User Manual.)

Table 5-2: Assignment of general purpose bits to LVDS connector pins

Bit	LVDS pin
GP0	SDATA4_P - Trigger1
GP1	SDATA4_P - Trigger2
GP2 *)	SDATA0_P - Reserve1
GP3 *)	SDATA4_P - Reserve2
GP4 *)	SDATA0_P - Marker1
GP5 *)	SDATA4_P - Marker2
*): not available for Digital I/Q enhanced mode	

Remote command:

TRIG:SOUR GP0, see [TRIGger\[:SEquence\]:SOURce](#) on page 250

FM / AM / PM / RF (Offline) ← Trigger Source

Triggers when the demodulated input signal exceeds the trigger level.

Remote command:

[TRIGger\[:SEquence\]:SOURce](#) on page 250

Time ← Trigger Source

Triggers in a specified repetition interval.

Remote command:

TRIG:SOUR TIME, see [TRIGger\[:SEquence\]:SOURce](#) on page 250

RF Power ← Trigger Source

Defines triggering of the measurement via signals which are outside the displayed measurement range.

For this purpose the instrument uses a level detector at the first intermediate frequency. The input signal must be in the frequency range between 500 MHz and 8 GHz.

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

Note: If the input signal contains frequencies outside of this range (e.g. for fullspan measurements), the sweep may be aborted and 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".

This trigger source is not available for input from the Digital Baseband Interface (R&S FSW-B17) or the Analog Baseband Interface (R&S FSW-B71). If the trigger source "RF Power" is selected and digital I/Q or analog baseband input is activated, the trigger source is automatically switched to "Free Run".

Remote command:

TRIG:SOUR RFP, see [TRIGger\[:SEquence\]:SOURce](#) on page 250

Power Sensor ← Trigger Source

Uses an external power sensor as a trigger source. This option is only available if a power sensor is connected and configured.

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

Remote command:

TRIG:SOUR PSE, see [TRIGger\[:SEquence\]:SOURce](#) on page 250

Trigger Level

Defines the trigger level for the specified trigger source.

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

Remote command:

[TRIGger\[:SEquence\]:LEVel:IFPower](#) on page 247

[TRIGger\[:SEquence\]:LEVel:IQPower](#) on page 248

[TRIGger\[:SEquence\]:LEVel\[:EXternal<port>\]](#) on page 247

For analog baseband (B71) or digital baseband (B17) input only:

[TRIGger\[:SEquence\]:LEVel:RFPower](#) on page 248

[TRIGger\[:SEquence\]:LEVel:AM:RELative](#) on page 248

[TRIGger\[:SEquence\]:LEVel:AM\[:ABSolute\]](#) on page 249

[TRIGger\[:SEquence\]:LEVel:FM](#) on page 249

[TRIGger\[:SEquence\]:LEVel:PM](#) on page 249

Trigger Offset

Defines the time offset between the trigger event and the start of the sweep.

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)

For the "Time" trigger source, this function is not available.

Remote command:

[TRIGger\[:SEquence\]:HOLDoff\[:TIME\]](#) on page 246

Hysteresis

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" trigger sources. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

Remote command:

[TRIGger\[:SEquence\]:IFPower:HYSteresis](#) on page 246

Drop-Out Time

Defines the time the input signal must stay below the trigger level before triggering again.

Note: For input from the Analog Baseband Interface (R&S FSW-B71) using the baseband power trigger (BBP), the default drop out time is set to 100 ns to avoid unintentional trigger events (as no hysteresis can be configured in this case).

Remote command:

[TRIGger\[:SEquence\]:DTIME](#) on page 245

Slope

For all trigger sources except time and frequency mask (Realtime only) 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 250

Trigger Holdoff

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 246

5.5.2 Trigger Input and Output Settings

The trigger input and output settings are configured in the "Trigger In/Out" tab of the "Trigger" dialog box, or in the "Outputs" configuration dialog box (via the INPUT/OUTPUT key).

Trigger 2/3.....	100
L Output Type.....	100
L Level.....	100
L Pulse Length.....	101
L Send Trigger.....	101

Trigger 2/3

Defines the usage of the variable TRIGGER INPUT/OUTPUT connectors, where:

"Trigger 2": TRIGGER INPUT/OUTPUT connector on the front panel

"Trigger 3": TRIGGER 3 INPUT/ OUTPUT connector on the rear panel

(Trigger 1 is INPUT only.)

Note: Providing trigger signals as output is described in detail in the R&S FSW User Manual.

"Input" The signal at the connector is used as an external trigger source by the R&S FSW. No further trigger parameters are available for the connector.

"Output" The R&S FSW sends a trigger signal to the output connector to be used by connected devices.
Further trigger parameters are available for the connector.

Note: For offline AF or RF triggers, no output signal is provided.

Remote command:

`OUTPut:TRIGger<port>:LEVel` on page 253

`OUTPut:TRIGger<port>:DIRection` on page 253

Output Type ← Trigger 2/3

Type of signal to be sent to the output

"Device Trig- (Default) Sends a trigger when the R&S FSW triggers.
gered"

"Trigger Sends a (high level) trigger when the R&S FSW is in "Ready for trig-
Armed" ger" state.
This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low level signal at the AUX port (pin 9).
For details see the description of the `STATUS:OPERation` register in the R&S FSW User Manual and the description of the AUX port in the R&S FSW Getting Started manual.

"User Defined" Sends a trigger when user selects "Send Trigger" button.
In this case, further parameters are available for the output signal.

Remote command:

`OUTPut:TRIGger<port>:OTYPe` on page 254

Level ← Output Type ← Trigger 2/3

Defines whether a constant high (1) or low (0) signal is sent to the output connector.

Remote command:

`OUTPut:TRIGger<port>:LEVel` on page 253

Pulse Length ← Output Type ← Trigger 2/3

Defines the length of the pulse sent as a trigger to the output connector.

Remote command:

[OUTPut:TRIGger<port>:PULSe:LENGth](#) on page 254

Send Trigger ← Output Type ← Trigger 2/3

Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:

[OUTPut:TRIGger<port>:PULSe:IMMediate](#) on page 254

5.6 Data Acquisition

How data is to be acquired and then demodulated is configured in the "Data Acquisition" dialog box.

**MSRA/MSRT operating mode**

In MSRA/MSRT operating mode, only the MSRA/MSRT Master channel actually captures data from the input signal. The data acquisition settings for the Analog Demodulation application in MSRA/MSRT mode define the analysis interval.

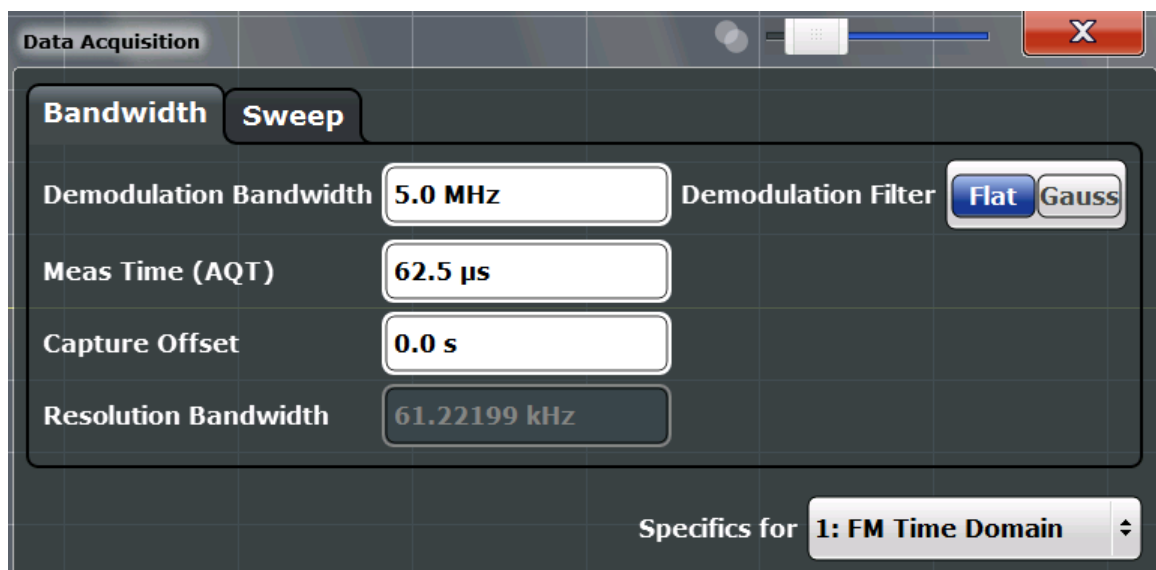
For details on the MSRA operating mode see the R&S FSW MSRA User Manual. For details on the MSRT operating mode see the R&S FSW Realtime Spectrum Application and MSRT Operating Mode User Manual.

- [Bandwidth Settings](#)..... 101
- [Sweep Settings](#)..... 103

5.6.1 Bandwidth Settings

The bandwidth settings define which parts of the input signal are acquired and then demodulated. They are configured via the BW key or in the "Bandwidth" tab of the "Data Acquisition" dialog box.

- ▶ To display this dialog box, do one of the following:
 - Select the "Data Acquisition" button in the Analog Demodulation "Overview"
 - Select the BW key and then the "Bandwidth Config" softkey.



Demodulation Bandwidth..... 102
 Demodulation Filter..... 102
 Measurement Time (AQT)..... 103
 Capture Offset..... 103
 Resolution Bandwidth..... 103

Demodulation Bandwidth

Defines the demodulation bandwidth of the measurement. The demodulation bandwidth determines the sampling rate with which the input signal is captured and analyzed.

For recommendations on finding the correct demodulation bandwidth see [chapter 4.2, "Demodulation Bandwidth"](#), on page 28.

For details on the relation between demodulation bandwidth and sampling rate refer to [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

Remote command:

`[SENSe:]BANDwidth|BWIDth:DEMod` on page 242

Demodulation Filter

Defines the filter to be used for demodulation.

For details on sample rates, measurement times and trigger offsets for various demodulation bandwidths when using a Gaussian filter, see [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

"Flat" Default

"Gauss" Optimizes the settling behaviour of the filter

Remote command:

`[SENSe:]BANDwidth|BWIDth:DEMod:TYPE` on page 243

Measurement Time (AQT)

Defines how long data is acquired for demodulation. For details on the measurement time see [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

Remote command:

[\[SENSe:\]ADEMod:MTIME](#) on page 240

Capture Offset

This setting is only available for applications in **MSRA or MSRT operating mode**. It has a similar effect as the trigger offset in other measurements: it defines the time offset between the capture buffer start and the start of the extracted application data.

In MSRA mode, the offset must be a positive value, as the capture buffer starts at the trigger time = 0.

In MSRT mode, the offset may be negative if a pretrigger time is defined.

Remote command:

[\[SENSe:\]MSRA:CAPTURE:OFFSET](#) on page 338

[\[SENSe:\]RTMS:CAPTURE:OFFSET](#) on page 339

Resolution Bandwidth

Defines the resolution bandwidth for data acquisition. The available range is specified in the data sheet.

Remote command:

[\[SENSe:\]BANDwidth|BWIDth\[:RESolution\]](#) on page 243

5.6.2 Sweep Settings

The sweep settings define how often data from the input signal is acquired and then demodulated. They are configured via the SWEEP key or in the "Sweep" tab of the "Data Acquisition" dialog box.

- ▶ To display this dialog box, do one of the following:
 - Select the "Data Acquisition" button in the Analog Demodulation "Overview" and switch to the "Sweep" tab.
 - Select the SWEEP key and then the "Sweep Config" softkey.



Continuous Sweep/RUN CONT..... 104
 Single Sweep/ RUN SINGLE..... 104
 Continue Single Sweep..... 105
 Refresh..... 105
 Measurement Time (AQT)..... 105
 Sweep Points..... 106
 Sweep/Average Count..... 106

Continuous Sweep/RUN CONT

After triggering, starts the sweep and repeats it continuously until stopped. This is the default setting.

While the measurement is running, the "Continuous Sweep" softkey and the RUN CONT key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again. The results are not deleted until a new measurement is started.

Note: Sequencer. If the Sequencer is active, the "Continuous Sweep" softkey only controls the sweep mode for the currently selected channel; however, the sweep mode only has an effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in continuous sweep mode is swept repeatedly.

If the Sequencer is active in MSRT mode, the "Continuous Sweep" function does not start data capturing; it merely has an effect on trace averaging over multiple sequences. In this case, trace averaging is performed.

Furthermore, the RUN CONT key controls the Sequencer, not individual sweeps. RUN CONT starts the Sequencer in continuous mode.

For details on the Sequencer, see the R&S FSW User Manual.

Remote command:

[INITiate:CONTinuous](#) on page 278

Single Sweep/ RUN SINGLE

After triggering, starts the number of sweeps set in "Sweep Count". The measurement stops after the defined number of sweeps has been performed.

While the measurement is running, the "Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Note: Sequencer. If the Sequencer is active, the "Single Sweep" softkey only controls the sweep mode for the currently selected channel; however, the sweep mode only has an effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in single sweep mode is swept only once by the Sequencer.

If the Sequencer is active in MSRT mode, the "Single Sweep" function does not start data capturing; it merely has an effect on trace averaging over multiple sequences. In this case, no trace averaging is performed.

Furthermore, the RUN SINGLE key controls the Sequencer, not individual sweeps. RUN SINGLE starts the Sequencer in single mode.

If the Sequencer is off, only the evaluation for the currently displayed measurement channel is updated.

For details on the Sequencer, see the R&S FSW User Manual.

Remote command:

`INITiate[:IMMediate]` on page 279

Continue Single Sweep

After triggering, repeats the number of sweeps set in "Sweep Count", without deleting the trace of the last measurement.

While the measurement is running, the "Continue Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:

`INITiate:CONMeas` on page 278

Refresh

This function is only available if the Sequencer is deactivated and only for **MSRA or MSRT applications**.

The data in the capture buffer is re-evaluated by the currently active application only. The results for any other applications remain unchanged.

This is useful, for example, after evaluation changes have been made or if a new sweep was performed from another application; in this case, only that application is updated automatically after data acquisition.

Note: To update all active applications at once, use the "Refresh all" function in the "Sequencer" menu.

Remote command:

`INITiate:REFresh` on page 279

Measurement Time (AQT)

Defines how long data is acquired for demodulation. For details on the measurement time see [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

Remote command:

`[SENSe:]ADEMod:MTIME` on page 240

Sweep Points

Defines the number of measured values to be collected during one sweep.

All values from 101 to 100001 can be set. The default value is 1001 sweep points.

Remote command:

[SENSe:] SWEEp: POINts on page 244

Sweep/Average Count

Defines the number of sweeps to be performed in the single sweep mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one sweep is performed.

The sweep count is applied to all the traces in all diagrams.

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

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


Remote command:

[SENSe:] SWEEp: COUNT on page 243

[SENSe:] AVERAge: COUNT on page 274

5.7 Demodulation Display

The demodulated signal can be displayed using various evaluation methods. All evaluation methods available for the Analog Demodulation application are displayed in the evaluation bar in SmartGrid mode when you do one of the following:

- Select the  "SmartGrid" icon from the toolbar.
- Select the "Demod/Display" button in the "Overview".
- Press the MEAS key.
- Select the "Display Config" softkey in the main "Analog Demod" menu.

Up to six evaluation methods can be displayed simultaneously in separate windows. The Analog Demodulation evaluation methods are described in [chapter 3, "Measurements and Result Displays"](#), on page 15.



For details on working with the SmartGrid see the R&S FSW Getting Started manual.

5.8 Demodulation

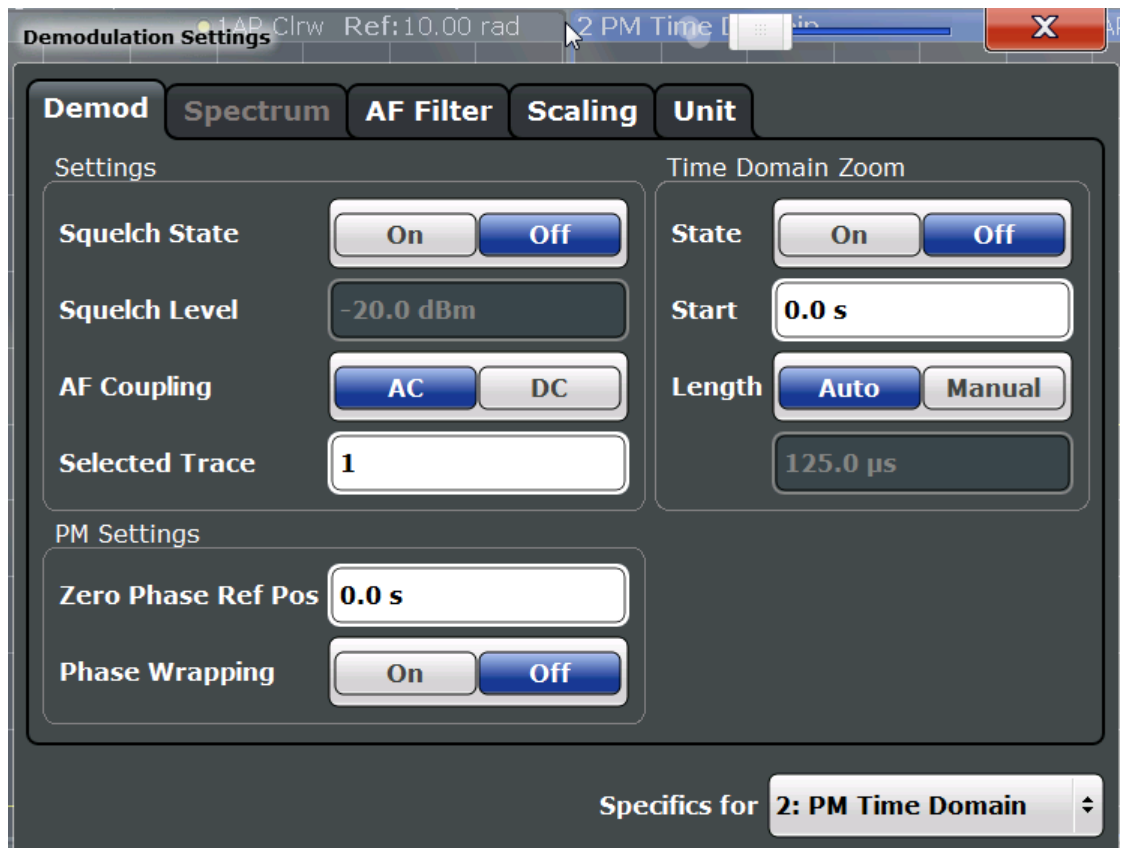
Demodulation parameters can be configured in the "Demodulation Settings" dialog box which is displayed when you select the "Demod Settings" button in the "Overview".

- [Basic Demodulation Measurement Parameters \(Demod\)](#).....107
- [Demodulation Spectrum](#).....110
- [AF Filter](#).....113
- [Scaling](#).....117
- [Units](#).....120

5.8.1 Basic Demodulation Measurement Parameters (Demod)

The basic demodulation measurement parameters define how the measurement is performed. They are configured in the "Demod" tab of the "Demodulation Settings" dialog box.

- ▶ To display this dialog box, do one of the following:
 - Select the "Demod Settings" button in the Analog Demodulation "Overview" and select the "Demod" tab.
 - Select the MEAS CONFIG key and then the "Demod Config" softkey.



- [Squelch State](#).....108
- [Squelch Level](#).....108
- [AF Coupling](#).....108
- [Selected Trace](#).....108
- [Time Domain Zoom](#).....109
 - ↳ [State](#).....109

L Start.....	109
L Length.....	109
L Time per Division.....	109
Zero Phase Reference Position (PM Time Domain only).....	110
Phase Wrap On/Off (PM Time Domain only).....	110

Squelch State

Activates the squelch function, i.e. if the signal falls below a defined threshold, the demodulated data is automatically set to 0. This is useful, for example, to avoid demodulation noise during transmission breaks.

Remote command:

[SENSe:]ADEMod:SQUelch[:STATe] on page 256

Squelch Level

Defines the level threshold below which the demodulated data is set to 0 if squelching is enabled. The squelch level is an absolute value.

Remote command:

[SENSe:]ADEMod:SQUelch:LEVel on page 256

AF Coupling

Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation
 - If DC is selected, the absolute frequency is displayed, i.e. an input signal with an offset relative to the center frequency is not displayed symmetrically with respect to the zero line.
 - If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric with respect to the zero line.
- PM time evaluation
 - If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of $\pm \pi$.
 - If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

Remote command:

[SENSe:]ADEMod<n>:AF:COUPling on page 255

Selected Trace

Defines the trace used to determine the results in the Result Summary.

Time Domain Zoom

Using the time domain zoom, the demodulated data for a particular time span is extracted and displayed in more detail. This is useful if the measurement time is very large and thus each sweep point represents a large time span. The time domain zoom function distributes the available sweep points only among the time span defined by the zoom area length. The time span displayed per division of the diagram is decreased. Thus, the display of the extracted time span becomes more precise. Note that the time domain zoom area affects not only the diagram display, but the entire evaluation for the current window.

This function is only available for evaluations in the time domain.

Tip: In addition to the Time Domain Zoom, a graphical zoom is available for all diagram evaluations. However, the graphical zoom is useful only if more measured values than trace points are available. The (time) span represented by each measurement point remains the same. For details see [chapter 6.8, "Zoom Functions"](#), on page 153.

State ← Time Domain Zoom

Activates or deactivates the time domain zoom mode.

"ON"	Activates the time domain zoom.
"OFF"	Deactivates the time domain zoom and restores the original display. If more measured values than measurement points are available, several measured values are combined in one measurement point according to the method of the selected trace detector.

Remote command:

[\[SENSe:\]ADEMod<n>:ZOOM\[:STATe\]](#) on page 258

Start ← Time Domain Zoom

Defines the start time for the time domain zoom area. For spectrum evaluations the start time is always 0.

Remote command:

[\[SENSe:\]ADEMod<n>:ZOOM:START](#) on page 257

Length ← Time Domain Zoom

Defines the length of the time domain zoom area. Enter the length as a time value manually, or use the "Auto" setting to set the length to the current number of sweep points automatically.

Remote command:

[\[SENSe:\]ADEMod<n>:ZOOM:LENGth](#) on page 257

[\[SENSe:\]ADEMod<n>:ZOOM:LENGth:MODE](#) on page 257

Time per Division ← Time Domain Zoom

The "Time per Division" softkey in the main Analog Demodulation menu enables the "Time Domain Zoom" function and defines the zoom area length in one step. The width of the zoom display is divided into 10 divisions; thus, by entering the time that is displayed in each division, you indirectly define the zoom area length ("Time per Division" * 10). The starting point of the zoom area is determined automatically. To specify the starting point manually, use the [Start](#) setting.

Zero Phase Reference Position (PM Time Domain only)

Defines the position at which the phase of the PM-demodulated signal is set to 0 rad. The entry is made with respect to time. In the default setting, the first measured value is set to 0 rad.

This setting is only available for PM time domain displays with DC coupling.

Remote command:

[SENSe:]ADEMod:PM:RPOint[:X] on page 255

Phase Wrap On/Off (PM Time Domain only)

Activates/deactivates the phase wrap.

On	The phase is displayed in the range $\pm 180^\circ$ ($\pm \Pi$). For example, if the phase exceeds $+180^\circ$, 360° is subtracted from the phase value, with the display thus showing $>-180^\circ$.
Off	The phase is not wrapped.

This setting is only available for PM time domain displays with DC coupling.

5.8.2 Demodulation Spectrum

The demodulation spectrum defines which span of the demodulated data is evaluated. It is configured in the "Spectrum" tab of the "Demodulation Settings" dialog box.

► To display this dialog box, do one of the following:

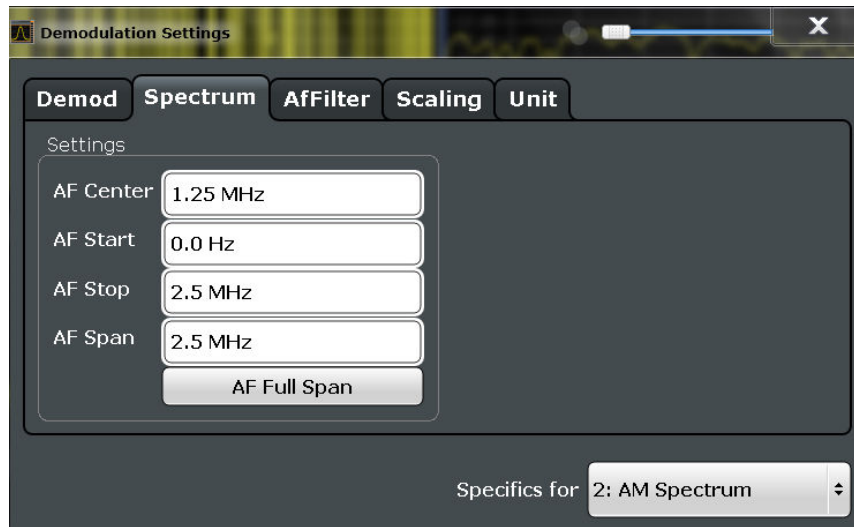
- Select the "Demod Settings" button in the Analog Demodulation "Overview" and select the "Spectrum" tab.
- Select the MEAS CONFIG key and then the "Demod Config" softkey. Then select the "Spectrum" tab.

Depending on the evaluation (AF or RF display), the settings vary.

- [AF Evaluation](#)..... 110
- [RF Evaluation](#)..... 112

5.8.2.1 AF Evaluation

These settings are only available for AF Spectrum evaluations, not in the time domain.



AF Center.....	111
AF Start.....	111
AF Stop.....	111
AF Span.....	111
AF Full Span.....	112

AF Center

Defines the center frequency of the demodulated data to evaluate.

Remote command:

[\[SENSe:\]ADEMod:AF:CENTer](#) on page 258

AF Start

Defines the start frequency of the demodulated data to evaluate.

Remote command:

[\[SENSe:\]ADEMod:AF:START](#) on page 259

AF Stop

Defines the stop frequency of the demodulated data to evaluate.

The maximum AF stop frequency corresponds to half the demodulation bandwidth.

Remote command:

[\[SENSe:\]ADEMod:AF:STOP](#) on page 259

AF Span

Defines the span (around the center frequency) of the demodulated data to evaluate. The maximum span is DBW/2.

Remote command:

[\[SENSe:\]ADEMod:AF:SPAN](#) on page 259

AF Full Span

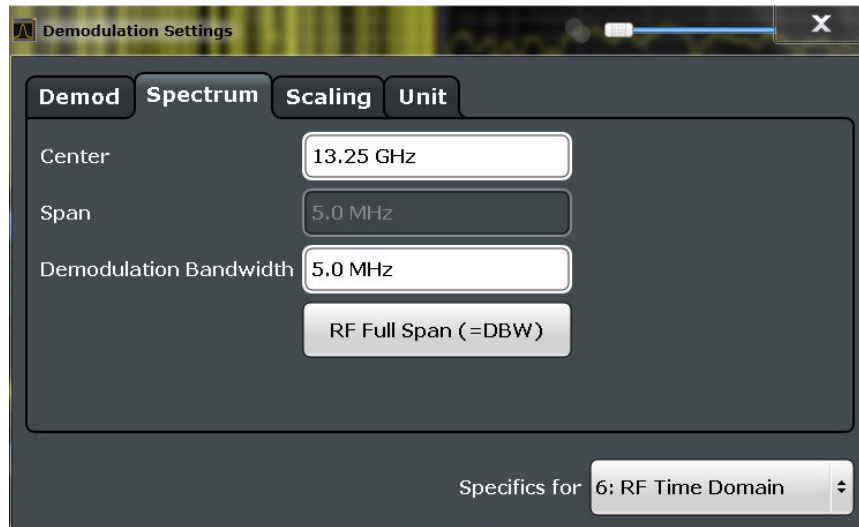
Sets the span (around the center frequency) of the demodulated data to the maximum of DBW/2.

Remote command:

[SENSe:]ADEMod:AF:SPAN:FULL on page 259

5.8.2.2 RF Evaluation

These settings are only available for RF evaluation, both in time and frequency domain. Note that for RF data the center frequency and demodulation bandwidth correspond to the settings defined in the "Input" and "Data Acquisition" configuration.



Center frequency.....112
 Span.....112
 Demodulation Bandwidth.....113
 RF Full Span.....113

Center frequency

Defines the normal center frequency of the signal. The allowed range of values for the center frequency depends on the frequency span.

$$\text{span} > 0: \text{span}_{\min}/2 \leq f_{\text{center}} \leq f_{\text{max}} - \text{span}_{\min}/2$$

f_{max} and span_{\min} are specified in the data sheet.

Remote command:

[SENSe:]FREQuency:CENTer on page 231

Span

Defines the frequency span. The center frequency is kept constant. The following range is allowed:

span = 0: 0 Hz

span >0:

$$\text{span}_{\min} \leq f_{\text{span}} \leq f_{\text{max}}$$

and $f_{\max} = \text{DBW}/2$

f_{\max} and span_{\min} are specified in the data sheet.

Remote command:

[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum] on page 260

[SENSe:]ADEMod:SPEC:SPAN:ZOOM on page 260

Demodulation Bandwidth

Defines the demodulation bandwidth of the measurement. The demodulation bandwidth determines the sampling rate with which the input signal is captured and analyzed.

For recommendations on finding the correct demodulation bandwidth see [chapter 4.2, "Demodulation Bandwidth"](#), on page 28.

For details on the relation between demodulation bandwidth and sampling rate refer to [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

Remote command:

[SENSe:]BANDwidth|BWIDth:DEMod on page 242

RF Full Span

Sets the span (around the center frequency) of the RF data to be evaluated to the demodulation bandwidth.

Remote command:

[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum] on page 260

5.8.3 AF Filter

The AF filter reduces the evaluated bandwidth of the demodulated signal and can define a weighting function. It is configured in the "AF Filter" tab of the "Demodulation Settings" dialog box.

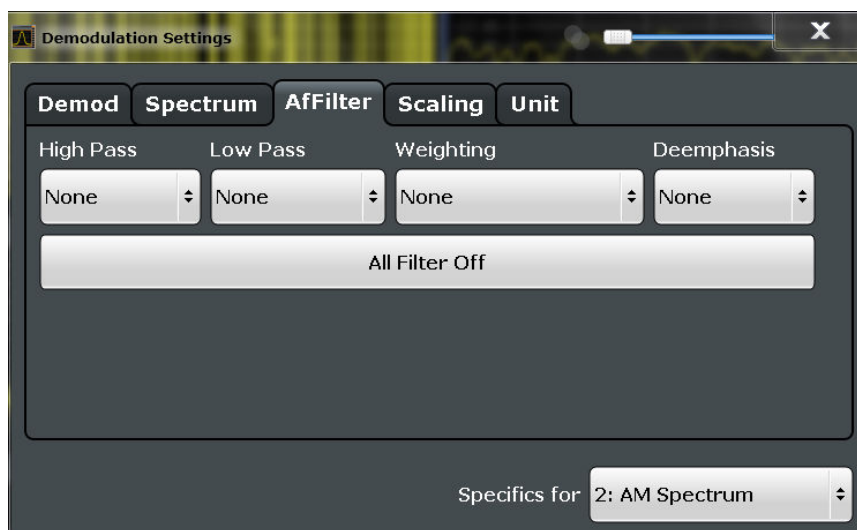


AF filters are only available for AF time domain evaluations.

A maximum of two filters out of high pass, low pass or deemphasis filters can be active at the same time if analog demodulation output is active (see [chapter 5.9.2, "Analog Demodulation Output Settings"](#), on page 124).

► To display this dialog box, do one of the following:

- Select the "Demod Settings" button in the Analog Demodulation "Overview" and select the "AF Filter" tab.
- Select the MEAS CONFIG key and then the "AF Filter Config" softkey.



High Pass..... 114
 Low Pass..... 114
 Weighting..... 115
 Deemphasis..... 116
 Deactivating all AF Filters..... 116

High Pass

Defines a high pass filter with the given limit to separate the DC component. The filters are indicated by the 3 dB cutoff frequency. The 50 Hz and 300 Hz filters are designed as 2nd-order Butterworth filter (12 dB/octave). The 20 Hz filter is designed as 3rd-order Butterworth filter (18 dB/octave).

The high pass filters are active in the following demodulation bandwidth range:

None	No AF Filter used (default)
20 Hz	100 Hz ≤ demodulation bandwidth ≤ 1.6 MHz
50 Hz:	200 Hz ≤ demodulation bandwidth ≤ 3 MHz
300 Hz:	800 Hz ≤ demodulation bandwidth ≤ 8 MHz
Manual:	A high pass filter with the manually defined frequency is used.

Note: If online demodulation output is active, the predefined (fixed) filters are not available. In this case, the frequency for the high pass filter must be defined manually (see also [chapter 5.9.2, "Analog Demodulation Output Settings"](#), on page 124).

If a filter was already configured when online demodulation output is activated, it is replaced by a manual filter that provides corresponding results, if possible.

Remote command:

[SENSe:] FILTer<n>:HPASs [:STATe] on page 264

[SENSe:] FILTer<n>:HPASs:FREQuency[:ABSolute] on page 263

[SENSe:] FILTer<n>:HPASs:FREQuency:MANual on page 263

Low Pass

Defines a low pass filter type. Relative and absolute low pass filter are available.

- Absolute low pass filters:
Absolute filters are indicated by the 3 dB cutoff frequency. The 3 kHz, 15 kHz and 23 kHz filters are designed as 5th-order Butterworth filters (30 dB/octave). The 150 kHz filter is designed as 8th-order Butterworth filter (48 dB/octave).
The absolute low pass filters are active in the following demodulation bandwidth range:

Filter type	Demodulation bandwidth
3 kHz:	6.4 kHz ≤ demodulation bandwidth ≤ 3 MHz
15 kHz:	50 kHz ≤ demodulation bandwidth ≤ 8 MHz
23 kHz:	50 kHz ≤ demodulation bandwidth ≤ 18 MHz
150 kHz:	400 kHz ≤ demodulation bandwidth ≤ 8 MHz
Manual:	A low pass filter with the manually defined frequency is used.

Note: If online demodulation output is active, the predefined (fixed) filters are not available. In this case, the frequency for the low pass filter must be defined manually (see also [chapter 5.9.2, "Analog Demodulation Output Settings"](#), on page 124).

If a filter was already configured when online demodulation output is activated, it is replaced by a manual filter that provides corresponding results, if possible.

- Relative low pass filters:
Relative filters (3 dB) can be selected in % of the demodulation bandwidth. The filters are designed as 5th-order Butterworth filter (30 dB/octave) and active for all demodulation bandwidths.
- "None" deactivates the AF low pass filter (default).

Remote command:

[SENSe:] FILTER<n>:LPASs[:STATe] on page 265

[SENSe:] FILTER<n>:LPASs:FREQuency[:ABSolute] on page 264

[SENSe:] FILTER<n>:LPASs:FREQuency:RELative on page 264

[SENSe:] FILTER<n>:LPASs:FREQuency:MANual on page 264

Weighting

Selects a weighting AF filter. By default, no weighting filter is active.

"A weighted"	Switches on the A weighted filter. The weighting filter is active in the following demodulation bandwidth range: 100 kHz ≤ demodulation bandwidth ≤ 800 kHz
"CCITT"	Switches on a CCITT P.53 weighting filter. The weighting filter is active in the following demodulation bandwidth range: 20 kHz ≤ demodulation bandwidth ≤ 3 MHz
"CCIR weighted"	Switches on the CCIR weighted filter. The weighting filter is active in the following demodulation bandwidth range: 100 kHz ≤ demodulation bandwidth ≤ 3.0 MHz

"CCIR unweighted" Switches on the CCIR unweighted filter, which is the combination of the 20 Hz highpass and 23 kHz low pass filter. The weighting filter is active in the following demodulation bandwidth range:
 $50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 1.6 \text{ MHz}$

Remote command:

[SENSe:] FILTer<n>:CCIT on page 262

[SENSe:] FILTer<n>:CCIR[:UNWeighted][:STATe] on page 262

[SENSe:] FILTer<n>:CCIR:WEIGhted[:STATe] on page 261

[SENSe:] FILTer<n>:AWEighted[:STATe] on page 261

Deemphasis

Activates a deemphasis filter with the given time constant.

Sometimes a modulated signal is extorted by a pre-emphasis filter before transmission, for example to eliminate frequencies that are more prone to interferences. In this case, the emphasis function must be reversed after demodulation. This is done by the deemphasis filter.

The deemphasis filter is active in the following demodulation bandwidth range:

25 μs :	$25 \text{ kHz} \leq \text{demodulation bandwidth} \leq 40 \text{ MHz}$
50 μs :	$6.4 \text{ kHz} \leq \text{demodulation bandwidth} \leq 18 \text{ MHz}$
75 μs :	$6.4 \text{ kHz} \leq \text{demodulation bandwidth} \leq 18 \text{ MHz}$
750 μs :	$800 \text{ Hz} \leq \text{demodulation bandwidth} \leq 3 \text{ MHz}$

Depending on the deemphasis filter, a minimum demodulation bandwidth is required for an error less than 0.5 dB, up to a maximum AF frequency. The following table shows the dependencies.

Deemphasis [μs]	25 μs	50 μs	75 μs	750 μs
Max. AF frequency	25 kHz	12 kHz	8 kHz	800 Hz
Required demodulation bandwidth	$\geq 200 \text{ kHz}$	$\geq 100 \text{ kHz}$	$\geq 50 \text{ kHz}$	$\geq 6.4 \text{ kHz}$

For higher AF frequencies the demodulation bandwidth must be increased.

Remote command:

[SENSe:] FILTer<n>:DEMPHasis[:STATe] on page 263

[SENSe:] FILTer<n>:DEMPHasis:TCONstant on page 262

Deactivating all AF Filters

The "All Filter Off" button deactivates all AF filters for the selected evaluation.

Remote command:

[SENSe:] FILTer<n>:AOFF on page 261

5.8.4 Scaling

The scaling parameters define the range of the demodulated data to be displayed. They are configured in the "Scaling" tab of the "Demodulation Settings" dialog box.

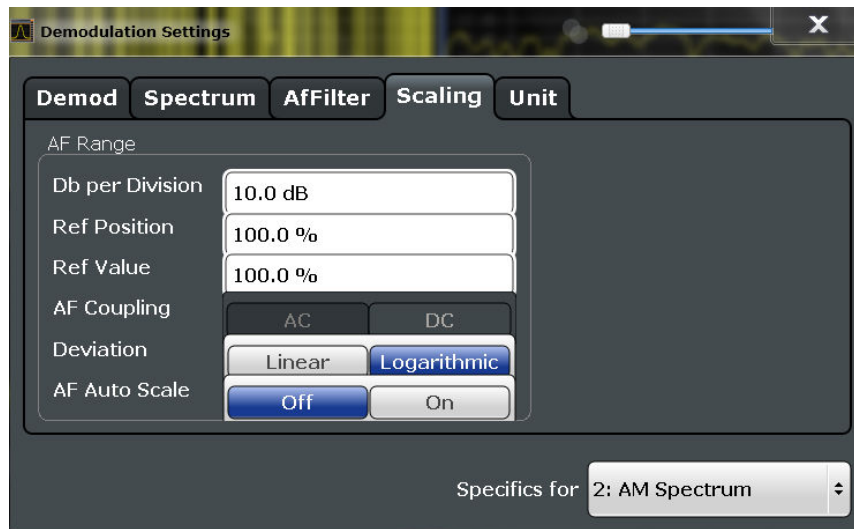
- ▶ To display this dialog box, do one of the following:
 - Select the "Demod Settings" button in the Analog Demodulation "Overview" and select the "Scaling" tab.
 - Select the MEAS CONFIG key and then the "Scale Config" softkey.

Depending on the evaluation (AF or RF display), the settings vary.

- [AF Evaluation](#)..... 117
- [RF Evaluation](#)..... 119

5.8.4.1 AF Evaluation

These settings are only available for AF evaluations.



- [Dev per Division/ Db per Division](#)..... 117
- [Reference Value Position](#)..... 118
- [Reference Value](#)..... 118
- [AF Coupling](#)..... 118
- [Deviation](#)..... 119
- [AF Auto Scale](#)..... 119

Dev per Division/ Db per Division

Defines the modulation depth or the phase deviation or frequency deviation per division (logarithmic: 0.1 to 20 dB):

AM display:	0.0001 % to 1000 %
FM display:	1 Hz/div to 100 MHz/div
PM display:	0.0001 rad/div to 1000 rad/div

Note: The value defined per division refers to the default display of 10 divisions on the y-axis. If fewer divisions are displayed (e.g. because the window is reduced in height), the range per division is increased in order to display the same result range in the smaller window. In this case, the per division value does not correspond to the actual display.

Reference Value Position

Determines the position of the reference value for the modulation depth or the phase deviation or frequency deviation on the y-axis of the diagram.

The position is entered as a percentage of the diagram height with 100 % corresponding to the upper diagram border. The default setting is 50 % (diagram center) for the AF time evaluations and 100 % (upper diagram border) for the AF spectrum evaluations.

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RPOSition` on page 239

Reference Value

Determines the modulation depth or the phase deviation or the frequency deviation at the reference line of the y-axis. The reference value can be set specifically for each evaluation.

- AF time display
The trace display takes individual frequency/phase offsets into account (in contrast, the [AF Coupling](#) setting permits automatic correction by the average frequency/phase offset of the signal, and can therefore not be activated simultaneously).
- AF spectrum display
In the default setting, the reference value defines the modulation depth or the FM/PM deviation at the upper diagram border.

Possible values:

- AM: 0 and ± 10000 %
- FM: 0 and ± 10 MHz
- PM: 0 and ± 10000 rad

Note: The reference value for the AF range in the **window title bar** is displayed with respect to the defined reference *position*. The position may vary for different windows. For time domain and frequency domain windows, for example, a different reference value may be displayed, although the same reference is actually used (but the positions vary).

Remote command:

`DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue` on page 265

AF Coupling

Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation
If DC is selected, the absolute frequency is displayed, i.e. an input signal with an offset relative to the center frequency is not displayed symmetrically with respect to the zero line.

If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

- PM time evaluation
 If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of $\pm \pi$.
 If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

Remote command:

[SENSe:]ADEMod<n>:AF:COUPling on page 255

Deviation

Switches between logarithmic and linear display of the modulation depth or the phase deviation or the frequency deviation.

Remote command:

DISPlay[:WINDow<n>]:TRACe:Y:SPACing on page 239

AF Auto Scale

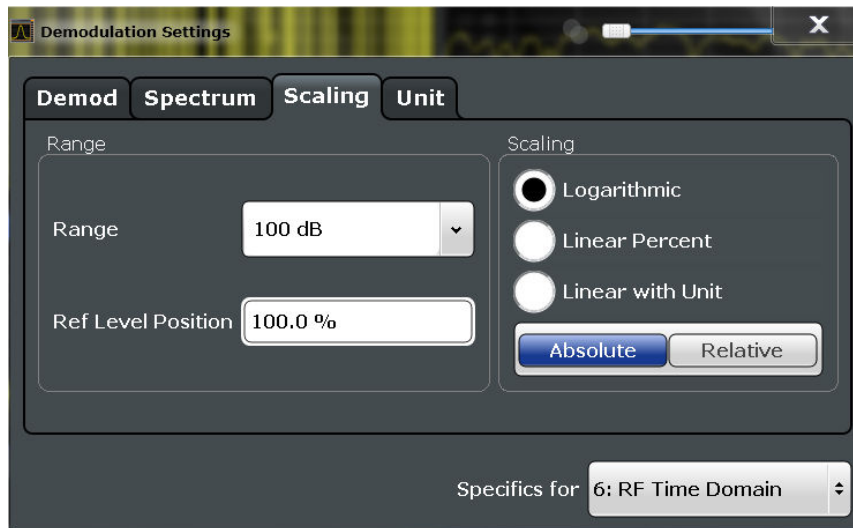
Activates automatic scaling of the y-axis for AF measurements. RF power and RF spectrum measurements are not affected by the auto-scaling.

Remote command:

[SENSe:]ADJust:SCALe:Y:AUTO[:CONTinuous] on page 269

5.8.4.2 RF Evaluation

These settings are only available for RF evaluations and the result summary.



Range..... 120
 Ref Level Position..... 120
 Auto Scale Once..... 120
 Scaling..... 120

Range

Defines the displayed y-axis range in dB.

The default value is 100 dB.

For Analog Demodulation measurements, time domain scaling is defined in Hz (default: 500 kHz).

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]](#) on page 238

Ref Level Position

Defines the reference level position, i.e. the position of the maximum AD converter value on the level axis in %, where 0 % corresponds to the lower and 100 % to the upper limit of the diagram.

Only available for RF measurements.

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:RPOSition](#) on page 239

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.

Remote command:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:AUTO ONCE](#) on page 238

Scaling

Defines the scaling method for the y-axis.

"Logarithmic"	Logarithmic scaling (only available for logarithmic units - dB..., and A, V, Watt)
"Linear Unit"	Linear scaling in the unit of the measured signal
"Linear Percent"	Linear scaling in percentages from 0 to 100
"Absolute"	The labeling of the level lines refers to the absolute value of the reference level (not available for "Linear Percent")
"Relative"	The scaling is in dB, relative to the reference level (only available for logarithmic units - dB...). The upper line of the grid (reference level) is always at 0 dB.

Remote command:

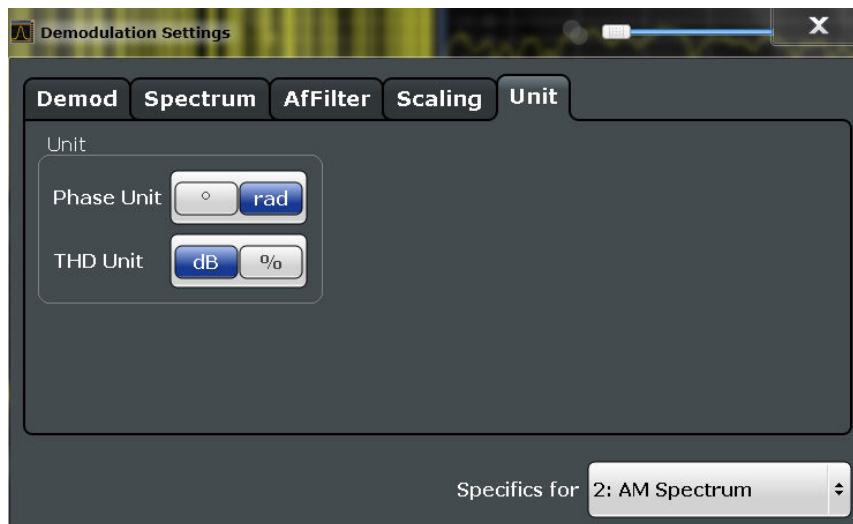
[DISPlay\[:WINDow<n>\]:TRACe:Y:SPACing](#) on page 239

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:MODE](#) on page 238

5.8.5 Units

The units define how the demodulated data is displayed. They are configured in the "Units" tab of the "Demodulation Settings" dialog box.

- ▶ To display this dialog box, do one of the following:
 - Select the "Demod Settings" button in the Analog Demodulation "Overview" and select the "Units" tab.
 - Select the MEAS CONFIG key and then the "Scale Config" softkey. Then select the "Units" tab.



Phase Unit (Rad/Deg)..... 121
 THD Unit (% / DB)..... 121

Phase Unit (Rad/Deg)

Sets the phase unit to rad or deg for displaying PM signals.

Remote command:

[UNIT:ANGLE](#) on page 266

THD Unit (% / DB)

Sets the unit to percent or DB for the calculation of the THD (in the Result Summary).

Remote command:

[UNIT:THD](#) on page 266

5.9 Output Settings

- [Output Settings](#)..... 121
- [Analog Demodulation Output Settings](#)..... 124

5.9.1 Output Settings

The R&S FSW can provide output to special connectors for other devices.

For details on connectors refer to the R&S FSW Getting Started manual, "Front / Rear Panel View" chapters.



How to provide trigger signals as output is described in detail in the R&S FSW User Manual.

Digital I/Q output is not available for Analog Demodulation measurements.

Output settings can be configured via the INPUT/OUTPUT key or in the "Outputs" dialog box.



Noise Source..... 122

Trigger 2/3..... 122

 L Output Type..... 123

 L Level..... 123

 L Pulse Length..... 123

 L Send Trigger..... 123

Noise Source

Switches the supply voltage for an external noise source on or off.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the R&S FSW itself, for example when measuring the noise level of a DUT.

Remote command:

[DIAGnostic:SERVice:NSource](#) on page 229

Trigger 2/3

Defines the usage of the variable TRIGGER INPUT/OUTPUT connectors, where:

"Trigger 2": TRIGGER INPUT/OUTPUT connector on the front panel

"Trigger 3": TRIGGER 3 INPUT/ OUTPUT connector on the rear panel

(Trigger 1 is INPUT only.)

Note: Providing trigger signals as output is described in detail in the R&S FSW User Manual.

- "Input" The signal at the connector is used as an external trigger source by the R&S FSW. No further trigger parameters are available for the connector.
- "Output" The R&S FSW sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.
- Note:** For offline AF or RF triggers, no output signal is provided.

Remote command:

[OUTPut:TRIGger<port>:LEVel](#) on page 253

[OUTPut:TRIGger<port>:DIRectioN](#) on page 253

Output Type ← Trigger 2/3

Type of signal to be sent to the output

- "Device Triggered" (Default) Sends a trigger when the R&S FSW triggers.
- "Trigger Armed" Sends a (high level) trigger when the R&S FSW is in "Ready for trigger" state. This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low level signal at the AUX port (pin 9). For details see the description of the `STATUS:OPERation` register in the R&S FSW User Manual and the description of the AUX port in the R&S FSW Getting Started manual.
- "User Defined" Sends a trigger when user selects "Send Trigger" button. In this case, further parameters are available for the output signal.

Remote command:

[OUTPut:TRIGger<port>:OTYPe](#) on page 254

Level ← Output Type ← Trigger 2/3

Defines whether a constant high (1) or low (0) signal is sent to the output connector.

Remote command:

[OUTPut:TRIGger<port>:LEVel](#) on page 253

Pulse Length ← Output Type ← Trigger 2/3

Defines the length of the pulse sent as a trigger to the output connector.

Remote command:

[OUTPut:TRIGger<port>:PULSe:LENGth](#) on page 254

Send Trigger ← Output Type ← Trigger 2/3

Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:

[OUTPut:TRIGger<port>:PULSe:IMMediate](#) on page 254

5.9.2 Analog Demodulation Output Settings

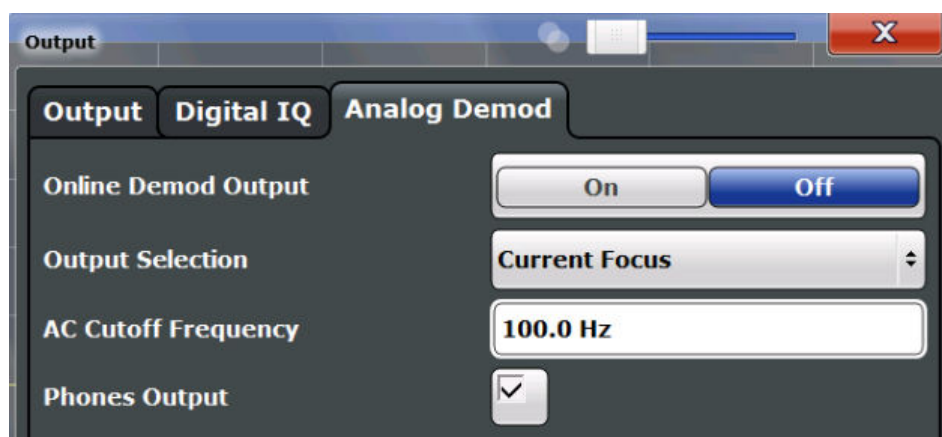
The demodulated signal in time domain results can be output to the IF/VIDEO/DEMODO output connector on the rear panel of the R&S FSW.



Output is not possible if the Digital Baseband Interface (R&S FSW-B17) is active.

The following settings and functions are available to configure the output in the Analog Demodulation application. They can be configured via the INPUT/OUTPUT key, in the "Output" dialog box, in the "Analog Demod" tab.

Note that the audio frequency (AF) filter settings used for demodulation also apply to the online output (see [chapter 5.8.3, "AF Filter"](#), on page 113). However, a maximum of two high pass, low pass or deemphasis filters can be active at the same time if analog demodulation output is active.



Online Demodulation Output State	124
Output Selection	124
AF Coupling	125
AC Cutoff Frequency	125
Phones Output	125

Online Demodulation Output State

Enables or disables online demodulation output. If enabled, the demodulated audio frequencies are output to the IF/VIDEO/DEMODO output connector on the rear panel of the R&S FSW and, optionally, to the PHONES connector on the front panel (see ["Phones Output"](#) on page 125).

Remote command:

`OUTPut:ADEMod[:ONLine] [:STATe]` on page 230

Output Selection

Selects the result display whose results are output. Only time domain results can be selected. All currently active time domain result displays are listed.

"Current Focus" dynamically switches to the currently selected window. Thus you can easily change the output signal simply by selecting the windows in the display. If a window is selected that does not contain a time-domain result display, the selection is ignored and the previous setting is maintained.

The result display currently used for output is indicated by a "Demod Out" label in the window title bar.

Remote command:

`OUTPut:ADEMod[:ONLine]:SOURCE` on page 230

AF Coupling

Controls the automatic correction of the frequency offset and phase offset of the input signal:

This function is only available for FM or PM time domain evaluations.

- FM time evaluation
 - If DC is selected, the absolute frequency is displayed, i.e. an input signal with an offset relative to the center frequency is not displayed symmetrically with respect to the zero line.
 - If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric with respect to the zero line.
- PM time evaluation
 - If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of $\pm \pi$.
 - If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

Remote command:

`[SENSe:]ADEMod<n>:AF:COUpling` on page 255

AC Cutoff Frequency

Defines the cutoff frequency for the AC highpass filter (for AC coupling only, see [AF Coupling](#)).

Note that the audio frequency (AF) filter settings used for demodulation also apply to the online output (see [chapter 5.8.3, "AF Filter"](#), on page 113).

Remote command:

`OUTPut:ADEMod[:ONLine]:AF[:CFrequency]` on page 230

Phones Output

In addition to sending the output to the IF/VIDEO/DEMODO connector (on the rear panel of the R&S FSW), it can also be output to headphones connected on the front panel (PHONES connector).

CAUTION! Risk of hearing damage . To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.

Note: If you do not hear output on the connected headphones despite having enabled both general online demodulation output (see ["Online Demodulation Output State"](#)

on page 124) and "Phones Output", adjust the volume setting using the rotary knob on the front panel.

Remote command:

`OUTPut:ADEMod[:ONLine]:PHONes` on page 231

5.10 Automatic Settings

Some settings can be adjusted by the R&S FSW automatically according to the current measurement settings.

To activate the automatic adjustment of a setting, select the corresponding function in the AUTO SET menu or in the configuration dialog box for the setting, where available.



MSRA/MSRT operating mode

In MSRA/MSRT operating mode, settings related to data acquisition cannot be adjusted for Analog Demodulation applications.

Adjusting all Determinable Settings Automatically (Auto All).....	126
Adjusting the Center Frequency Automatically (Auto Freq).....	126
Setting the Reference Level Automatically (Auto Level).....	127
Resetting the Automatic Measurement Time (Meastime Auto).....	127
Changing the Automatic Measurement Time (Meastime Manual).....	127
Upper Level Hysteresis.....	127
Lower Level Hysteresis.....	127
AF Auto Scale.....	128

Adjusting all Determinable Settings Automatically (Auto All)

Activates all automatic adjustment functions for the current measurement settings.

This includes:

- [Auto Frequency](#)
- [Auto Level](#)
- ["AF Auto Scale"](#) on page 119

This function is only available for the MSRA/MSRT Master, not for the applications.

Remote command:

`[SENSe:]ADJust:ALL` on page 267

Adjusting the Center Frequency Automatically (Auto Freq)

This function adjusts the center frequency automatically.

The optimum center frequency is the frequency with the highest S/N ratio in the frequency span. As this function uses the signal counter, it is intended for use with sinusoidal signals.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

Remote command:

`[SENSe:]ADJust:FREQuency` on page 268

Setting the Reference Level Automatically (Auto Level)

Automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized.

In order to do so, a level measurement is performed to determine the optimal reference level.

This function is only available for the MSRA/MSRT Master, not for the applications.

You can change the measurement time for the level measurement if necessary (see "[Changing the Automatic Measurement Time \(Meastime Manual\)](#)" on page 127).

Remote command:

`[SENSe:]ADJust:LEVel` on page 269

Resetting the Automatic Measurement Time (Meastime Auto)

Resets the measurement duration for automatic settings to the default value.

This function is only available for the MSRA/MSRT Master, not for the applications.

Remote command:

`[SENSe:]ADJust:CONFigure:DURation:MODE` on page 268

Changing the Automatic Measurement Time (Meastime Manual)

This function allows you to change the measurement duration for automatic setting adjustments. Enter the value in seconds.

This function is only available for the MSRA/MSRT Master, not for the applications.

Remote command:

`[SENSe:]ADJust:CONFigure:DURation:MODE` on page 268

`[SENSe:]ADJust:CONFigure:DURation` on page 267

Upper Level Hysteresis

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

This function is only available for the MSRA/MSRT Master, not for the applications.

Remote command:

`[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer` on page 269

Lower Level Hysteresis

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

This function is only available for the MSRA/MSRT Master, not for the applications.

Remote command:

`[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer` on page 268

AF Auto Scale

Activates automatic scaling of the y-axis for AF measurements. RF power and RF spectrum measurements are not affected by the auto-scaling.

Remote command:

`[SENSe:]ADJust:SCALe:Y:AUTO[:CONTInuous]` on page 269

6 Analysis

General result analysis settings concerning the trace, markers, lines etc. can be configured via the "Analysis" button in the "Overview". They are identical to the analysis functions in the base unit except for the special marker functions.

The remote commands required to perform these tasks are described in [chapter 11, "Remote Commands for Analog Demodulation Measurements"](#), on page 170.

6.1	Trace Settings	129
6.2	Trace / Data Export Configuration	133
6.3	Marker Settings	134
6.3.1	Individual Marker Setup.....	135
6.3.2	General Marker Settings.....	137
6.4	Marker Search Settings and Positioning Functions	139
6.4.1	Marker Search Settings.....	139
6.4.2	Positioning Functions.....	140
6.5	Marker Function Configuration	142
6.5.1	Phase Noise Measurement Marker.....	143
6.5.2	n dB Down Marker.....	144
6.5.3	Deactivating All Marker Functions.....	145
6.6	Marker Peak List Configuration	145
6.7	Limit Line Settings and Functions	147
6.7.1	Limit Line Management.....	147
6.7.2	Limit Line Details.....	150
6.8	Zoom Functions	153
6.9	Analysis in MSRA/MSRT Mode	154

6.1 Trace Settings

You can configure the settings for up to 6 individual traces.

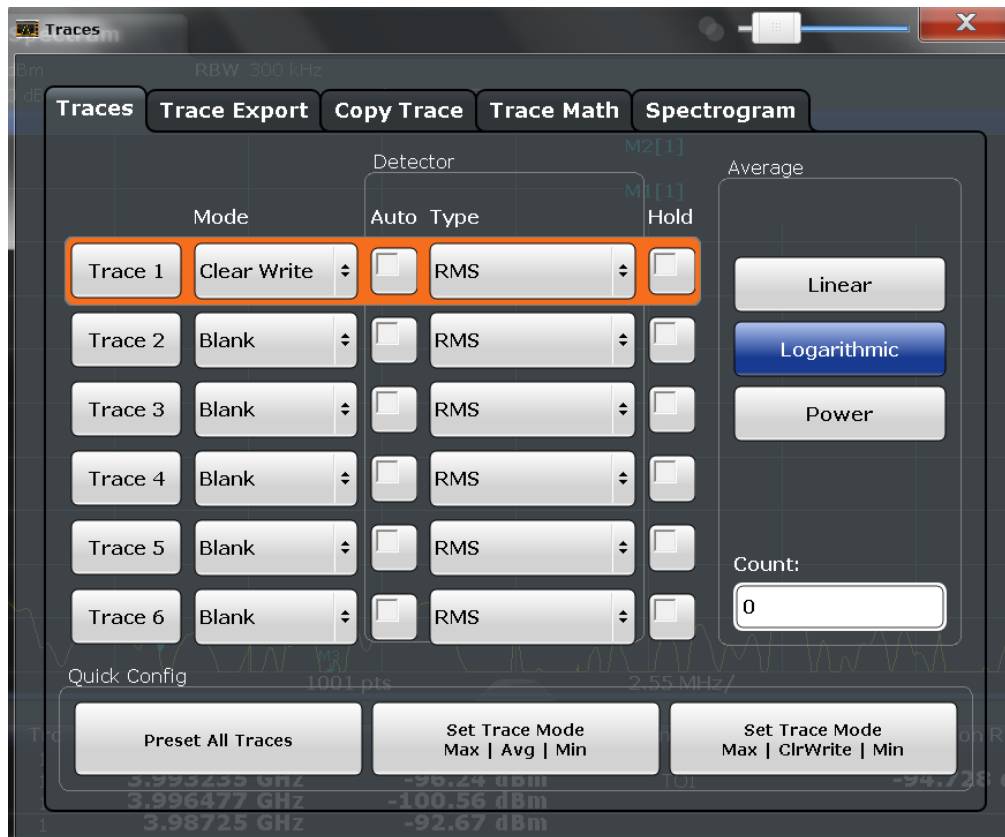
Trace settings can be configured via the TRACE key, in the "Traces" dialog box, or in the vertical "Traces" tab of the "Analysis" dialog box.



In the Analog Demodulation application when you configure the traces for a window with a specific evaluation (e.g. AM time domain), the traces in all windows with the same evaluation are configured identically.



Trace data can also be exported to an ASCII file for further analysis. For details see chapter 6.2, "Trace / Data Export Configuration", on page 133.



Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6..... 130

Trace Mode..... 130

Detector..... 131

Hold..... 131

Average Mode..... 131

Average Count..... 132

Predefined Trace Settings - Quick Config..... 132

Trace 1/Trace 2/Trace 3/Trace 4 (Softkeys)..... 132

Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6

Selects the corresponding trace for configuration. The currently selected trace is highlighted orange.

Remote command:

Selected via numeric suffix of:TRACe<1 . . . 6> commands

Trace Mode

Defines the update mode for subsequent traces.

"Clear Write" Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

"Max Hold"	The maximum value is determined over several sweeps and displayed. The R&S FSW 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 FSW 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 sweeps. The Sweep/Average Count determines the number of averaging procedures.
"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>]:TRACe<t>:MODE` on page 270

Detector

Defines the trace detector to be used for trace analysis.

"Auto"	Selects the optimum detector for the selected trace and filter mode. This is the default setting.
"Type"	Defines the selected detector type.

Note: If the EMI (R&S FSW-K54) measurement option is installed and the filter type "CISPR" is selected, additional detectors are available, even if EMI measurement is not active.

Remote command:

`[SENSe:] [WINDow<n>:] DETector<trace>[:FUNction]` on page 275

`[SENSe:] [WINDow<n>:] DETector<t>[:FUNction]:AUTO` on page 276

Hold

If activated, traces in "Min Hold", "Max Hold" and "Average" mode are not reset after specific parameter changes have been made.

Normally, the measurement is started anew after parameter changes, before the measurement results are analyzed (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

The default setting is off.

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous` on page 271

Average Mode

Defines the mode with which the trace is averaged over several sweeps. A different averaging mode can be defined for each trace.

This setting is only applicable if trace mode "Average" is selected.

How many sweeps are averaged is defined by the ["Average Count"](#) on page 132.

"Linear"	The power level values are converted into linear units prior to averaging. After the averaging, the data is converted back into its original unit.
"Logarithmic"	For logarithmic scaling, the values are averaged in dBm. For linear scaling, the behavior is the same as with linear averaging.
"Power"	Activates linear power averaging. The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit. Use this mode to average power values in Volts or Amperes correctly.

Remote command:

[SENSe:] AVERAge<n>: TYPE on page 275

Average Count

Determines the number of averaging or maximum search procedures if the trace modes "Average", "Max Hold" or "Min Hold" are set.

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

Remote command:

[SENSe:] AVERAge: COUNT on page 274

Predefined Trace Settings - Quick Config

Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

Function	Trace Settings	
Preset All Traces	Trace 1:	Clear Write
	Traces 2-6:	Blank
Set Trace Mode Max Avg Min	Trace 1:	Max Hold
	Trace 2:	Average
	Trace 3:	Min Hold
	Traces 4-6:	Blank
Set Trace Mode Max ClrWrite Min	Trace 1:	Max Hold
	Trace 2:	Clear Write
	Trace 3:	Min Hold
	Traces 4-6:	Blank

Trace 1/Trace 2/Trace 3/Trace 4 (Softkeys)

Displays the "Traces" settings and focuses the "Mode" list for the selected trace.

Remote command:

DISPlay[:WINDow<n>]: TRACe<t>[:STATe] on page 272

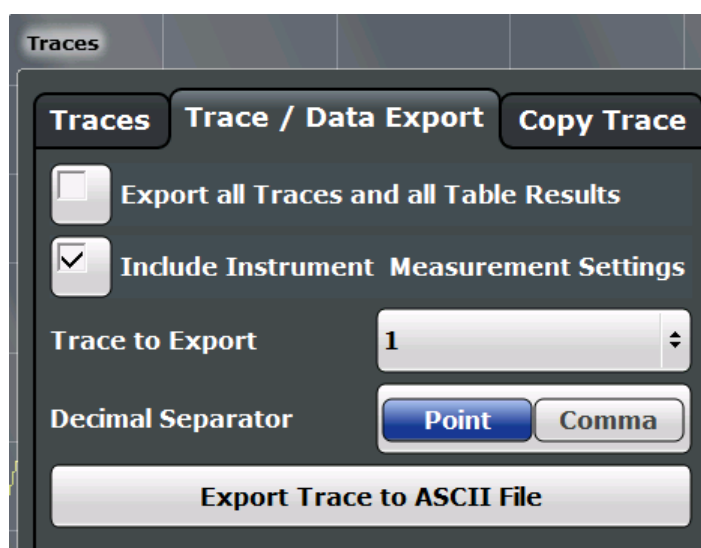
6.2 Trace / Data Export Configuration



The standard data management functions (e.g. saving or loading instrument settings) that are available for all R&S FSW applications are not described here.

See the R&S FSW User Manual for a description of the standard functions.

Trace and data export settings can be configured in the "Traces" dialog box ("Trace/ Data Export" tab).



Export all Traces and all Table Results	133
Include Instrument Measurement Settings	133
Trace to Export	134
Decimal Separator	134
Export Trace to ASCII File	134

Export all Traces and all Table Results

Selects all displayed traces and result tables (e.g. Result Summary, marker table etc.) in the current application for export to an ASCII file.

Alternatively, you can select one specific trace only for export (see [Trace to Export](#)).

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.

Remote command:

[FORMat:DEXPort:TRACes](#) on page 293

Include Instrument Measurement Settings

Includes additional instrument and measurement settings in the header of the export file for result data.

See [chapter 11.7.5, "Reference: ASCII File Export Format"](#), on page 297 for details.

Remote command:

`FORMat:DEXPort:HEADer` on page 293

Trace to Export

Defines an individual trace that will be exported to a file.

This setting is not available if [Export all Traces and all Table Results](#) is selected.

Decimal Separator

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

Remote command:

`FORMat:DEXPort:DSEParator` on page 292

Export Trace to ASCII File

Opens a file selection dialog box and saves the selected trace in ASCII format (`.dat`) to the specified file and directory.

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.

For details on the file format see [chapter 11.7.5, "Reference: ASCII File Export Format"](#), on page 297.

Note: Secure user mode.

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Remote command:

`MMEMory:STORe<n>:TRACe` on page 292

6.3 Marker Settings

Marker settings can be configured via the MARKER key or in the "Marker" dialog box. To display the "Marker" dialog box, do one of the following:

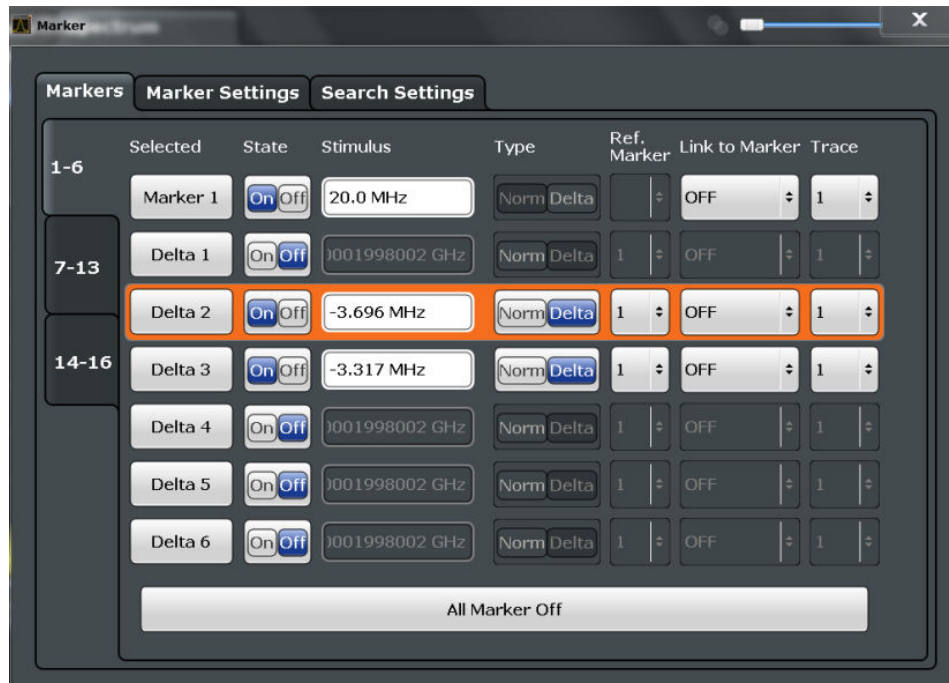
- Press the MKR key, then select the "Marker Config" softkey.
- In the Analog Demodulation "Overview", select "Analysis", and switch to the vertical "Marker" tab.

The remote commands required to define these settings are described in [chapter 11.8.1, "Working with Markers Remotely"](#), on page 300.

- [Individual Marker Setup](#)..... 135
- [General Marker Settings](#)..... 137

6.3.1 Individual Marker Setup

In the Analog Demodulation application, up to 17 markers or delta markers can be activated for each window simultaneously. Initial marker setup is performed using the "Marker" dialog box.



The markers are distributed among 3 tabs for a better overview. By default, the first marker is defined as a normal marker, whereas all others are defined as delta markers with reference to the first marker. All markers are assigned to trace 1, but only the first marker is active.

Selected Marker.....	135
Marker State.....	136
Marker Position (X-value).....	136
Marker Type.....	136
Reference Marker.....	136
Linking to Another Marker.....	136
Assigning the Marker to a Trace.....	137
All Markers Off.....	137

Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:

Marker selected via suffix <m> in remote commands.

Marker State

Activates or deactivates the marker in the diagram.

Remote command:

`CALCulate<n>:MARKer<m>[:STATe]` on page 301

`CALCulate<n>:DELTamarker<m>[:STATe]` on page 304

Marker Position (X-value)

Defines the position (x-value) of the marker in the diagram.

Remote command:

`CALCulate<n>:MARKer<m>:X` on page 301

`CALCulate<n>:DELTamarker<m>:X` on page 305

Marker Type

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

Note: If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal" A normal marker indicates the absolute value at the defined position in the diagram.

"Delta" A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

`CALCulate<n>:MARKer<m>[:STATe]` on page 301

`CALCulate<n>:DELTamarker<m>[:STATe]` on page 304

Reference Marker

Defines a marker as the reference marker which is used to determine relative analysis results (delta marker values).

If a fixed reference point is configured (see "[Defining a Fixed Reference](#)" on page 138), the reference point ("FXD") can also be selected instead of another marker.

Remote command:

`CALCulate<n>:DELTamarker<m>:MREF` on page 304

Linking to Another Marker

Links the current marker to the marker selected from the list of active markers. If the x-axis value of the initial marker is changed, the linked marker follows on the same x-position. Linking is off by default.

Using this function you can set two markers on different traces to measure the difference (e.g. between a max hold trace and a min hold trace or between a measurement and a reference trace).

Remote command:

[CALCulate<n>:MARKer<m1>:LINK:TO:MARKer<m2>](#) on page 301

[CALCulate<n>:DELTamarker<m1>:LINK:TO:MARKer<m2>](#) on page 303

[CALCulate<n>:DELTamarker<m>:LINK](#) on page 303

Assigning the Marker to a Trace

The "Trace" setting assigns the selected marker to an active trace. The trace determines which value the marker shows at the marker position. If the marker was previously assigned to a different trace, the marker remains on the previous frequency or time, but indicates the value of the new trace.

The marker can also be assigned to the currently active trace using the "Marker to Trace" softkey in the "Marker" menu.

If a trace is turned off, the assigned markers and marker functions are also deactivated.

Remote command:

[CALCulate<n>:MARKer<m>:TRACe](#) on page 301

All Markers Off

Deactivates all markers in one step.

Remote command:

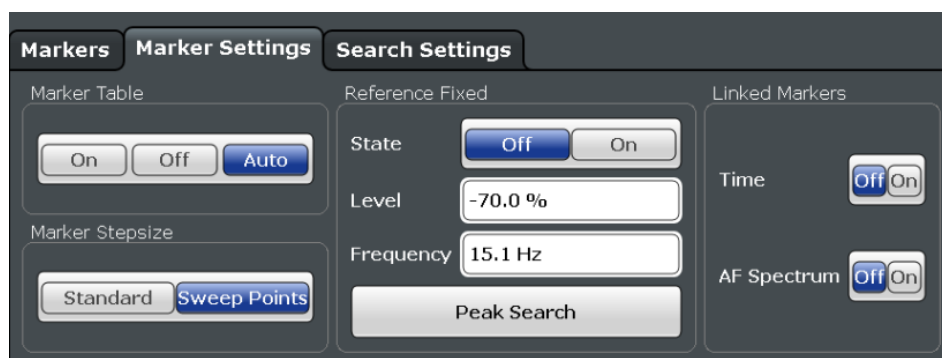
[CALCulate<n>:MARKer<m>:AOFF](#) on page 300

6.3.2 General Marker Settings

Some general marker settings allow you to influence the marker behavior for all markers.

These settings are located in the "Marker Settings" tab of the "Marker" dialog box. To display this tab, do one of the following:

- Press the MKR key, then select the "Marker Config" softkey.
- In the Analog Demodulation "Overview", select "Analysis", and switch to the vertical "Marker" tab. Then select the horizontal "Marker Settings" tab.



Marker Table Display.....	138
Marker Stepsize.....	138
Defining a Fixed Reference.....	138
Link Time Marker.....	139
Link AF Spectrum Marker.....	139

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"	Displays the marker information within the diagram area.
"Auto"	(Default) Up to two markers are displayed in the diagram area. If more markers are active, the marker table is displayed automatically.

Remote command:

`DISPlay:MTABLE` on page 307

Marker Stepsize

Defines the size of the steps that the marker position is moved using the rotary knob.

"Standard"	The marker position is moved from pixel to pixel on the display. This setting is most suitable to move the marker over a larger distance.
"Sweep Points"	The marker position is moved from one sweep point to the next. This setting is required for a very precise positioning if more sweep points are collected than the number of pixels that can be displayed on the screen. It is the default mode.

Remote command:

`CALCulate:MARKer:X:SSIZE` on page 306

Defining a Fixed Reference

Instead of using a reference marker that may vary its position depending on the measurement results, a fixed reference marker can be defined for trace analysis.

When you set the "State" to "On", a vertical and a horizontal red display line are displayed, marked as "FXD". The normal marker 1 is activated and set to the peak value of the trace assigned to marker 1, and a delta marker to the next peak. The fixed reference marker is set to the position of marker 1 at the peak value. The delta marker refers to the fixed reference marker.

If activated, the fixed reference marker ("FXD") can also be selected as a "Reference Marker" instead of another marker.

The "Level" and "Frequency" or "Time" settings define the position and value of the reference marker.

Alternatively, a **Peak Search** can be performed to set the current maximum value of the trace assigned to marker 1 as the fixed reference marker.

Remote command:

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed[:STATe]` on page 313

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed:RPOint:Y` on page 313

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed:RPOint:X` on page 312

`CALCulate<n>:DELTamarker<m>:FUNction:FIXed:RPOint:MAXimum[:PEAK]`
on page 312

Link Time Marker

Links the markers in all time domain diagrams.

Remote command:

`CALCulate:MARKer<m>:LINK` on page 307

Link AF Spectrum Marker

Links the markers in all AF spectrum displays.

Remote command:

`CALCulate:MARKer<m>:LINK` on page 307

6.4 Marker Search Settings and Positioning Functions

Several functions are available to set the marker to a specific position very quickly and easily, or to use the current marker position to define another characteristic value. In order to determine the required marker position, searches may be performed. The search results can be influenced by special settings.

Most marker positioning functions and the search settings are available in the MKR -> menu.

Search settings are also available via the MARKER key or in the vertical "Marker Config" tab of the "Analysis" dialog box (horizontal "Search Settings" tab).

The remote commands required to define these settings are described in [chapter 11.8.1, "Working with Markers Remotely"](#), on page 300.

- [Marker Search Settings](#)..... 139
- [Positioning Functions](#)..... 140

6.4.1 Marker Search Settings

Markers are commonly used to determine peak values, i.e. maximum or minimum values, in the measured signal. Configuration settings allow you to influence the peak search results.

These settings are available as softkeys in the Marker To menu, or in the "Search Settings" tab of the "Marker" dialog box. To display this tab, do one of the following:

- Press the MKR key, then select the "Marker Config" softkey. Then select the horizontal "Search Settings" tab.
- In the "Overview", select "Analysis", and switch to the vertical "Marker Config" tab. Then select the horizontal "Search Settings" tab.

Search Mode for Next Peak	140
Peak Excursion	140

Search Mode for Next Peak

Selects the search mode for the next peak search.

"Left"	Determines the next maximum/minimum to the left of the current peak.
"Absolute"	Determines the next maximum/minimum to either side of the current peak.
"Right"	Determines the next maximum/minimum to the right of the current peak.

Remote command:

[CALCulate<n>:DELTaMarker<m>:MAXimum:LEFT](#) on page 310
[CALCulate<n>:MARKer<m>:MAXimum:LEFT](#) on page 309
[CALCulate<n>:DELTaMarker<m>:MAXimum:NEXT](#) on page 311
[CALCulate<n>:MARKer<m>:MAXimum:NEXT](#) on page 309
[CALCulate<n>:DELTaMarker<m>:MAXimum:RIGHT](#) on page 311
[CALCulate<n>:MARKer<m>:MAXimum:RIGHT](#) on page 309
[CALCulate<n>:DELTaMarker<m>:MINimum:LEFT](#) on page 311
[CALCulate<n>:MARKer<m>:MINimum:LEFT](#) on page 309
[CALCulate<n>:DELTaMarker<m>:MINimum:NEXT](#) on page 311
[CALCulate<n>:MARKer<m>:MINimum:NEXT](#) on page 310
[CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT](#) on page 312
[CALCulate<n>:MARKer<m>:MINimum:RIGHT](#) on page 310

Peak Excursion

Defines the minimum level value by which a signal must rise or fall so that it will be identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

Remote command:

[CALCulate<n>:MARKer:PEXCursion](#) on page 308

6.4.2 Positioning Functions

The following functions set the currently selected marker to the result of a peak search or set other characteristic values to the current marker value. These functions are available as softkeys in the "Marker To" menu, which is displayed when you press the MKR -> key, or in the "Marker" menu.

Select Marker.....	141
Peak Search.....	141
Search Next Peak.....	141
Search Minimum.....	141
Search Next Minimum.....	142

Select Marker

Opens a dialog box to select and activate or deactivate one or more markers quickly.



Remote command:

Marker selected via suffix <m> in remote commands.

Peak Search

Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum\[:PEAK\]](#) on page 309

[CALCulate<n>:DELTAmarker<m>:MAXimum\[:PEAK\]](#) on page 311

Search Next Peak

Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum:NEXT](#) on page 309

[CALCulate<n>:DELTAmarker<m>:MAXimum:NEXT](#) on page 311

Search Minimum

Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MINimum\[:PEAK\]](#) on page 310

[CALCulate<n>:DELTAmarker<m>:MINimum\[:PEAK\]](#) on page 311

Search Next Minimum

Sets the selected marker/delta marker to the next (higher) minimum of the selected trace. If no marker is active, marker 1 is activated.

Remote command:

`CALCulate<n>:MARKer<m>:MINimum:NEXT` on page 310

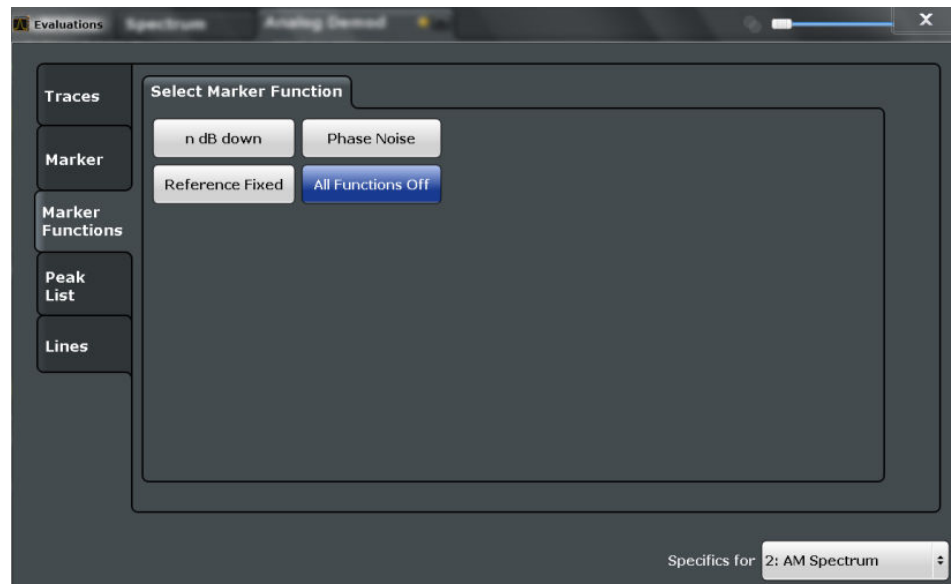
`CALCulate<n>:DELTAmarker<m>:MINimum:NEXT` on page 311

6.5 Marker Function Configuration

Special marker functions can be selected via the "Marker Function" dialog box.

To display this dialog box, do one of the following:

- Press the MKR FUNC key, then select the "Select Marker Function" softkey.
- In the "Overview", select "Analysis", and switch to the vertical "Marker Function Config" tab.



Not all marker functions are available for all evaluations. The following table indicates which functions are available for which evaluations.

Evaluation	n dB down	Phase Noise	Reference Fixed
AF time	-	-	X
AF spectrum	X	X	X
RF time	X	-	X
RF spectrum	X	X	X

For details on the special marker functions see the R&S FSW User Manual.

The remote commands required to define these settings are described in [chapter 11.8.1.5, "Configuring Special Marker Functions"](#), on page 312.



The Fixed Reference Marker settings are described in ["Defining a Fixed Reference"](#) on page 138.

- [Phase Noise Measurement Marker](#).....143
- [n dB Down Marker](#)..... 144
- [Deactivating All Marker Functions](#).....145

6.5.1 Phase Noise Measurement Marker

For each of the 16 markers phase noise measurement can be activated. Phase noise measurement markers are configured in the "Phase Noise Config" dialog box, using the "Phase Noise" function.

The individual marker settings correspond to those defined in the "Marker" dialog box. Any settings to the marker state or type changed in the "Marker Function" dialog box are also changed in the "Marker" dialog box and vice versa.

To display the "Phase Noise Config" dialog box, do one of the following:

- Press the MKR FUNC key, then select the "Select Marker Function" softkey. Then select the "Phase Noise" button. Select the "Phase Noise Config" softkey.
- In the "Overview", select "Analysis", and switch to the vertical "Marker Function Config" tab. Then select the "Phase Noise" button. Select the "Phase Noise Config" softkey.



Phase Noise Measurement State.....	144
Defining a Reference Point.....	144
Switching All Phase Noise Measurements Off.....	144

Phase Noise Measurement State

Activates or deactivates phase noise measurement for the reference point in the diagram.

This function is only available for delta markers.

If activated, the delta markers display the phase noise measured at defined offsets from the reference position.

Remote command:

`CALCulate<n>:DELTAmarker<m>:FUNCTION:PNOise[:STATe]` on page 321

`CALCulate<n>:DELTAmarker<m>:FUNCTION:PNOise:RESult?` on page 321

Defining a Reference Point

Instead of using marker 1 as the reference marker, a fixed reference marker can be defined for phase noise measurement in RF Spectrum analysis.

The "Level" and "Frequency" or "Time" settings define the position and value of the reference point.

Alternatively, a **Peak Search** can be performed to set the maximum value of the selected trace as the reference point.

If "Automatic Peak Search" is activated, a peak search is started automatically after each sweep and the result is used as the reference point.

Remote command:

`CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:Y` on page 313

`CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:X` on page 312

`CALCulate<n>:DELTAmarker<m>:FUNCTION:FIXed:RPOint:MAXimum[:PEAK]`
on page 312

`CALCulate<n>:DELTAmarker<m>:FUNCTION:PNOise:AUTO` on page 320

Switching All Phase Noise Measurements Off

Deactivates phase noise measurement for all markers.

Remote command:

`CALCulate<n>:DELTAmarker<m>:FUNCTION:PNOise[:STATe]` on page 321

6.5.2 n dB Down Marker

A special marker can be defined to determine a characteristic bandwidth or time span in a measured signal. n dB down markers are configured in the "N dB Down Config" dialog box, using the "n dB down" function.

To display the "N dB Down Config" dialog box, do one of the following:

- Press the MKR FUNC key, then select the "Select Marker Function" softkey. Then select the "n dB down" button. Select the "N dB Down Config" softkey.

- In the "Overview", select "Analysis", and switch to the vertical "Marker Function Config" tab. Then select the "n dB down" button. Select the "N dB Down Config" softkey.



n dB down Marker State	145
n dB down Delta Value	145

n dB down Marker State

Activates or deactivates the special n dB down marker function.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:NDBDown:STATe](#) on page 319

[CALCulate<n>:MARKer<m>:FUNCTION:NDBDown:RESult?](#) on page 319

n dB down Delta Value

Defines the delta level from the reference marker 1 used to determine the bandwidth or time span.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTION:NDBDown:FREQuency?](#) on page 318

[CALCulate<n>:MARKer<m>:FUNCTION:NDBDown:TIME?](#) on page 320

6.5.3 Deactivating All Marker Functions

All special marker functions can be deactivated in one step.

Use the "All Functions Off" button in the "Marker Functions" dialog box.

6.6 Marker Peak List Configuration

In the Analog Demodulation application the search limits are not available.

To display the "Marker Peak List" dialog, do one of the following:

- Press the MKR FUNC key, then select the "Marker Peak List" softkey.
- In the "Overview", select "Analysis", and switch to the vertical "Peak List" tab.



Peak List State..... 146
 Sort Mode..... 146
 Maximum Number of Peaks..... 146
 Peak Excursion..... 146
 Displaying Marker Numbers..... 147
 Exporting the Peak List..... 147

Peak List State

Activates/deactivates the marker peak list. If activated, the peak list is displayed and the peaks are indicated in the trace display.

For each listed peak the frequency/time ("X-value") and level ("Y-value") values are given.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:STAT](#) on page 316

Sort Mode

Defines whether the peak list is sorted according to the x-values or y-values. In either case the values are sorted in ascending order.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:SORT](#) on page 315

Maximum Number of Peaks

Defines the maximum number of peaks to be determined and displayed.

Remote command:

[CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:LIST:SIZE](#) on page 315

Peak Excursion

Defines the minimum level value by which a signal must rise or fall so that it will be identified as a maximum or a minimum by the search functions.

Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

Remote command:

`CALCulate<n>:MARKer:PEXCursion` on page 308

Displaying Marker Numbers

By default, the marker numbers are indicated in the diagram so you can find the peaks from the list. However, for large numbers of peaks the marker numbers may decrease readability; in this case, deactivate the marker number display.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:FPEaks:ANNotation:LABel[:STATe]`
on page 314

Exporting the Peak List

The peak list can be exported to an ASCII file (.DAT) for analysis in an external application.

Remote command:

`MMEMoRY:STORe:PEAK` on page 317

`FORMat:DEXPort:DSEParator` on page 292

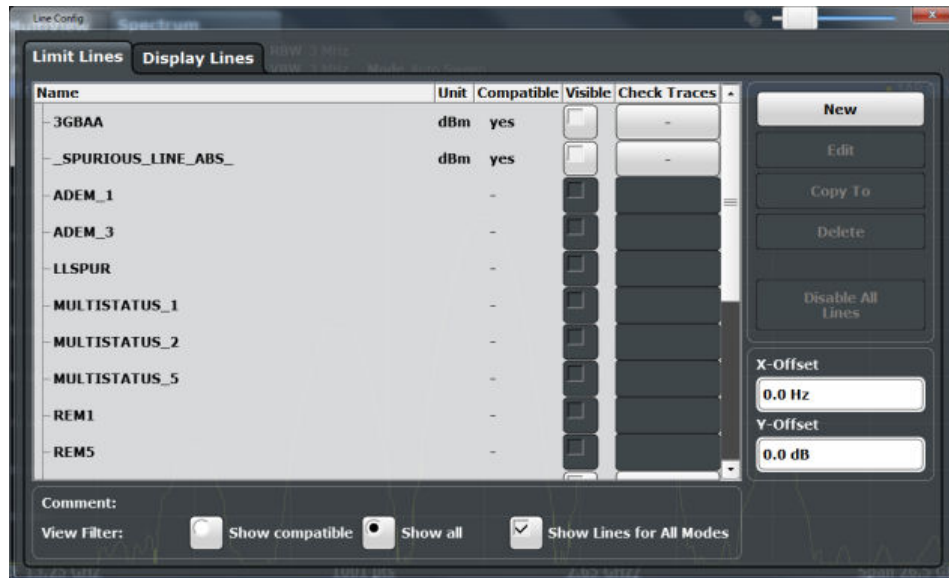
6.7 Limit Line Settings and Functions

Up to 8 limit lines can be displayed simultaneously in the R&S FSW. Many more can be stored on the instrument.

6.7.1	Limit Line Management.....	147
6.7.2	Limit Line Details.....	150

6.7.1 Limit Line Management

Limit lines are managed in the "Line Config" dialog box which is displayed when you press the LINES key and then "Lines Config" softkey.



For the limit line overview, the R&S FSW searches for all stored limit lines with the file extension `.LIN` in the `limits` subfolder of the main installation folder. The overview allows you to determine which limit lines are available and can be used for the current measurement.

For details on settings for individual lines see [chapter 6.7.2, "Limit Line Details"](#), on page 150.

Name.....	148
Unit.....	148
Compatibility.....	148
Visibility.....	149
Traces to be Checked.....	149
Comment.....	149
Included Lines in Overview (View Filter).....	149
L Show lines for all modes.....	149
X-Offset.....	149
Y-Offset.....	149
Create New Line.....	150
Edit Line.....	150
Copy Line.....	150
Delete Line.....	150
Disable All Lines.....	150

Name

The name of the stored limit line.

Unit

The unit in which the y-values of the data points of the limit line are defined.

Compatibility

Indicates whether the limit line definition is compatible with the current measurement settings.

Visibility

Displays or hides the limit line in the diagram. Up to 8 limit lines can be visible at the same time. Inactive limit lines can also be displayed in the diagram.

Remote command:

[CALCulate:LIMit<k>:LOWer:STATe](#) on page 326

[CALCulate:LIMit<k>:UPPer:STATe](#) on page 329

[CALCulate:LIMit:ACTive?](#) on page 329

Traces to be Checked

Defines which traces are automatically checked for conformance with the limit lines. As soon as a trace to be checked is defined, the assigned limit line is active. One limit line can be activated for several traces simultaneously. If any of the "Traces to be Checked" violate any of the active limit lines, a message is indicated in the diagram.

Remote command:

[CALCulate:LIMit<k>:TRACe<t>:CHECK](#) on page 331

Comment

An optional description of the limit line.

Included Lines in Overview (View Filter)

Defines which of the stored lines are included in the overview.

"Show compatible" Only compatible lines
Whether a line is compatible or not is indicated in the [Compatibility](#) setting.

"Show all" All stored limit lines with the file extension `.LIN` in the `limits` subfolder of the main installation folder (if not restricted by "Show lines for all modes" setting).

Show lines for all modes ← Included Lines in Overview (View Filter)

If activated (default), limit lines from all applications are displayed. Otherwise, only lines that were created in the Spectrum application are displayed.

Note that limit lines from some applications may include additional properties that are lost when the limit lines are edited in the Spectrum application. In this case a warning is displayed when you try to store the limit line.

X-Offset

Shifts a limit line that has been specified for relative frequencies or times (x-axis) horizontally.

This setting does not have any effect on limit lines that are defined by absolute values for the x-axis.

Remote command:

[CALCulate:LIMit<k>:CONTRol:OFFSet](#) on page 323

Y-Offset

Shifts a limit line that has relative values for the y-axis (levels or linear units such as volt) vertically.

This setting does not have any effect on limit lines that are defined by absolute values for the y-axis.

Remote command:

[CALCulate:LIMit<k>:LOWer:OFFSet](#) on page 325

[CALCulate:LIMit<k>:UPPer:OFFSet](#) on page 328

Create New Line

Creates a new limit line.

Edit Line

Edit an existing limit line configuration.

Copy Line

Copy the selected limit line configuration to create a new line.

Remote command:

[CALCulate:LIMit<k>:COPY](#) on page 330

Delete Line

Delete the selected limit line configuration.

Remote command:

[CALCulate:LIMit<k>:DELeTe](#) on page 330

Disable All Lines

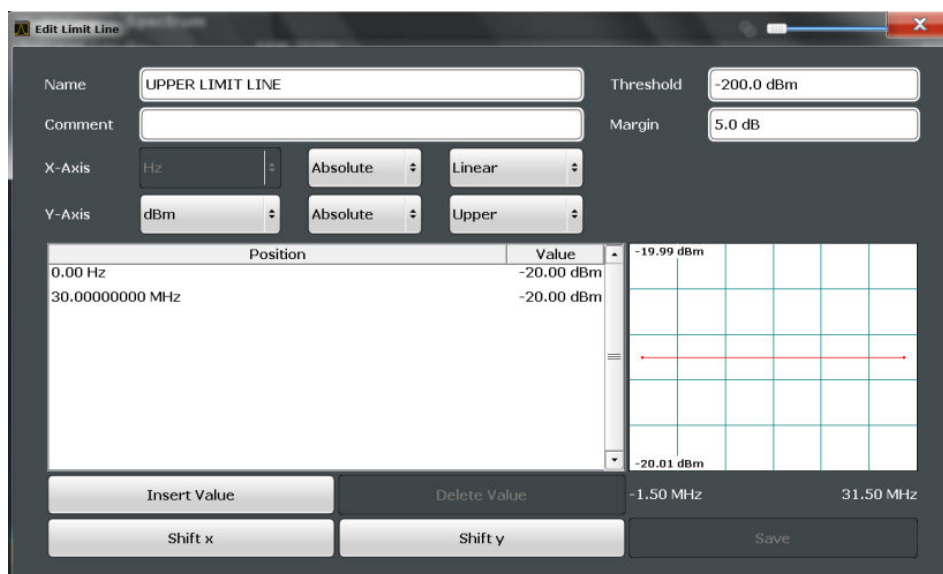
Disable all limit lines in one step.

Remote command:

[CALCulate:LIMit<k>:STATe](#) on page 330

6.7.2 Limit Line Details

Limit lines details are configured in the "Edit Line Line" dialog box which is displayed when you select the "New", "Edit" or "Copy To" buttons in the "Line Config" dialog box.



Name..... 151

Comment..... 151

Threshold..... 151

Margin..... 152

X-Axis..... 152

Y-Axis..... 152

Data points..... 152

Insert Value..... 153

Delete Value..... 153

Shift x..... 153

Shift y..... 153

Save..... 153

Name

Defines the limit line name. All names must be compatible with Windows conventions for file names. The limit line data is stored under this name (with a .LIN extension).

Remote command:

[CALCulate:LIMit<k>:NAME](#) on page 326

Comment

Defines an optional comment for the limit line. The text may contain up to 40 characters.

Remote command:

[CALCulate:LIMit:COMMeNt](#) on page 322

Threshold

Defines an absolute threshold value (only for relative scaling of the y-axis).

Remote command:

[CALCulate:LIMit<k>:LOWer:THReshold](#) on page 326

[CALCulate:LIMit<k>:UPPer:THReshold](#) on page 329

Margin

Defines a margin for the limit line. The default setting is 0 dB (i.e. no margin).

Remote command:

[CALCulate:LIMit<k>:LOWer:MARGin](#) on page 325

[CALCulate:LIMit<k>:UPPer:MARGin](#) on page 327

X-Axis

Describes the horizontal axis on which the data points of the limit line are defined.

Includes the following settings:

- Domain:
 - "Hz": for frequency domain
 - "s": for time domain
- Scaling mode: absolute or relative (Hz/s/%) values
For relative values, the frequencies are referred to the currently set center frequency. In the zero span mode, the left boundary of the diagram is used as the reference.
- Scaling: linear or logarithmic

Remote command:

[CALCulate:LIMit<k>:LOWer:SPACing](#) on page 326

[CALCulate:LIMit<k>:UPPer:SPACing](#) on page 328

[CALCulate:LIMit<k>:LOWer:MODE](#) on page 325

[CALCulate:LIMit<k>:UPPer:MODE](#) on page 327

[CALCulate:LIMit<k>:CONTrol:DOMain](#) on page 323

Y-Axis

Describes the vertical axis on which the data points of the limit line are defined.

Includes the following settings:

- Level unit
- Scaling mode: absolute or relative (dB/%) values
Relative limit values refer to the reference level.
- Limit type: upper or lower limit; values must stay above the lower limit and below the upper limit to pass the limit check

Remote command:

[CALCulate:LIMit<k>:UNIT](#) on page 327

[CALCulate:LIMit<k>:LOWer:SPACing](#) on page 326

[CALCulate:LIMit<k>:UPPer:SPACing](#) on page 328

Data points

Each limit line is defined by a minimum of 2 and a maximum of 200 data points. Each data point is defined by its position (x-axis) and value (y-value). Data points must be defined in ascending order. The same position can have two different values.

Remote command:

[CALCulate:LIMit<k>:CONTrol\[:DATA\]](#) on page 323

[CALCulate:LIMit<k>:LOWer\[:DATA\]](#) on page 324

[CALCulate:LIMit<k>:UPPer\[:DATA\]](#) on page 327

Insert Value

Inserts a data point in the limit line above the selected one in the "Edit Limit Line" dialog box.

Delete Value

Deletes the selected data point in the "Edit Limit Line" dialog box.

Shift x

Shifts the x-value of each data point horizontally by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "[X-Offset](#)" on page 149).

Remote command:

[CALCulate:LIMit<k>:CONTrol:SHIFt](#) on page 324

Shift y

Shifts the y-value of each data point vertically by the defined shift width (as opposed to an additive offset defined for the entire limit line, see "[Y-Offset](#)" on page 149).

Remote command:

[CALCulate:LIMit<k>:LOWer:SHIFt](#) on page 325

[CALCulate:LIMit<k>:UPPer:SHIFt](#) on page 328

Save

Saves the currently edited limit line under the name defined in the "Name" field.

6.8 Zoom Functions

The zoom functions are only available from the toolbar.

For details on the zoom functions see the R&S FSW User Manual.

Single Zoom	153
Multiple Zoom	153
Restore Original Display	154
Deactivating Zoom (Selection mode)	154

Single Zoom

A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible.

Remote command:

[DISPlay\[:WINDow<n>\]:ZOOM:STATe](#) on page 335

[DISPlay\[:WINDow<n>\]:ZOOM:AREA](#) on page 334

Multiple Zoom

In multiple zoom mode, you can enlarge several different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 336

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA` on page 335

Restore Original Display



Restores the original display and closes all zoom windows.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 335 (single zoom)

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 336 (for each multiple zoom window)

Deactivating Zoom (Selection mode)



Deactivates zoom mode.

Tapping the screen no longer invokes a zoom, but selects an object.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 335 (single zoom)

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 336 (for each multiple zoom window)

6.9 Analysis in MSRA/MSRT Mode

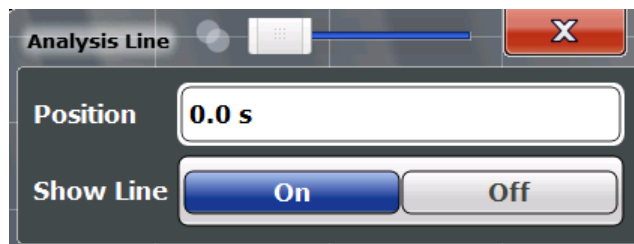
The data that was captured by the MSRA/MSRT Master can be analyzed in the Analog Demodulation application.

The analysis settings and functions available in MSRA/MSRT mode are those described for common Signal and Spectrum Analyzer mode.

Analysis line settings

In addition, an analysis line can be positioned. The analysis line is a common time marker for all MSRA/MSRT applications.

To hide or show and position the analysis line, a dialog box is available. To display the "Analysis Line" dialog box, tap the "AL" icon in the toolbar (only available in MSRA/MSRT mode). The current position of the analysis line is indicated on the icon.



Position.....	155
Show Line.....	155

Position

Defines the position of the analysis line in the time domain. The position must lie within the measurement time of the multistandard measurement.

Remote command:

[CALCulate:MSRA:ALINE\[:VALue\]](#) on page 337

[CALCulate:RTMS:ALINE\[:VALue\]](#) on page 339

Show Line

Hides or displays the analysis line in the time-based windows. By default, the line is displayed.

Note: even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active application remains in the window title bars.

Remote command:

[CALCulate:MSRA:ALINE:SHOW](#) on page 337

[CALCulate:RTMS:ALINE:SHOW](#) on page 339

7 I/Q Data Import and Export

Baseband signals mostly occur as so-called complex baseband signals, i.e. a signal representation that consists of two channels; the in phase (I) and the quadrature (Q) channel. Such signals are referred to as I/Q signals. I/Q signals are useful because the specific RF or IF frequencies are not needed. The complete modulation information and even distortion that originates from the RF, IF or baseband domains can be analyzed in the I/Q baseband.

Importing and exporting I/Q signals is useful for various applications:

- Generating and saving I/Q signals in an RF or baseband signal generator or in external software tools to analyze them with the R&S FSW later
- Capturing and saving I/Q signals with an RF or baseband signal analyzer to analyze them with the R&S FSW or an external software tool later

For example, you can capture I/Q data using the I/Q Analyzer application, if available, and then perform a Analog Demodulation measurement on that data later using the R&S FSW Analog Demodulation application.

As opposed to storing trace data, which may be averaged or restricted to peak values, I/Q data is stored as it was captured, without further processing. The data is stored as complex values in 32-bit floating-point format. Multi-channel data is not supported. The I/Q data is stored in a format with the file extension `.iq.tar`.

For a detailed description see the R&S FSW I/Q Analyzer and I/Q Input User Manual.



Export only in MSRA mode

In MSRA mode, I/Q data can only be exported to other applications; I/Q data cannot be imported to the MSRA Master or any MSRA applications.

- [Import/Export Functions](#)..... 156
- [How to Export and Import I/Q Data](#)..... 158

7.1 Import/Export Functions



The following import and export functions are available via softkeys in the "Save/Recall" menu which is displayed when you select the "Save" or "Open" icon in the toolbar.



For a description of the other functions in the "Save/Recall" menu see the R&S FSW User Manual.

- [Import](#)..... 157
 - [I/Q Import](#)..... 157
- [Export](#)..... 157

L Export Trace to ASCII File	157
L Trace Export Configuration	157
L I/Q Export	157

Import

Provides functions to import data.

I/Q Import ← Import

Opens a file selection dialog box to select an import file that contains IQ data. This function is only available in single sweep mode and only in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Note that the I/Q data must have a specific format as described in the R&S FSW I/Q Analyzer and I/Q Input User Manual.

I/Q import is not available in MSRA/MSRT mode.

Remote command:

[MMEMory:LOAD:IQ:STATe](#) on page 340

Export

Opens a submenu to configure data export.

Export Trace to ASCII File ← Export

Opens a file selection dialog box and saves the selected trace in ASCII format (.dat) to the specified file and directory.

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.

For details on the file format see [chapter 11.7.5, "Reference: ASCII File Export Format"](#), on page 297.

Note: Secure user mode.

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Remote command:

[MMEMory:STORe<n>:TRACe](#) on page 292

Trace Export Configuration ← Export

Opens the "Traces" dialog box to configure the trace and data export settings. See [chapter 6.2, "Trace / Data Export Configuration"](#), on page 133.

I/Q Export ← Export

Opens a file selection dialog box to select an export file to which the IQ data will be stored. This function is only available in single sweep mode, and only in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Note: Secure user mode.

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Remote command:

`MMEMory:STORe:IQ:STATe` on page 341


`MMEMory:STORe:IQ:COMMeNt` on page 340

7.2 How to Export and Import I/Q Data




I/Q data can only be exported in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Capturing and exporting I/Q data

1. Press the PRESET key.
2. Press the MODE key and select the "IQ Analyzer" or any other application that supports I/Q data.
3. Configure the data acquisition.
4. Press the RUN SINGLE key to perform a single sweep measurement.
5. Select the  "Save" icon in the toolbar.
6. Select the "I/Q Export" softkey.
7. In the file selection dialog box, select a storage location and enter a file name.
8. Select "Save".

The captured data is stored to a file with the extension `.iq.tar`.

Importing I/Q data

1. Press the MODE key and select the "IQ Analyzer" or any other application that supports I/Q data.
2. If necessary, switch to single sweep mode by pressing the RUN SINGLE key.
3. Select the  "Open" icon in the toolbar.
4. Select the "I/Q Import" softkey.
5. Select the storage location and the file name with the `.iq.tar` file extension.

6. Select "Open".

The stored data is loaded from the file and displayed in the current application.

Previewing the I/Q data in a web browser

The `iq-tar` file format allows you to preview the I/Q data in a web browser.

1. Use an archive tool (e.g. WinZip® or PowerArchiver®) to unpack the `iq-tar` file into a folder.
2. Locate the folder using Windows Explorer.
3. Open your web browser.

4. Drag the I/Q parameter XML file, e.g. `example.xml`, into your web browser.

xzy.xml (of .iq.tar file)

Description	
Saved by	FSV IQ Analyzer
Comment	Here is a comment
Date & Time	2011-03-03 14:33:05
Sample rate	6.5 MHz
Number of samples	65000
Duration of signal	10 ms
Data format	complex, float32
Data filename	xzy.complex.1ch.float32
Scaling factor	1 V


Channel 1	
Comment	Channel 1 of 1
Power vs time y-axis: 10 dB /div x-axis: 1 ms /div	
Spectrum y-axis: 20 dB /div x-axis: 500 kHz /div	

E-mail: info@rohde-schwarz.com
 Internet: <http://www.rohde-schwarz.com>
 Fileformat version: 1

8 How to Perform Measurements in the Analog Demodulation Application

The following step-by-step instructions demonstrate how to perform an Analog Demodulation measurement with the R&S FSW-K7 option.

1. Press the MODE key on the front panel and select the "Analog Demod" application.
2. Select the "Overview" softkey to display the "Overview" for an Analog Demodulation measurement.
3. Select the "Input/Frontend" button and then the "Frequency" tab to define the input signal's center frequency.
4. Select the "Data Acquisition" button and define the bandwidth parameters for the input signal:
(Note: in MSRA/MSRT mode, define the analysis interval using the same settings.)
 - "Demodulation Bandwidth": the span of the input signal to be demodulated
 - "Measurement Time": how long the input signal is to be measured
 - "Resolution Bandwidth": how precise the signal is to be demodulated
 - "Capture Offset" (multistandard mode only): the offset of the analysis interval from the start of the capture buffer
5. Optionally, select the "Trigger" button and define a trigger for data acquisition, for example an offline demodulation trigger to start capturing data only when a useful signal is transmitted.
6. Select the "Demod/Display" button and select the demodulation displays that are of interest to you (up to 6).
Arrange them on the display to suit your preferences.
7. Exit the SmartGrid mode and select the "Overview" softkey to display the "Overview" again.
8. Select the "Demodulation Settings" button to define demodulation parameters for each evaluation:
 - Configure the "Squelch" function (on the "Demod" tab) to suppress noise during demodulation.
 - For time domain evaluations, zoom into the areas of interest by defining a zoom area (on the "Demod" tab).
 - For AF evaluations, use special filters to eliminate certain effects of demodulation or to correct pre-emphasized modulated signals (on the "AF Filters" tab).
 - Adapt the diagram scaling to the displayed data (on the "Scaling" tab).
9. Select the "Analysis" button in the "Overview" to make use of the advanced analysis functions in the demodulation displays.

- Configure a trace to display the average over a series of sweeps (on the "Trace" tab; if necessary, increase the "Sweep Count" in the "Data Acquisition" settings).
 - Configure markers and delta markers to determine deviations and offsets within the demodulated signal (on the "Marker" tab).
 - Use special marker functions to calculate phase noise or an n dB down bandwidth (on the "Marker Config" tab).
 - Configure a limit check to detect excessive deviations (on the "Lines" tab).
10. Start a new sweep with the defined settings.
In multistandard mode you may want to stop the continuous measurement mode by the Sequencer and perform a single data acquisition:
- a) Select the Sequencer icon () from the toolbar.
 - b) Set the Sequencer state to "OFF".
 - c) Press the RUN SINGLE key.
11. Optionally, export the trace data of the demodulated signal to a file.
- a) In the "Traces" tab of the "Analysis" dialog box, switch to the "Trace Export" tab.
 - b) Select "Export Trace to ASCII File".
 - c) Define a file name and storage location and select "OK".

9 Measurement Example: Demodulating an FM Signal

A practical example for a basic Analog Demodulation measurement is provided here. It demonstrates how operating and measurement errors can be avoided using correct configuration settings.

The measurement is performed using the following devices:

- An R&S FSW with application firmware R&S FSW-K7: Analog Demodulation
- A vector signal generator, e.g. R&S SMU

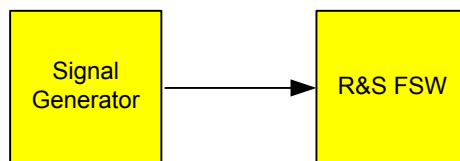


Fig. 9-1: Test setup

Signal generator settings (e.g. R&S SMU):

Frequency:	500 MHz
Level:	-10 dBm
Modulation:	FM
Modulation frequency:	10 kHz
Frequency deviation:	50 kHz

Procedure:

1. Preset the R&S FSW.
2. Set the center frequency to *500 MHz*.
3. Set the reference level to *0 dBm*.
4. Select the MODE key and then the "Analog Demod" button.

By default, the FM Time Domain result display and a Result Summary are shown.

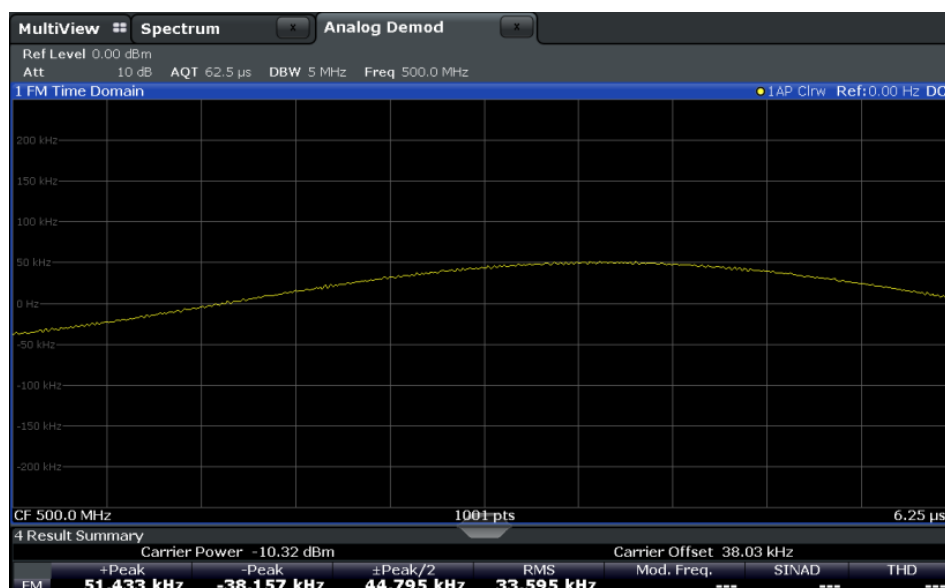


Fig. 9-2: Default Analog Demodulation measurement result display

- Set the measurement time (AQT) to 1 ms in order to measure 10 periods of the signal.
- Adjust the y-axis scaling to the measured frequency deviation automatically by selecting the "Scale Config" softkey and, in the "Scaling" tab, setting "AF Auto Scale" to "ON".

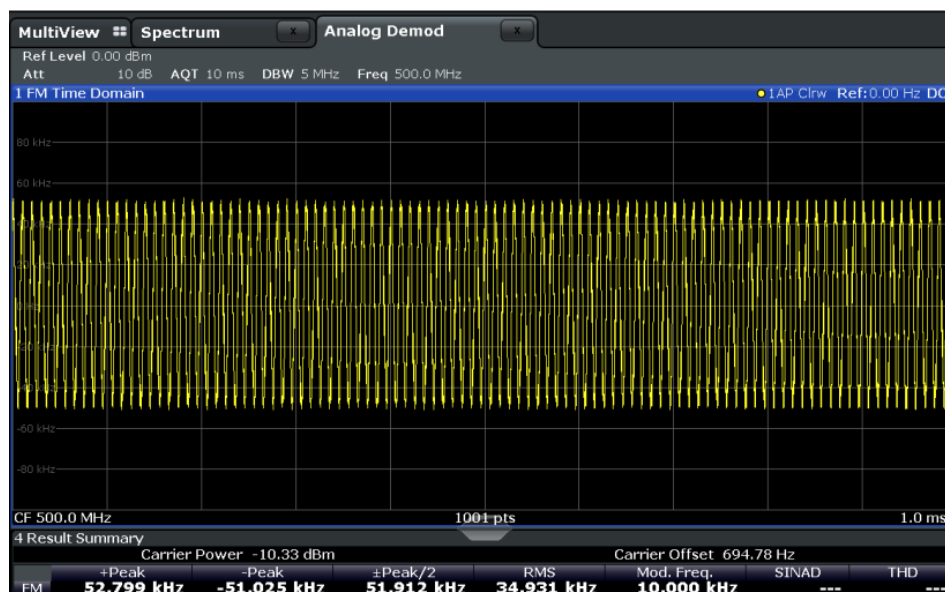


Fig. 9-3: Auto-scaled measurement of 10 signal periods (continuous)

- Display the RF spectrum of the measured signal to determine the required demodulation bandwidth. Select the "Display Config" softkey and add an "RF Spectrum" window to the display.

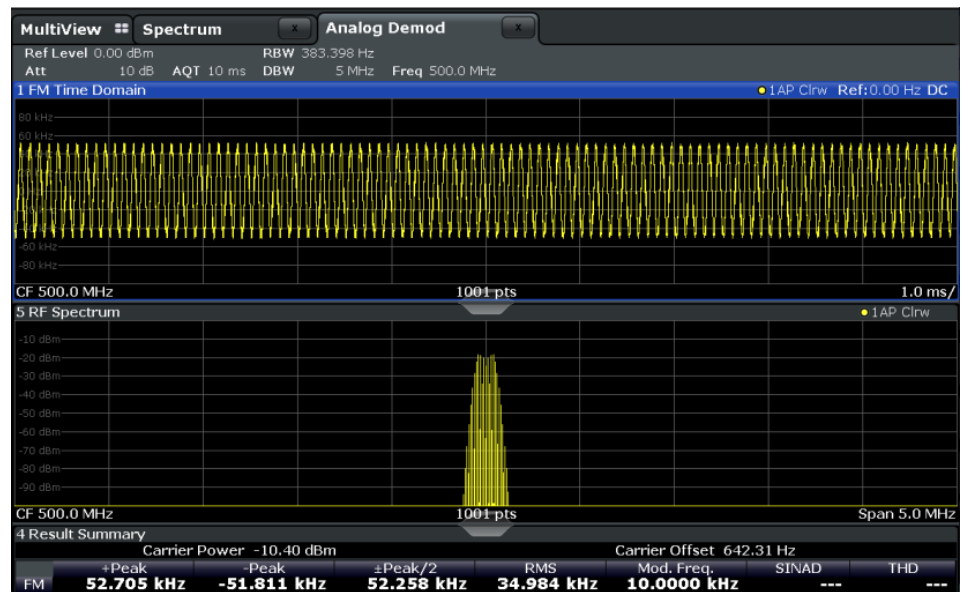


Fig. 9-4: RF spectrum of FM signal with default demodulation bandwidth = 5 MHz

8. As you can see in figure 9-4, the default demodulation bandwidth of 5 MHz is much too large - the actual signal takes up only a small part of the displayed range. That means that any noise or additional signals apart from the FM signal of interest may be included in the measured results. Select the "Demod BW" softkey and reduce the value to 200 kHz.

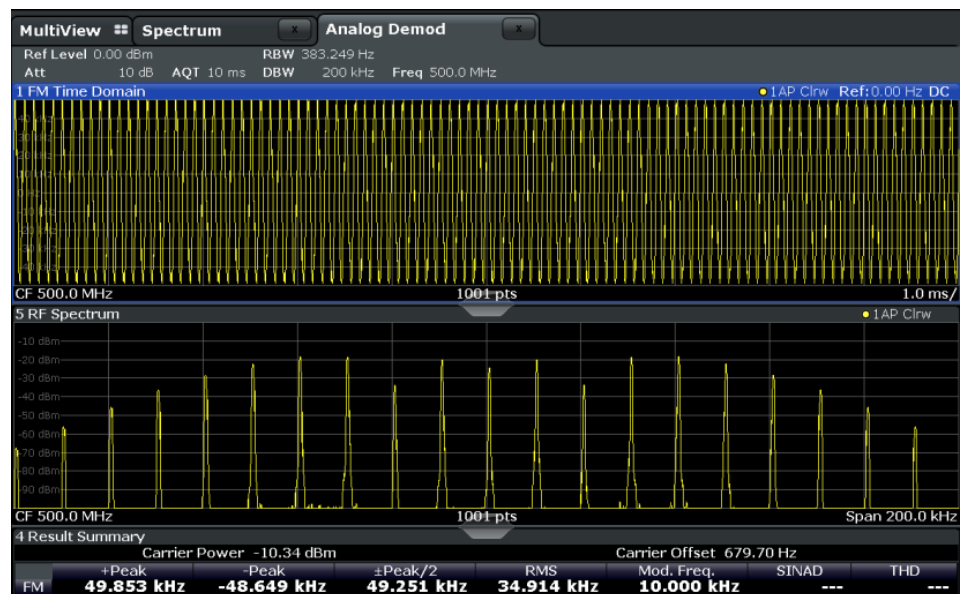


Fig. 9-5: RF spectrum with demodulation bandwidth = 200 kHz

The span is automatically reduced to 200 kHz as well, as only the demodulated range can be displayed.

9. Now the RF spectrum shows that part of the FM signal is cut off. The missing signal parts are not included in the calculated results. Increase the demodulation bandwidth to 400 kHz to include the entire signal, but no interfering frequencies. The span is not automatically increased for the wider DBW since it may be useful to display only a small range from the demodulated bandwidth. However, this means the RF spectrum will still not show the entire signal.
10. Increase the span manually to show the entire demodulated bandwidth:
 - a) Select the RF Spectrum window.
 - b) Press the SPAN key.
 - c) Select the "Full Span" softkey.

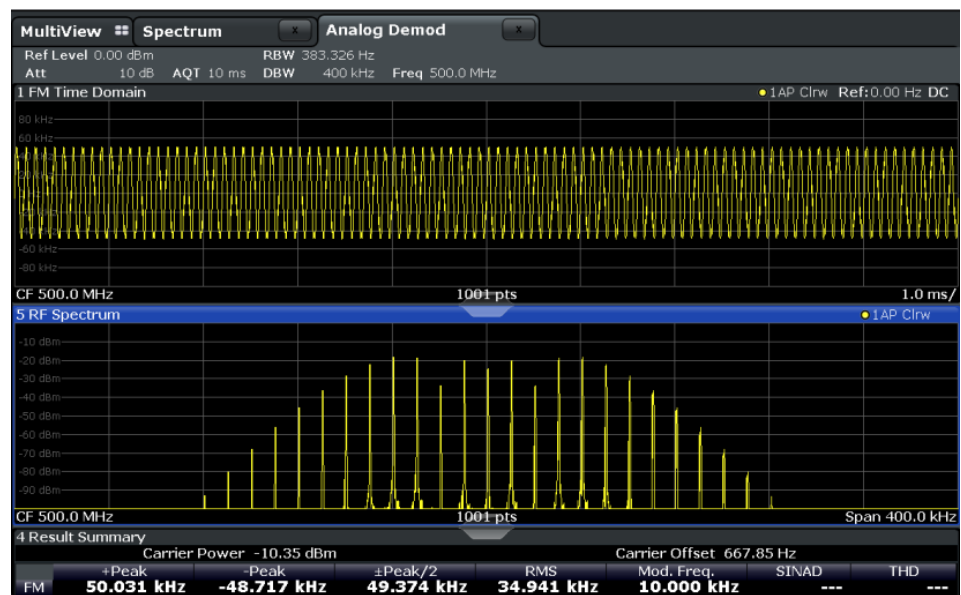


Fig. 9-6: RF spectrum with demodulation bandwidth = 400 kHz

11. Once the correct DBW has been determined, you can replace the RF spectrum by the FM spectrum result display to analyze the spectrum of the FM signal. Select the "Display Config" softkey and move an "FM Spectrum" window over the "RF Spectrum" window in the display.

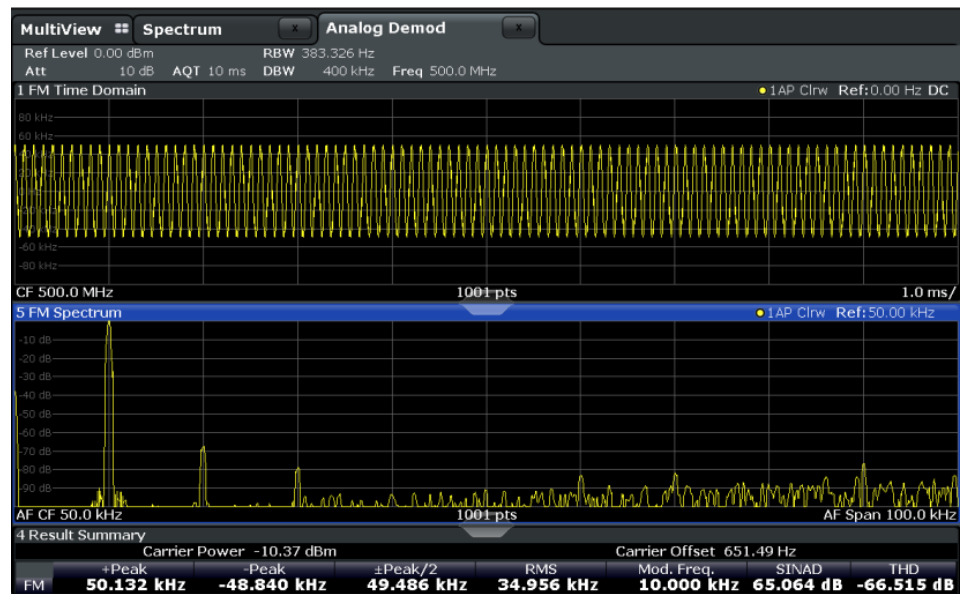
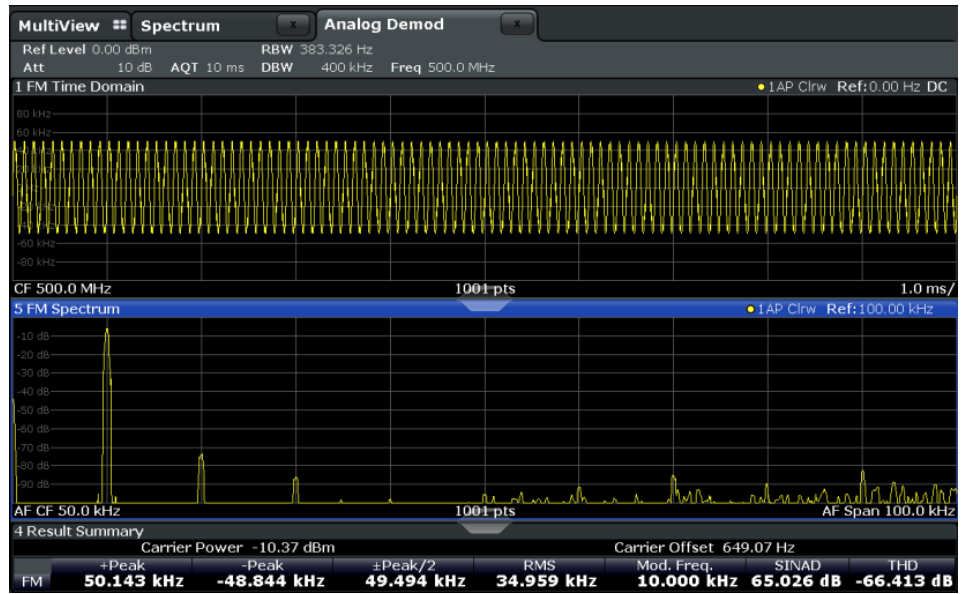


Fig. 9-7: FM spectrum and Result Summary including SINAD and THD values

From the FM spectrum, the SINAD and THD are also calculated and displayed in the Result Summary.

12. Since the "AF Auto Scale" function is enabled, the "FM Spectrum" diagram is scaled according to the current measurement automatically. Each diagram is scaled individually, so that the reference values at the top of the two diagrams can differ (100 kHz in the "FM Time Domain" versus 50 kHz in the "FM Spectrum"). However, you can adjust the values manually.
 - a) Select the "FM Spectrum" window to set the focus in it.
 - b) Press the AMPT key and select the "Scale Config" softkey.
 - c) Disable the "AF Auto Scale" function.
 - d) Define the new reference value (at 100% = top of the diagram) as 100 kHz.



Note that while the reference values at the top of both y-axes are now identical, the reference values indicated in the window title bars are not. This is due to the fact that, by default, in AF time domain displays the reference value is defined at the reference position 50 % (=center of diagram), while in AF frequency domains it is defined at the position 100 % (= top of diagram).

10 Optimizing and Troubleshooting the Measurement

If the results do not meet your expectations, consider the following notes and tips to optimize the measurement.

Determining the demodulation bandwidth

A frequent cause for measurement errors and false results is an **incorrectly defined demodulation bandwidth (DBW)**.

If the DBW is too large, the actual signal takes up only a small part of the demodulated range. That means that any noise or additional signal parts may be included in the measured results, which are then false.

On the other hand, if the DBW is too small, part of the signal is cut off and thus not included in the calculation of the results.

An easy way to determine the required DBW is to display the RF spectrum of the input signal. If the entire signal is displayed there and takes up most of the diagram width, the DBW should be appropriate.

This procedure is demonstrated in the measurement example described in [chapter 9, "Measurement Example: Demodulating an FM Signal"](#), on page 163.

For further recommendations on finding the correct demodulation bandwidth see [chapter 4.2, "Demodulation Bandwidth"](#), on page 28.

Adjusting the displayed span

Be aware that the span of the RF Spectrum display is not automatically increased for a wider DBW, since it may be useful to display only a small range from the demodulated bandwidth. However, this means the RF spectrum may not show the entire demodulated bandwidth. In this case you must increase the span manually to show the entire signal.

Determining the SINAD and THD

The signal-to-noise-and-distortion ratio (SINAD) and the total harmonic distortion (THD) of the demodulated signal are a good indicator of the signal quality sent by the DUT. Both values are calculated inside the AF spectrum span and thus only if an AF spectrum window is displayed. If either value deviates strongly from the expected result, make sure the demodulation bandwidth is defined correctly (see [Determining the demodulation bandwidth](#)).

11 Remote Commands for Analog Demodulation Measurements

The commands required to perform measurements in the Analog Demodulation application in a remote environment are described here.

It is assumed that the R&S FSW has already been set up for remote control in a network as described in the R&S FSW User Manual.



A programming example at the end of the remote commands description demonstrates the most important commands in a typical application scenario, see [chapter 11.11, "Programming Example"](#), on page 342.



Status registers

The R&S FSW-K7 option uses the status registers of the base unit (except for the `STATus:QUESTionable:ACPLimit` register).

For a description see the R&S FSW User Manual.

General R&S FSW Remote Commands

The application-independent remote commands for general tasks on the R&S FSW are also available for Analog Demodulation measurements and are described in the R&S FSW User Manual. In particular, this comprises the following functionality:

- Managing Settings and Results
- Setting Up the Instrument
- Using the Status Register

Channel-specific commands

Apart from a few general commands on the R&S FSW, most commands refer to the currently active channel. Thus, always remember to activate an Analog Demodulation channel before starting a remote program for an Analog Demodulation measurement.

• Introduction	171
• Common Suffixes	175
• Activating Analog Demodulation Measurements	176
• Configuring the Measurement	180
• Capturing Data and Performing Sweeps	277
• Configuring the Result Display	282
• Retrieving Results	289
• Analyzing Results	299
• Importing and Exporting I/Q Data and Results	340
• Commands for Compatibility	341
• Programming Example	342

11.1 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, in most cases, 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, these 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 FSW.



Remote command examples

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

11.1.1 Conventions used in Descriptions

Note the following conventions 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 FSW 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**
This is the unit 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.

11.1.2 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 upper case 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.

11.1.3 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 don't 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.

11.1.4 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.

Note that 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.

11.1.5 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.

11.1.6 SCPI Parameters

Many commands feature one or more parameters.

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

Example:

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

Parameters may have different forms of values.

- [Numeric Values](#)..... 173
- [Boolean](#)..... 174
- [Character Data](#)..... 175
- [Character Strings](#)..... 175
- [Block Data](#)..... 175

11.1.6.1 Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. In case of 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. in case of 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. In some cases you can customize the step size with a corresponding command.

Querying numeric values

When you query numeric values, the system returns a number. In case of physical quantities, it applies the basic unit (e.g. Hz in case of 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`

In some cases, numeric values may be 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 in case of errors.

11.1.6.2 Boolean

Boolean parameters represent two states. The "ON" state (logically true) is represented by "ON" or a 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`

11.1.6.3 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 11.1.2, "Long and Short Form"](#), on page 172.

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`

11.1.6.4 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'`

11.1.6.5 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. In the example the 4 following digits indicate the length to be 5168 bytes. 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 a `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.

11.2 Common Suffixes

In the Analog Demodulation application, the following common suffixes are used in remote commands:

Suffix	Value range	Description
<k>	1..8	Limit line
<m>	1..16	Marker

Suffix	Value range	Description
<n>	1..6	Window or Evaluation
<t>	1..6	Trace

11.3 Activating Analog Demodulation Measurements

Analog demodulation measurements require a special application on the R&S FSW. The measurement is started immediately with the default settings.

INSTrument:CREate:DUPLicate	176
INSTrument:CREate[:NEW]	176
INSTrument:CREate:REPLace	177
INSTrument:DELeTe	177
INSTrument:LIST?	177
INSTrument:REName	179
INSTrument[:SELeCt]	179
SYSTem:PRESet:CHANnel[:EXECute]	179

INSTrument:CREate:DUPLicate

This command duplicates the currently selected measurement channel, i.e starts a new measurement channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "Spectrum" -> "Spectrum 2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

This command is not available if the MSRA/MSRT Master channel is selected.

Example:

```
INST:SEL 'Spectrum'
INST:CRE:DUPL
```

Duplicates the channel named 'Spectrum' and creates a new measurement channel named 'Spectrum 2'.

Usage: Event

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds an additional measurement channel. The number of measurement channels you can configure at the same time depends on available memory.

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types see [INSTrument:LIST?](#) on page 177.

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.
 Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 177).

Example: `INST:CRE SAN, 'Spectrum 2'`
 Adds an additional spectrum display named "Spectrum 2".

INSTrument:CREate:REPLace <ChannelName1>,<ChannelType>,<ChannelName2>

This command replaces a measurement channel with another one.

Parameters:

<ChannelName1> String containing the name of the measurement channel you want to replace.

<ChannelType> Channel type of the new channel.
 For a list of available channel types see [INSTrument:LIST?](#) on page 177.

<ChannelName2> String containing the name of the new channel.
 Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 177).

Example: `INST:CRE:REPL 'Spectrum2', IQ, 'IQAnalyzer'`
 Replaces the channel named 'Spectrum2' by a new measurement channel of type 'IQ Analyzer' named 'IQAnalyzer'.

INSTrument:DELeTe <ChannelName>

This command deletes a measurement channel. If you delete the last measurement channel, the default "Spectrum" channel is activated.

Parameters:

<ChannelName> String containing the name of the channel you want to delete.
 A measurement channel must exist in order to be able delete it.

Example: `INST:DEL 'Spectrum4'`
 Deletes the spectrum channel with the name 'Spectrum4'.

INSTrument:LIST?

This command queries all active measurement channels. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

Return values:

<ChannelType>
<ChannelName>

For each channel, the command returns the channel type and channel name (see tables below).

Tip: to change the channel name, use the `INST:REName` command.

Example:

```
INST:LIST?
```

Result for 3 measurement channels:

```
'ADEM', 'Analog Demod', 'IQ', 'IQ Analyzer',  
'SANALYZER', 'Spectrum'
```

Usage:

Query only

Table 11-1: Available measurement channel types and default channel names in Signal and Spectrum Analyzer mode

Application	<ChannelType> Parameter	Default Channel Name*)
Spectrum	SANALYZER	Spectrum
I/Q Analyzer	IQ	IQ Analyzer
Pulse (R&S FSW-K6)	PULSE	Pulse
Analog Demodulation (R&S FSW-K7)	ADEM	Analog Demod
GSM (R&S FSW-K10)	GSM	GSM
Multi-Carrier Group Delay (R&S FSW-K17)	MCGD	MC Group Delay
Noise (R&S FSW-K30)	NOISE	Noise
Phase Noise (R&S FSW-K40)	PNOISE	Phase Noise
Transient Analysis (R&S FSW-K60)	TA	Transient Analysis
VSA (R&S FSW-K70)	DDEM	VSA
3GPP FDD BTS (R&S FSW-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S FSW-K73)	MWCD	3G FDD UE
TD-SCDMA BTS (R&S FSW-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (R&S FSW-K77)	MTDS	TD-SCDMA UE
cdma2000 BTS (R&S FSW-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (R&S FSW-K83)	MC2K	CDMA2000 MS

Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

Application	<ChannelType> Parameter	Default Channel Name*)
1xEV-DO BTS (R&S FSW-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (R&S FSW-K85)	MDO	1xEV-DO MS
WLAN (R&S FSW-K91)	WLAN	WLAN
LTE (R&S FSW-K10x)	LTE	LTE
Realtime Spectrum (R&S FSW-K160R)	RTIM	Realtime Spectrum

Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

INSTRument:REName <ChannelName1>, <ChannelName2>

This command renames a measurement channel.

Parameters:

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.
Note that you can not assign an existing channel name to a new channel; this will cause an error.

Example:

```
INST:REN 'Spectrum2', 'Spectrum3'
```

Renames the channel with the name 'Spectrum2' to 'Spectrum3'.

INSTRument[:SElect] <ChannelType>

Selects the channel type for the current channel.

See also [INSTRument:CREate\[:NEW\]](#) on page 176.

For a list of available channel types see [table 11-1](#).

Parameters:

<ChannelType> **ADEMod**
Analog Demodulation application, R&S FSW-K7

SYSTem:PRESet:CHANnel[:EXECute]

This command restores the default instrument settings in the current channel.

Use `INST:SEL` to select the channel.

Example:

```
INST 'Spectrum2'
```

Selects the channel for "Spectrum2".

```
SYST:PRESet:CHAN:EXEC
```

Restores the factory default settings to the "Spectrum2" channel.

Usage:

Event

Manual operation: See ["Preset Channel"](#) on page 55

11.4 Configuring the Measurement

The following remote commands are required to configure an Analog Demodulation measurement.

Specific commands:

• Managing Standard Settings	180
• Configuring the Input	181
• Configuring the Output	229
• Frequency Settings	231
• Configuring the Vertical Axis (Amplitude, Scaling)	233
• Configuring Data Acquisition	240
• Triggering	244
• Configuring Demodulation	255
• Adjusting Settings Automatically	267
• Configuring Standard Traces	270

11.4.1 Managing Standard Settings

You can configure the Analog Demodulation application using predefined standard settings. This allows for quick and easy configuration for commonly performed measurements.

For details see [chapter 5.2, "Configuration According to Digital Standards"](#), on page 51.

For an overview of predefined standards and settings see [chapter A.1, "Predefined Standards and Settings"](#), on page 345.

[SENSe:]ADEMod:PRESet[:STANdard]	180
[SENSe:]ADEMod:PRESet:REStore	181
[SENSe:]ADEMod:PRESet:StORe	181

[SENSe:]ADEMod:PRESet[:STANdard] <Standard>

This command loads a measurement configuration.

Standard definitions are stored in an xml file. The default directory for Analog Demodulation standards is C:\r_s\instr\user\predefined\AdemodPredefined.

Parameters:

<Standard> String containing the file name.
If you have stored the file in a subdirectory of the directory mentioned above, you have to include the relative path to the file.

Return values:

<Standard> The query returns the name of the currently loaded standard.

Manual operation: See ["Load Standard"](#) on page 53

[SENSe:]ADEMod:PRESet:REStore

This command restores the default configurations of predefined Analog Demodulation standards.

Note that the command will overwrite customized standards that have the same name as predefined standards.

Usage: Event

Manual operation: See ["Restore Standard Files"](#) on page 53

[SENSe:]ADEMod:PRESet:StORe <Standard>

This command saves the current Analog Demodulation measurement configuration.

Standard definitions are stored in an xml file. The default directory for Analog Demodulation standards is C:\r_s\instr\user\predefined\AdemodPredefined.

Parameters:

<Standard> String containing the file name.
You can save the file in a subdirectory of the directory mentioned above. In that case, you have to include the relative path to the file.

Manual operation: See ["Save Standard"](#) on page 53

11.4.2 Configuring the Input

- [RF Input](#)..... 181
- [Using External Mixers](#)..... 184
- [Configuring Input via the Analog Baseband Interface \(R&S FSW-B71\)](#)..... 198
- [Configuring Digital I/Q Input and Output](#)..... 202
- [Setting up Probes](#)..... 206
- [Working with Power Sensors](#)..... 208
- [External Generator Control](#)..... 219

11.4.2.1 RF Input

INPut:ATTenuation:PROtection:RESet	182
INPut:CONNector	182
INPut:COUPling	182
INPut:FILTer:HPASs[:STATe]	183
INPut:FILTer:YIG[:STATe]	183
INPut:IMPedance	183
INPut:SELEct	184

INPut:ATTenuation:PROTection:RESet

This command resets the attenuator and reconnects the RF input with the input mixer 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 OVL` message in the status bar are cleared.

(For details on the status register see the R&S FSW User Manual).

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

Usage: Event

INPut:CONNector <ConnType>

Determines whether the RF input data is taken from the RF input connector or the optional Analog Baseband I connector. This command is only available if the Analog Baseband interface (R&S FSW-B71) is installed and active for input.

For more information on the Analog Baseband Interface (R&S FSW-B71) see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Parameters:

<ConnType> **RF**
RF input connector

AIQI
Analog Baseband I connector

*RST: RF

Example: INP:CONN:AIQI
Selects the analog baseband input.

Usage: SCPI confirmed

Manual operation: See "[Input Connector](#)" on page 58

INPut:COUPling <CouplingType>

This command selects the coupling type of the RF input.

Parameters:

<CouplingType> **AC**
AC coupling

DC
DC coupling

*RST: AC

Example: INP:COUP DC

Usage: SCPI confirmed

Manual operation: See "[Input Coupling](#)" on page 56

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 R&S FSW in order to measure the harmonics for a DUT, for example.

This function requires option R&S FSW-B13.

(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 filter.)

Parameters:

<State> ON | OFF
*RST: OFF

Usage: SCPI confirmed

Manual operation: See "[High-Pass Filter 1...3 GHz](#)" on page 57

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

This command turns the YIG-preselector on and off.

Note the special conditions and restrictions for the YIG filter described in "[YIG-Preselector](#)" on page 57.

Parameters:

<State> ON | OFF | 0 | 1
*RST: 1 (0 for I/Q Analyzer, GSM, VSA and MC Group Delay measurements)

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

Manual operation: See "[YIG-Preselector](#)" on page 57

INPut:IMPedance <Impedance>

This command selects the nominal input impedance of the RF input.

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

The command is not available for measurements with the Digital Baseband Interface (R&S FSW-B17).

Parameters:

<Impedance> 50 | 75
*RST: 50 Ω

Example: INP:IMP 75

- Usage:** SCPI confirmed
- Manual operation:** See "[Impedance](#)" on page 57
See "[Unit](#)" on page 87

INPut:SElect <Source>

This command selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S FSW. If no additional options are installed, only RF input is supported.

Parameters:

- <Source>
- RF**
Radio Frequency ("RF INPUT" connector)
 - DIQ**
Digital IQ data (only available with optional Digital Baseband Interface R&S FSW-B17)
For details on I/Q input see the R&S FSW I/Q Analyzer User Manual.
 - AIQ**
Analog Baseband signal (only available with optional Analog Baseband Interface R&S FSW-B71)
For details on Analog Baseband input see the R&S FSW I/Q Analyzer User Manual.
- *RST: RF

- Manual operation:** See "[Radio Frequency State](#)" on page 56
See "[Digital I/Q Input State](#)" on page 69
See "[Analog Baseband Input State](#)" on page 71

11.4.2.2 Using External Mixers

The commands required to work with external mixers in a remote environment are described here. Note that these commands require the R&S FSW-B21 option to be installed and an external mixer to be connected to the front panel of the R&S FSW. In MSRA/MSRT mode, external mixers are not supported.

For details on working with external mixers see the R&S FSW User Manual.

- [Basic Settings](#)..... 184
- [Mixer Settings](#)..... 186
- [Conversion Loss Table Settings](#)..... 191
- [Programming Example: Working with an External Mixer](#)..... 195

Basic Settings

The basic settings concern general usage of an external mixer.

- [\[SENSe:\]MIXer\[:STATe\]](#)..... 185
- [\[SENSe:\]MIXer:BIAS:HIGH](#)..... 185
- [\[SENSe:\]MIXer:BIAS:LOW](#)..... 185

[SENSe:]MIXer:LOPower.....	185
[SENSe:]MIXer:SIGNal.....	186
[SENSe:]MIXer:THReshold.....	186

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

Activates or deactivates the use of a connected external mixer as input for the measurement. This command is only available if the R&S FSW-B21 option is installed and an external mixer is connected.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: MIX ON

Manual operation: See "[External Mixer State](#)" on page 59

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

This command defines the bias current for the high (second) range.

This command is only available if the external mixer is active (see [\[SENSe:\]MIXer\[:STATe\]](#) on page 185).

Parameters:

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

Manual operation: See "[Bias Settings](#)" on page 63

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

This command defines the bias current for the low (first) range.

This command is only available if the external mixer is active (see [\[SENSe:\]MIXer\[:STATe\]](#) on page 185).

Parameters:

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

Manual operation: See "[Bias Settings](#)" on page 63

[SENSe:]MIXer:LOPower <Level>

This command specifies the LO level of the external mixer's LO port.

Parameters:

<Level> numeric value
 Range: 13.0 dBm to 17.0 dBm
 Increment: 0.1 dB
 *RST: 15.5 dBm

Example: MIX:LOP 16.0dBm

Manual operation: See "[LO Level](#)" on page 62

[SENSe:]MIXer:SIGNal <State>

This command specifies whether automatic signal detection is active or not.

Note that automatic signal identification is only available for measurements that perform frequency sweeps (not in vector signal analysis or the I/Q Analyzer, for instance).

Parameters:

<State>

OFF | ON | AUTO | ALL

OFF

No automatic signal detection is active.

ON

Automatic signal detection (Signal ID) is active.

AUTO

Automatic signal detection (Auto ID) is active.

ALL

Both automatic signal detection functions (Signal ID+Auto ID) are active.

*RST: OFF

Manual operation: See "[Signal ID](#)" on page 63

See "[Auto ID](#)" on page 63

[SENSe:]MIXer:THReshold <Value>

This command defines the maximum permissible level difference between test sweep and reference sweep to be corrected during automatic comparison (see [[SENSe:\]MIXer:SIGNal](#) on page 186).

Parameters:

<Value>

<numeric value>

Range: 0.1 dB to 100 dB

*RST: 10 dB

Example: MIX:PORT 3

Manual operation: See "[Auto ID Threshold](#)" on page 63

Mixer Settings

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

[SENSe:]MIXer:FREQuency:HANDoVer.....	187
[SENSe:]MIXer:FREQuency:STARt?.....	187
[SENSe:]MIXer:FREQuency:STOP?.....	187
[SENSe:]MIXer:HARMonic:BAND:PRESet.....	188

[SENSe:]MIXer:HARMonic:BAND[:VALue].....	188
[SENSe:]MIXer:HARMonic:HIGH:STATe.....	189
[SENSe:]MIXer:HARMonic:HIGH[:VALue].....	189
[SENSe:]MIXer:HARMonic:TYPE.....	189
[SENSe:]MIXer:HARMonic[:LOW].....	189
[SENSe:]MIXer:LOSS:HIGH.....	190
[SENSe:]MIXer:LOSS:TABLE:HIGH.....	190
[SENSe:]MIXer:LOSS:TABLE[:LOW].....	190
[SENSe:]MIXer:LOSS[:LOW].....	190
[SENSe:]MIXer:PORTs.....	191
[SENSe:]MIXer:RFOVerrange[:STATe].....	191

[SENSe:]MIXer:FREQUency:HANdOver <Frequency>

This command 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.

This command is only available if the external mixer is active (see [SENSe:]MIXer[:STATe] on page 185).

Parameters:

<Frequency> numeric value

Example:

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

Manual operation: See "Handover Freq." on page 60

[SENSe:]MIXer:FREQUency:STARt?

This command queries the frequency at which the external mixer band starts.

Example:

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

Usage:

Query only

Manual operation: See "RF Start / RF Stop" on page 59

[SENSe:]MIXer:FREQUency:STOP?

This command queries the frequency at which the external mixer band stops.

Example:

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

Usage:

Query only

Manual operation: See "RF Start / RF Stop" on page 59

[SENSe:]MIXer:HARMonic:BAND:PRESet

This command 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.

Example: MIX:HARM:BAND:PRESet
Presets the selected waveguide band.

Usage: Event

Manual operation: See "[Preset Band](#)" on page 60

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

This command selects the external mixer band. The query returns the currently selected band.

This command is only available if the external mixer is active (see [\[SENSe:\]MIXer\[:STATe\]](#) on page 185).

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

Manual operation: See "[Band](#)" on page 60

Table 11-2: 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:LOSS:HIGH <Average>

This command defines the average conversion loss to be used for the entire high (second) range.

Parameters:

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

Example: MIX:LOSS:HIGH 20dB

Manual operation: See "[Conversion loss](#)" on page 61

[SENSe:]MIXer:LOSS:TABLE:HIGH <FileName>

This command defines the file name of the conversion loss table to be used for the high (second) range.

Parameters:

<FileName> string ('<file name>')

Example: MIX:LOSS:TABLE:HIGH 'MyCVLTable'

Manual operation: See "[Conversion loss](#)" on page 61

[SENSe:]MIXer:LOSS:TABLE[:LOW] <FileName>

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

Parameters:

<FileName> string ('<file name>')

Example: MIX:LOSS:TABLE 'mix_1_4'
Specifies the conversion loss table *mix_1_4*.

Manual operation: See "[Conversion loss](#)" on page 61

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

This command defines the average conversion loss to be used for the entire low (first) range.

Parameters:

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

Example: MIX:LOSS 20dB

Manual operation: See "[Conversion loss](#)" on page 61

[SENSe:]MIXer:PORTs <PortType>

This command specifies whether the mixer is a 2-port or 3-port type.

Parameters:

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

Example: MIX:PORT 3

Manual operation: See "[Mixer Type](#)" on page 60

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

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

Parameters:

<State> ON | OFF
 *RST: OFF

Manual operation: See "[RF Overrange](#)" on page 60

Conversion Loss Table Settings

The following settings are required to configure and manage conversion loss tables.

[SENSe:]CORRection:CVL:BAND	191
[SENSe:]CORRection:CVL:BIAS	192
[SENSe:]CORRection:CVL:CATAlog?	192
[SENSe:]CORRection:CVL:CLEAr	192
[SENSe:]CORRection:CVL:COMMeNt	193
[SENSe:]CORRection:CVL:DATA	193
[SENSe:]CORRection:CVL:HARMonic	194
[SENSe:]CORRection:CVL:MIXer	194
[SENSe:]CORRection:CVL:PORTs	194
[SENSe:]CORRection:CVL:SELeCt	195
[SENSe:]CORRection:CVL:SNUMber	195

[SENSe:]CORRection:CVL:BAND <Type>

This command defines the waveguide band for which the conversion loss table is to be used. This setting is checked against the current mixer setting before the table can be assigned to the range.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SELeCt](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Band>

K | A | KA | Q | U | V | E | W | F | D | G | Y | J | USER

Standard waveguide band or user-defined band.

Note: The band formerly referred to as "A" is now named "KA"; the input parameter "A" is still available and refers to the same band as "KA".For a definition of the frequency range for the pre-defined bands, see [table 11-2](#)).

*RST: F (90 GHz - 140 GHz)

Example:

CORR:CVL:SEL 'LOSS_TAB_4'

Selects the conversion loss table.

CORR:CVL:BAND KA

Sets the band to KA (26.5 GHz - 40 GHz).

Manual operation: See "[Band](#)" on page 67**[SENSe:]CORRection:CVL:BIAS <BiasSetting>**

This command defines the bias setting to be used with the conversion loss table.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<BiasSetting>

numeric value

*RST: 0.0 A

Default unit: A

Example:

CORR:CVL:SEL 'LOSS_TAB_4'

Selects the conversion loss table.

CORR:CVL:BIAS 3A

Manual operation: See "[Write to <CVL table name>](#)" on page 64
See "[Bias](#)" on page 67**[SENSe:]CORRection:CVL:CATAlog?**

This command queries all available conversion loss tables saved in the C:\r_s\instr\user\cvl\ directory on the instrument.

This command is only available with option B21 (External Mixer) installed.

Usage:

Query only

[SENSe:]CORRection:CVL:CLEArThis command deletes the selected conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Example: CORR:CVL:SEL 'LOSS_TAB_4'
Selects the conversion loss table.
CORR:CVL:CLE

Usage: Event

Manual operation: See "[Delete Table](#)" on page 65

[SENSe:]CORRection:CVL:COMMeNT <Text>

This command defines a comment for the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELeCT on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Text>

Example: CORR:CVL:SEL 'LOSS_TAB_4'
Selects the conversion loss table.
CORR:CVL:COMM 'Conversion loss table for
FS_Z60'

Manual operation: See "[Comment](#)" on page 67

[SENSe:]CORRection:CVL:DATA <Freq>,<Level>

This command defines the reference values of the selected conversion loss tables. The values are entered as a set of frequency/level pairs. A maximum of 50 frequency/level pairs may be entered. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELeCT on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Freq> numeric value

The frequencies have to be sent in ascending order.

<Level>

Example: CORR:CVL:SEL 'LOSS_TAB_4'
Selects the conversion loss table.
CORR:CVL:DATA 1MHZ,-30DB,2MHZ,-40DB

Manual operation: See "[Position/Value](#)" on page 68

[SENSe:]CORRection:CVL:HARMonic <HarmOrder>

This command defines the harmonic order for which the conversion loss table is to be used. This setting is checked against the current mixer setting before the table can be assigned to the range.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<HarmOrder> numeric value
Range: 2 to 65

Example:

```
CORR:CVL:SEL 'LOSS_TAB_4'  
Selects the conversion loss table.  
CORR:CVL:HARM 3
```

Manual operation: See ["Harmonic Order"](#) on page 67

[SENSe:]CORRection:CVL:MIXer <Type>

This command defines the mixer name in the conversion loss table. This setting is checked against the current mixer setting before the table can be assigned to the range.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Type> string
Name of mixer with a maximum of 16 characters

Example:

```
CORR:CVL:SEL 'LOSS_TAB_4'  
Selects the conversion loss table.  
CORR:CVL:MIX 'FS_Z60'
```

Manual operation: See ["Mixer Name"](#) on page 67

[SENSe:]CORRection:CVL:PORTs <PortNo>

This command defines the mixer type in the conversion loss table. This setting is checked against the current mixer setting before the table can be assigned to the range.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<PortType> 2 | 3
 *RST: 2

Example:

```
CORR:CVL:SEL 'LOSS_TAB_4'
Selects the conversion loss table.
CORR:CVL:PORT 3
```

Manual operation: See "[Mixer Type](#)" on page 68

[SENSe:]CORRection:CVL:SElect <FileName>

This command selects the conversion loss table with the specified file name. If <file_name> is not available, a new conversion loss table is created.

This command is only available with option B21 (External Mixer) installed.

Parameters:

<FileName> '<File name>'

Example:

```
CORR:CVL:SEL 'LOSS_TAB_4'
```

Manual operation: See "[New Table](#)" on page 64
 See "[Edit Table](#)" on page 65
 See "[File Name](#)" on page 66

[SENSe:]CORRection:CVL:SNUMber <SerialNo>

This command defines the serial number of the mixer for which the conversion loss table is to be used. This setting is checked against the current mixer setting before the table can be assigned to the range.

Before this command can be performed, the conversion loss table must be selected (see [\[SENSe:\]CORRection:CVL:SElect](#) on page 195).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<SerialNo> Serial number with a maximum of 16 characters

Example:

```
CORR:CVL:SEL 'LOSS_TAB_4'
Selects the conversion loss table.
CORR:CVL:MIX '123.4567'
```

Manual operation: See "[Mixer S/N](#)" on page 67

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

```

Configuring a conversion loss table for a user-defined band

```

//-----Preparing the instrument -----
//Reset the instrument

```

```

*RST
//Activate the use of the connected external mixer.
SENS:MIX ON
//-----Configuring a new conversion loss table -----
//Define cvl table for range 1 of band as described in previous example
// (extended V band)
SENS:CORR:CVL:SEL 'UserTable'
SENS:CORR:CVL:COMM 'User-defined conversion loss table for USER band'
SENS:CORR:CVL:BAND USER
SENS:CORR:CVL:HARM 6
SENS:CORR:CVL:BIAS -1mA
SENS:CORR:CVL:MIX 'FS_Z60'
SENS:CORR:CVL:SNUM '123.4567'
SENS:CORR:CVL:PORT 3
//Conversion loss is linear from 55 GHz to 75 GHz
SENS:CORR:CVL:DATA 55GHZ,-20DB,75GHZ,-30DB
//----- Configuring the mixer and band settings -----
//Use user-defined band and assign new cvl table.
SENS:MIX:HARM:BAND USER
//Define band by two ranges;
//range 1 covers 47.48 GHz to 80 GHz; harmonic 6, cvl table 'UserTable'
//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:TABL:LOW 'UserTable'
SENS:MIX:HARM:HIGH 8

SENS:MIX:LOSS:HIGH 30dB
//Query the possible range
SENS:MIX:FREQ:STAR?
//Result: 47480000000 (47.48 GHz)
SENS:MIX:FREQ:STOP?
//Result: 138020000000 (138.02 GHz)

//-----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 (default screen configuration)
TRAC:DATA? TRACel

```

11.4.2.3 Configuring Input via the Analog Baseband Interface (R&S FSW-B71)

The following commands are required to control the Analog Baseband Interface (R&S FSW-B71) in a remote environment. They are only available if this option is installed.

For more information on the Analog Baseband Interface see the R&S FSW I/Q Analyzer User Manual.

Useful commands for Analog Baseband data described elsewhere:

- `INP:SEL AIQ` (see `INPut:SElect` on page 184)
- `[SENSe:]FREQuency:CENTer` on page 231

Commands for the Analog Baseband calibration signal are described in the R&S FSW User Manual.

Remote commands exclusive to Analog Baseband data input and output

<code>INPut:IQ:BALanced[:STATe]</code>	198
<code>INPut:IQ:FULLscale:AUTO</code>	198
<code>INPut:IQ:FULLscale[:LEVel]</code>	199
<code>INPut:IQ:TYPE</code>	199
<code>CALibration:AIQ:DCOFFset:I</code>	200
<code>CALibration:AIQ:DCOFFset:Q</code>	200
<code>[SENSe:]PROBe<ch>:SETup:CMOFFset</code>	201
<code>TRACe:IQ:APCon[:STATe]</code>	201
<code>TRACe:IQ:APCon:A</code>	201
<code>TRACe:IQ:APCon:B</code>	202
<code>TRACe:IQ:APCon:RESult?</code>	202

`INPut:IQ:BALanced[:STATe]` <State>

This command defines whether the input is provided as a differential signal via all 4 Analog Baseband connectors or as a plain I/Q signal via 2 simple-ended lines.

Parameters:

<State>	ON Differential
	OFF Simple-ended
	*RST: ON

Example: `INP:IQ:BAL OFF`

Manual operation: See "[Input configuration](#)" on page 72

`INPut:IQ:FULLscale:AUTO` <State>

This command defines whether the full scale level (i.e. the maximum input power on the Baseband Input connector) is defined automatically according to the reference level, or manually.

Parameters:

<State>

ON

Automatic definition

OFFManual definition according to [INPut:IQ:FULLscale\[:LEVel\]](#) on page 199

*RST: ON

Example:

INP:IQ:FULL:AUTO OFF

Manual operation: See "[Full Scale Level Mode / Value](#)" on page 92**INPut:IQ:FULLscale[:LEVel]** <PeakVoltage>

This command defines the peak voltage at the Baseband Input connector if the full scale level is set to manual mode (see [INPut:IQ:FULLscale:AUTO](#) on page 198).

Parameters:

<PeakVoltage>

0.25 V | 0.5 V | 1 V | 2 V

Peak voltage level at the connector.

For probes, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.

*RST: 1V

Example:

INP:IQ:FULL 0.5V

Manual operation: See "[Full Scale Level Mode / Value](#)" on page 92**INPut:IQ:TYPE** <DataType>

This command defines the format of the input signal.

Parameters:

<DataType> IQ | I | Q

IQ

The input signal is filtered and resampled to the sample rate of the application.

Two input channels are required for each input signal, one for the in-phase component, and one for the quadrature component.

I

The in-phase component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0 (see [SENSe:]FREQuency:CENTer on page 231), the in-phase component of the input signal is down-converted first (Low IF I).

Q

The quadrature component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0, the quadrature component of the input signal is down-converted first (Low IF Q).

*RST: IQ

Example: INP:IQ:TYPE Q**Manual operation:** See "[I/Q Mode](#)" on page 71**CALibration:AIQ:DCOffset:I** <Offset>

This command defines a DC offset of the I input from the Analog Baseband interface (R&S FSW-B71).

Parameters:

<Offset> numeric value
DC offset
*RST: 0
Default unit: V

Example: CAL:AIQ:DCOF:I 0.001**CALibration:AIQ:DCOffset:Q** <Offset>

This command defines a DC offset of the Q input from the Analog Baseband interface (R&S FSW-B71).

Parameters:

<Offset> numeric value
DC offset
*RST: 0
Default unit: V

Example: CAL:AIQ:DCOF:Q 0.001

[SENSe:]PROBe<ch>:SETup:CMOffset <CMOffset>

Sets the common mode offset. The setting is only available if a differential probe is connected to the R&S FSW.

If the probe is disconnected, the common mode offset of the probe is reset to 0.0 V.

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

Suffix:

<ch> 1..4
Selects the input channel.

Parameters:

<CMOffset> Range: -100E+24 to 100E+24
Increment: 1E-3
*RST: 0
Default unit: V

TRACe:IQ:APCon[:STATe] <State>

If enabled, the average power consumption is calculated at the end of the I/Q data measurement. This command must be set *before* the measurement is performed!

The conversion factors A and B for the calculation are defined using [TRACe:IQ:APCon:A](#) and [TRACe:IQ:APCon:B](#).

The results can be queried using [TRACe:IQ:APCon:RESult?](#) on page 202.

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

Parameters:

<State> ON | OFF
*RST: OFF

Example:

```
*RST
TRAC:IQ:STAT ON
TRAC:IQ:SRAT 1MHZ
TRAC:IQ:RLEN 1000000
TRAC:IQ:APC:STAT ON
TRAC:IQ:APC:A 3.0
TRAC:IQ:APC:B 0.6
INIT;*WAI
TRAC:IQ:APC:RES?
```

TRACe:IQ:APCon:A <ConvFact>

Defines the conversion factor A for the calculation of the average power consumption.

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

Parameters:

<ConvFact> numeric value
 *RST: 1.0

TRACe:IQ:APCon:B <ConvFact>

Defines the conversion factor B for the calculation of the average power consumption.

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

Parameters:

<ConvFact> numeric value
 *RST: 0.0

TRACe:IQ:APCon:RESult?

Queries the average power consumption for an analog baseband input. This value is only calculated at the end of the I/Q data measurement if the [TRACe:IQ:APCon\[:STATe\]](#) command is set to ON *before* the measurement is performed!

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

Parameters:

<Average> numeric value
 Default unit: W

Usage: Query only

11.4.2.4 Configuring Digital I/Q Input and Output

Useful commands for digital I/Q data described elsewhere:

- [INP:SEL DIQ](#) (see [INPut:SElect](#) on page 184)
- [TRIGger\[:SEquence\]:LEVel:BBPower](#) on page 247



Remote commands for the R&S DigIConf software

Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the R&S FSW to the R&S DigIConf automatically which then configures the R&S EX-IQ-BOX via the USB connection.

All remote commands available for configuration via the R&S DigIConf software are described in the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

Example 1:

```
SOURce:EBOX:*RST
```

```
SOURce:EBOX:*IDN?
```

Result:

```
"Rohde&Schwarz,DigIConf,02.05.436 Build 47"
```

Example 2:

```
SOURce:EBOX:USER:CLOCK:REFERENCE:FREQUENCY 5MHZ
```

Defines the frequency value of the reference clock.

Remote commands exclusive to digital I/Q data input and output

<code>INPut:DIQ:CDEvice</code>	203
<code>INPut:DIQ:RANGe[:UPPer]:AUTO</code>	204
<code>INPut:DIQ:RANGe:COUPling</code>	205
<code>INPut:DIQ:RANGe[:UPPer]</code>	205
<code>INPut:DIQ:RANGe[:UPPer]:UNIT</code>	205
<code>INPut:DIQ:SRATe</code>	205
<code>INPut:DIQ:SRATe:AUTO</code>	206

`INPut:DIQ:CDEvice`

This command queries the current configuration and the status of the digital I/Q input from the optional Digital Baseband Interface (R&S FSW-B17).

For details see the section "Interface Status Information" for the Digital Baseband Interface (R&S FSW-B17) in the R&S FSW I/Q Analyzer User Manual.

Return values:

<code><ConnState></code>	Defines whether a device is connected or not.
<code>0</code>	No device is connected.
<code>1</code>	A device is connected.
<code><DeviceName></code>	Device ID of the connected device
<code><SerialNumber></code>	Serial number of the connected device
<code><PortName></code>	Port name used by the connected device

<SampleRate>	Maximum or currently used sample rate of the connected device in Hz (depends on the used connection protocol version; indicated by <SampleRateType> parameter)
<MaxTransferRate>	Maximum data transfer rate of the connected device in Hz
<ConnProtState>	State of the connection protocol which is used to identify the connected device. Not Started Has to be Started Started Passed Failed Done
<PRBSTestState>	State of the PRBS test. Not Started Has to be Started Started Passed Failed Done
<SampleRateType>	0 Maximum sample rate is displayed 1 Current sample rate is displayed
<FullScaleLevel>	The level (in dBm) that should correspond to an I/Q sample with the magnitude "1" (if transferred from connected device); If not available, 9.97e37 is returned

Example: INP:DIQ:CDEV?
Result:
1,SMU200A,103634,Out
A,70000000,100000000,Passed,Not Started,0,0

Manual operation: See "[Connected Instrument](#)" on page 70

INPut:DIQ:RANGe[:UPPer]:AUTO <State>

If enabled, the digital input full scale level is automatically set to the value provided by the connected device (if available).

This command is only available if the optional Digital Baseband interface (option R&S FSW-B17) is installed.

Parameters:

<State> ON | OFF
*RST: OFF

Manual operation: See ["Full Scale Level"](#) on page 70

INPut:DIQ:RANGe:COUPling <State>

If enabled, the reference level for digital input is adjusted to the full scale level automatically if the full scale level changes.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<State> ON | OFF
 *RST: OFF

Manual operation: See ["Adjust Reference Level to Full Scale Level"](#) on page 70

INPut:DIQ:RANGe[:UPPer] <Level>

Defines or queries the "Full Scale Level", i.e. the level that corresponds to an I/Q sample with the magnitude "1".

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<Level> <numeric value>
 Range: 1 μ V to 7.071 V
 *RST: 1 V

Manual operation: See ["Full Scale Level"](#) on page 70

INPut:DIQ:RANGe[:UPPer]:UNIT <Unit>

Defines the unit of the full scale level (see ["Full Scale Level"](#) on page 70). The availability of units depends on the measurement application you are using.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<Level> VOLT | DBM | DBPW | WATT | DBMV | DBUV | DBUA | AMPere
 *RST: Volt

Manual operation: See ["Full Scale Level"](#) on page 70

INPut:DIQ:SRATe <SampleRate>

This command specifies or queries the sample rate of the input signal from the Digital Baseband Interface (R&S FSW-B17, see ["Input Sample Rate"](#) on page 69).

Parameters:

<SampleRate> Range: 1 Hz to 10 GHz
 *RST: 32 MHz

Example: INP:DIQ:SRAT 200 MHz

Manual operation: See "Input Sample Rate" on page 69

INPut:DIQ:SRATe:AUTO <State>

If enabled, the sample rate of the digital I/Q input signal is set automatically by the connected device.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<State> ON | OFF
 *RST: OFF

Manual operation: See "Input Sample Rate" on page 69

11.4.2.5 Setting up Probes

Probes can be connected to the optional BASEBAND INPUT connectors, if the Analog Baseband interface (option R&S FSW-B71) is installed.

[SENSe:]PROBe<p>:ID:PARTnumber?	206
[SENSe:]PROBe<p>:ID:SRNumber?	207
[SENSe:]PROBe<p>:SETup:MODE	207
[SENSe:]PROBe<p>:SETup:NAME?	207
[SENSe:]PROBe<p>:SETup:STATe?	208
[SENSe:]PROBe<p>:SETup:TYPE?	208

[SENSe:]PROBe<p>:ID:PARTnumber?

Queries the R&S part number of the probe.

Suffix:

<p> 1 | 2 | 3
 Selects the connector:
 1 = Baseband Input I
 2 = Baseband Input Q
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Return values:

<PartNumber> Part number in a string.

Usage: Query only

[SENSe:]PROBe<p>:ID:SRNumber?

Queries the serial number of the probe.

Suffix:

<p> 1 | 2 | 3
 Selects the connector:
 1 = Baseband Input I
 2 = Baseband Input Q
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Return values:

<SerialNo> Serial number in a string.

Usage: Query only

[SENSe:]PROBe<p>:SETup:MODE <Mode>

Select the action that is started with the micro button on the probe head.

See also: "[Microbutton Action](#)" on page 73.

Suffix:

<p> 1 | 2 | 3
 Selects the connector:
 1 = Baseband Input I
 2 = Baseband Input Q
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Parameters:

<Mode> **RSINgle**
 Run single: starts one data acquisition.
NOACtion
 Nothing is started on pressing the micro button.
 *RST: RSINgle

Manual operation: See "[Microbutton Action](#)" on page 73

[SENSe:]PROBe<p>:SETup:NAME?

Queries the name of the probe.

Suffix:

<p> 1 | 2 | 3
 Selects the connector:
 1 = Baseband Input I
 2 = Baseband Input Q
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Return values:

<Name> Name string

Usage: Query only**[SENSe:]PROBe<p>:SETup:STATe?**

Queries if the probe at the specified connector is active (detected) or not active (not detected). To switch the probe on, i.e. activate input from the connector, use `INP:SEL:AIQ` (see `INPut:SElect` on page 184).

Suffix:

<p> 1 | 2 | 3

Selects the connector:

1 = Baseband Input I

2 = Baseband Input Q

3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Return values:

<State> DETected | NDETECTED

*RST: NDETECTED

Usage: Query only**[SENSe:]PROBe<p>:SETup:TYPE?**

Queries the type of the probe.

Suffix:

<p> 1 | 2 | 3

Selects the connector:

1 = Baseband Input I

2 = Baseband Input Q

3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

Return values:

<Type> String containing one of the following values:

– None (no probe detected)

– active differential

– active single-ended

Usage: Query only**11.4.2.6 Working with Power Sensors**

The following commands describe how to work with power sensors.

- [Configuring Power Sensors](#)..... 209
- [Configuring Power Sensor Measurements](#)..... 210
- [Triggering with Power Sensors](#)..... 217

Configuring Power Sensors

<code>SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO[:STATe]</code>	209
<code>SYSTem:COMMunicate:RDEvice:PMETer:COUNT?</code>	209
<code>SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine</code>	209

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

This command turns automatic assignment of a power sensor to the power sensor index on and off.

Suffix:

<p> 1...4
Power sensor index

Parameters:

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

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

Manual operation: See "[Select](#)" on page 82

SYSTem:COMMunicate:RDEvice:PMETer:COUNT?

This command queries the number of power sensors currently connected to the R&S FSW.

Parameters:

<NumberSensors> Number of connected power sensors.

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

Usage: Query only

Manual operation: See "[Select](#)" on page 82

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

This command 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> 1...4
Power sensor index

Setting parameters:

<Placeholder> Currently not evaluated

<SerialNo> Serial number of a connected power sensor

Query parameters:

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

<Interface> Currently not evaluated

Return values:

<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".

Manual operation: See "Select" on page 82

Configuring Power Sensor Measurements

CALibration:PMETer<p>:ZERO:AUTO ONCE.....	210
CALCulate<n>:PMETer<p>:RELative[:MAGNitude].....	211
CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE.....	211
CALCulate<n>:PMETer<p>:RELative:STATE.....	212
FETCH:PMETer<p>?.....	212
READ:PMETer<p>?.....	212
[SENSe:]PMETer<p>:DCYCLE[:STATE].....	212
[SENSe:]PMETer<p>:DCYCLE:VALue.....	213
[SENSe:]PMETer<p>:FREQuency.....	213
[SENSe:]PMETer<p>:FREQuency:LINK.....	213
[SENSe:]PMETer<p>:MTIME.....	214
[SENSe:]PMETer<p>:MTIME:AVERAge:COUNT.....	214
[SENSe:]PMETer<p>:MTIME:AVERAge[:STATE].....	215
[SENSe:]PMETer<p>:ROFFset[:STATE].....	215
[SENSe:]PMETer<p>[:STATE].....	215
[SENSe:]PMETer<p>:UPDate[:STATE].....	216
UNIT<n>:PMETer<p>:POWER.....	216
UNIT<n>:PMETer<p>:POWER:RATIo.....	216

CALibration:PMETer<p>:ZERO:AUTO ONCE

This commands starts to zero 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> 1...4
Power sensor index

Parameters:

ONCE

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

Manual operation: See ["Zeroing Power Sensor"](#) on page 82

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

This command defines the reference value for relative measurements.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<RefValue> Range: -200 dBm to 200 dBm
*RST: 0

Example:

CALC:PMET2:REL -30

Sets the reference value for relative measurements to -30 dBm for power sensor 2.

Manual operation: See ["Reference Value"](#) on page 84

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

This command sets the current measurement result as the reference level for relative measurements.

Suffix:

<p> 1...4
Power sensor index

Parameters:

ONCE

Example:

CALC:PMET2:REL:AUTO ONCE

Takes the current measurement value as reference value for relative measurements for power sensor 2.

Usage: Event

Manual operation: See ["Setting the Reference Level from the Measurement \(Measurement-Ref\)"](#) on page 83

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

This command turns relative power sensor measurements on and off.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<State> ON | OFF
*RST: OFF

Example:

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

FETCH:PMETer<p>?

This command queries the results of power sensor measurements.

Suffix:

<p> 1...4
Power sensor index

Return values:

<Level> Power level that has been measured by a power sensor.
The unit is either dBm (absolute measurements) or dB (relative measurements).

Usage: Query only

READ:PMETer<p>?

This command initiates a power sensor measurement and queries the results.

Suffix:

<p> 1...4
Power sensor index

Usage: Query only

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

This command turns the duty cycle correction on and off.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<State> ON | OFF
*RST: OFF

Example:

PMET2:DCYC:STAT ON

Manual operation: See "[Duty Cycle](#)" on page 84

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

This command 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> 1...4
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%.
```

Manual operation: See "[Duty Cycle](#)" on page 84

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

This command defines the frequency of the power sensor.

Suffix:

<p> 1...4
Power sensor index

Parameters:

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

Example:

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

Manual operation: See "[Frequency Manual](#)" on page 83

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

This command selects the frequency coupling for power sensor measurements.

Suffix:

<p> 1...4
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

Manual operation: See "[Frequency Coupling](#)" on page 83**[SENSe:]PMETer<p>:MTIME <Duration>**

This command selects the duration of power sensor measurements.

Suffix:

<p>

1...4

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.

Manual operation: See "[Meas Time/Average](#)" on page 83**[SENSe:]PMETer<p>:MTIME:AVERAge:COUNT <NumberReadings>**

This command 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>

1...4

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.

Manual operation: See "[Average Count \(Number of Readings\)](#)" on page 84

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

This command turns averaging for power sensor measurements on and off.

Suffix:
 <p> 1...4
 Power sensor index

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

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

Manual operation: See "[Meas Time/Average](#)" on page 83

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

This command includes or excludes the reference level offset of the analyzer for power sensor measurements.

Suffix:
 <p> 1...4
 Power sensor index

Parameters:
 <State> **ON | 1**
 Includes the reference level offset in the results.
OFF | 0
 Ignores the reference level offset.
 *RST: 1

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

Manual operation: See "[Use Ref Lev Offset](#)" on page 84

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

This command turns a power sensor on and off.

Suffix:
 <p> 1...4
 Power sensor index

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

PMET1 ON
 Switches the power sensor measurements on.

Manual operation:

See "State" on page 82
 See "Select" on page 82

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

This command turns continuous update of power sensor measurements on and off. If on, the results are update even if a single sweep is complete.

Suffix:

<p> 1...4
 Power sensor index

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

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

Manual operation:

See "Continuous Value Update" on page 82

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

This command selects the unit for absolute power sensor measurements.

Suffix:

<p> 1...4
 Power sensor index

Parameters:

<Unit> DBM | WATT | W
 *RST: DBM

Example:

UNIT:PMET:POW DBM

Manual operation:

See "Unit/Scale" on page 83

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

This command selects the unit for relative power sensor measurements.

Suffix:

<p> 1...4
 Power sensor index

Parameters:

<Unit> DB | PCT
 *RST: DB

Example: UNIT:PMET:POW:RAT DB

Manual operation: See "[Unit/Scale](#)" on page 83

Triggering with Power Sensors

[SENSe:]PMETer<p>:TRIGger:DTIME.....	217
[SENSe:]PMETer<p>:TRIGger:HOLDoff.....	217
[SENSe:]PMETer<p>:TRIGger:HYSteresis.....	218
[SENSe:]PMETer<p>:TRIGger:LEVel.....	218
[SENSe:]PMETer<p>:TRIGger:SLOPe.....	218
[SENSe:]PMETer<p>:TRIGger[:STATe].....	219

[SENSe:]PMETer<p>:TRIGger:DTIME <Time>

This command defines the time period that the input signal has to stay below the IF power trigger level before the measurement starts.

Suffix:

<p> 1...4
 Power sensor index

Parameters:

<Time> Range: 0 s to 1 s
 Increment: 100 ns
 *RST: 100 µs

Example: PMET2:TRIG:DTIME 0.001

[SENSe:]PMETer<p>:TRIGger:HOLDoff <Holdoff>

This command defines the trigger holdoff for external power triggers.

Suffix:

<p> 1...4
 Power sensor index

Parameters:

<Holdoff> Time period that has to pass between the trigger event and the start of the measurement, in case another trigger event occurs.

Range: 0 s to 1 s
 Increment: 100 ns
 *RST: 0 s

Example: PMET2:TRIG:HOLD 0.1
 Sets the holdoff time of the trigger to 100 ms

Manual operation: See "[Trigger Holdoff](#)" on page 85

[SENSe:]PMETer<p>:TRIGger:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis for external power triggers.

The hysteresis in dB is the value the input signal must stay below the IF power trigger level in order to allow a trigger to start the measurement.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<Hysteresis> Range: 3 dB to 50 dB
Increment: 1 dB
*RST: 0 dB

Example:

PMET2:TRIG:HYST 10
Sets the hysteresis of the trigger to 10 dB.

Manual operation: See "[Hysteresis](#)" on page 85

[SENSe:]PMETer<p>:TRIGger:LEVel <Level>

This command defines the trigger level for external power triggers.

This command requires the use of an R&S NRP-Z81 power sensor.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<Level> -20 to +20 dBm
Range: -20 dBm to 20 dBm
*RST: -10 dBm

Example:

PMET2:TRIG:LEV -10 dBm
Sets the level of the trigger

Manual operation: See "[External Trigger Level](#)" on page 84

[SENSe:]PMETer<p>:TRIGger:SLOPe <Edge>

This command selects the trigger condition for external power triggers.

Suffix:

<p> 1...4
Power sensor index

Parameters:

<Edge>

POSitive

The measurement starts in case the trigger signal shows a positive edge.

NEGative

The measurement starts in case the trigger signal shows a negative edge.

*RST: POSitive

Example:

```
PMET2:TRIG:SLOP NEG
```

Manual operation: See "[Slope](#)" on page 85

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

This command turns the external power trigger on and off.

This command requires the use of an R&S NRP-Z81 power sensor.

Suffix:

<p>

1...4

Power sensor index

Parameters:

<State>

ON | OFF

*RST: OFF

Example:

```
PMET2:TRIG ON
```

Switches the external power trigger on

Manual operation: See "[Using the power sensor as an external trigger](#)" on page 84

11.4.2.7 External Generator Control

External generator control commands are available if the R&S FSW External Generator Control option (R&S FSW-B10) is installed. For each measurement channel one external generator can be configured. To switch between different configurations define multiple measurement channels.

For more information on external generator control see [chapter 4.7.4, "Basics on External Generator Control"](#), on page 36.

- [Measurement Configuration](#).....219
- [Interface Configuration](#).....223
- [Source Calibration](#).....225
- [Programming Example for External Generator Control](#)..... 227

Measurement Configuration

The following commands are required to activate external generator control and to configure a calibration measurement with an external tracking generator.

SOURce:EXTernal:FREQuency	220
SOURce:EXTernal:FREQuency:COUPling[:STATe]	220
SOURce:EXTernal:FREQuency[:FACTor]:DENominator	220
SOURce:EXTernal:FREQuency[:FACTor]:NUMerator	221
SOURce:EXTernal:FREQuency:OFFSet	221
SOURce:EXTernal:POWer[:LEVel]	222
SOURce:EXTernal[:STATe]	222
SOURce:POWer[:LEVel][:IMMediate]:OFFSet	222

SOURce:EXTernal:FREQuency <Frequency>

This command defines a fixed source frequency for the external generator.

Parameters:

<Frequency> Source frequency of the external generator.
 *RST: 1100050000

Example: SOUR:EXT:FREQ 10MHz

Manual operation: See "[\(Manual\) Source Frequency](#)" on page 77

SOURce:EXTernal:FREQuency:COUPling[:STATe] <State>

This command couples the frequency of the external generator output to the R&S FSW.

Parameters:

<State> ON | OFF | 0 | 1
ON | 1
 Default setting: a series of frequencies is defined (one for each sweep point), based on the current frequency at the RF input of the R&S FSW; the RF frequency range covers the currently defined span of the R&S FSW (unless limited by the range of the signal generator)
OFF | 0
 The generator uses a single fixed frequency, defined by [SOURce:EXTernal:FREQuency](#).
 *RST: 1

Example: SOUR:EXT:FREQ:COUP ON

Manual operation: See "[Source Frequency Coupling](#)" on page 77

SOURce:EXTernal:FREQuency[:FACTor]:DENominator <Value>

This command defines the denominator of the factor with which the analyzer frequency is multiplied in order to obtain the transmit frequency of the selected generator.

Select the multiplication factor such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$\text{Source Freq} = \text{RF} \cdot \frac{\text{Numerator}}{\text{Denominator}} + \text{Offset}$$

Parameters:

<Value> <numeric value>
 *RST: 1

Example:

```
SOUR:EXT:FREQ:NUM 4"
"SOUR:EXT:FREQ:DEN 3"
```

Sets a multiplication factor of 4/3, i.e. the transmit frequency of the generator is 4/3 times the analyzer frequency.

Manual operation: See "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 77

SOURce:EXTernal:FREQUENCY[:FACTor]:NUMerator <Value>

This command defines the numerator of the factor with which the analyzer frequency is multiplied in order to obtain the transmit frequency of the selected generator.

Select the multiplication factor such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$\text{Source Freq} = \text{RF} \cdot \frac{\text{Numerator}}{\text{Denominator}} + \text{Offset}$$

Parameters:

<Value> <numeric value>
 *RST: 1

Example:

```
SOUR:EXT:FREQ:NUM 4"
"SOUR:EXT:FREQ:DEN 3"
```

Sets a multiplication factor of 4/3, i.e. the transmit frequency of the generator is 4/3 times the analyzer frequency.

Manual operation: See "(Automatic) Source Frequency (Numerator/Denominator/Offset)" on page 77

SOURce:EXTernal:FREQUENCY:OFFSet <Offset>

This command defines the frequency offset of the generator with reference to the analyzer frequency.

Select the offset such that the frequency range of the generator is not exceeded if the following formula is applied to the start and stop frequency of the analyzer:

$$\text{Source Freq} = \text{RF} \cdot \frac{\text{Numerator}}{\text{Denominator}} + \text{Offset}$$

Parameters:

<Offset> <numeric value>, specified in Hz, kHz, MHz or GHz, rounded to the nearest Hz

*RST: 0 Hz

Example:

SOUR:EXT:FREQ:OFFS 10HZ

Sets an offset of the generator output frequency compared to the analyzer frequency of 10 Hz.

Manual operation:

See "[\(Automatic\) Source Frequency \(Numerator/Denominator/Offset\)](#)" on page 77

SOURce:EXtErnal:POWer[:LEVel] <Level>

This command sets the output power of the selected generator.

Parameters:

<Level> <numeric value>

*RST: -20 dBm

Example:

SOUR:EXT:POW -30dBm

Sets the generator level to -30 dBm

Manual operation:

See "[Source Power](#)" on page 76

SOURce:EXtErnal[:STATe] <State>

This command activates or deactivates the connected external generator.

Parameters:

<State> ON | OFF

*RST: OFF

Manual operation:

See "[Source State](#)" on page 76

SOURce:POWer[:LEVel][:IMMediate]:OFFSet <Offset>

This command defines a level offset for the external generator level. Thus, for example, attenuators or amplifiers at the output of the external generator can be taken into account for the setting.

Parameters:

<Offset> Range: -200 dB to +200 dB

*RST: 0dB

Example:

SOUR:POW:OFFS -10dB

Sets the level offset of the external generator to -20 dBm.

Usage:

SCPI confirmed

Manual operation:

See "[Source Offset](#)" on page 76

Interface Configuration

The following commands are required to configure the interface for the connection to the external generator.

<code>SOURce:EXTernal:ROSCillator[:SOURce]</code>	223
<code>SYSTem:COMMunicate:GPIB:RDEvice:GENerator:ADDRess</code>	223
<code>SYSTem:COMMunicate:RDEvice:GENerator:INTerface</code>	223
<code>SYSTem:COMMunicate:RDEvice:GENerator:LINK</code>	224
<code>SYSTem:COMMunicate:RDEvice:GENerator:TYPE</code>	224
<code>SYSTem:COMMunicate:TCPip:RDEvice:GENerator:ADDRess</code>	224

`SOURce:EXTernal:ROSCillator[:SOURce]` <Source>

This command controls selection of the reference oscillator for the external generator.

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Parameters:

<Source>

INTernal

the internal reference is used

EXTernal

the external reference is used; if none is available, an error flag is displayed in the status bar

*RST: INT

Example:

`SOUR:EXT:ROSC EXT`

Switches to external reference oscillator

Manual operation: See "[Reference](#)" on page 75

`SYSTem:COMMunicate:GPIB:RDEvice:GENerator:ADDRess` <Number>

Changes the IEC/IEEE-bus address of the external generator.

Parameters:

<Number>

Range: 0 to 30

*RST: 28

Example:

`SYST:COMM:GPIB:RDEV:GEN:ADDR 15`

Manual operation: See "[GPIB Address / TCP/IP Address](#)" on page 75

`SYSTem:COMMunicate:RDEvice:GENerator:INTerface` <Type>

Defines the interface used for the connection to the external generator.

This command is only available if external generator control is active (see [SOURce:EXTernal\[:STATe\]](#) on page 222).

Parameters:

<Type>

GPIB | TCPip

*RST: GPIB

Example: `SYST:COMM:RDEV:GEN:INT TCP`

Manual operation: See ["Interface"](#) on page 74

SYSTem:COMMunicate:RDEvice:GENerator:LINK <Type>

This command selects the link type of the external generator if the GPIB interface is used.

The difference between the two GPIB operating modes is the execution speed. While, during GPIB operation, each frequency to be set is transmitted to the generator separately, a whole frequency list can be programmed in one go if the TTL interface is also used. Frequency switching can then be performed per TTL handshake which results in considerable speed advantages.

This command is only available if external generator control is active (see [SOURCE:EXTernal\[:STATe\]](#) on page 222).

Parameters:

<Type> GPIB | TTL

GPIB
GPIB connection without TTL synchronization (for all generators of other manufacturers and some Rohde & Schwarz devices)

TTL
GPIB connection with TTL synchronization (if available; for most Rohde&Schwarz devices)

*RST: GPIB

Example: `SYST:COMM:RDEV:GEN:LINK TTL`
Selects GPIB + TTL interface for generator operation.

Manual operation: See ["TTL Handshake"](#) on page 75

SYSTem:COMMunicate:RDEvice:GENerator:TYPE <Type>

This command selects the type of external generator.

For a list of the available generator types see the "External Generator Control Basics" section in the R&S FSW User Manual.

Parameters:

<Name> <Generator name as string value>

*RST: SMU02

Example: `SYST:COMM:RDEV:GEN2:TYPE 'SME02'`
Selects SME02 as generator 2

Manual operation: See ["Generator Type"](#) on page 74

SYSTem:COMMunicate:TCPIP:RDEvice:GENerator:ADDRess <Address>

Configures the TCP/IP address for the external generator.

Parameters:

<Address> TCP/IP address between 0.0.0.0 and 0.255.255.255
 *RST: 0.0.0.0

Example: SYST:COMM:TCP:RDEV:GEN:ADDR 130.094.122.195

Manual operation: See "[GPIB Address / TCP/IP Address](#)" on page 75

Source Calibration

The following commands are required to activate the calibration functions of the external tracking generator. However, they are only available if external generator control is active (see [SOURCE:EXTERNAL\[:STATE\]](#) on page 222).

Remote commands exclusive to source calibration:

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue	225
[SENSe:]CORRection:COLLect[:ACQuire]	225
[SENSe:]CORRection:METHod	226
[SENSe:]CORRection:RECall	226
[SENSe:]CORRection[:STATe]	227
[SENSe:]CORRection:TRANsducer:GENerator	227

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue <Value>

The command defines the power value assigned to the reference position in the grid.

For external generator calibration measurements (requires External Generator Control option R&S FSW-B10), this command defines the power offset value assigned to the reference position.

Parameters:

<Value> *RST: 0 dBm, coupled to reference level

Example: DISP:TRAC:Y:RVAL -20dBm
 Sets the power value assigned to the reference position to -20 dBm

Manual operation: See "[Reference Value](#)" on page 80

[SENSe:]CORRection:COLLect[:ACQuire] <MeasType>

This command initiates a reference measurement (calibration). The reference measurement is the basis for the measurement normalization. The result depends on whether a reflection measurement or transmission measurement is performed (see [\[SENSe:\]CORRection:METHod](#) on page 226).

To obtain a correct reference measurement, a complete sweep with synchronization to the end of the sweep must have been carried out. This is only possible in the single sweep mode.

This command is only available if external generator control is active (see [SOURCE:EXTERNAL\[:STATE\]](#) on page 222).

Parameters:

<MeasType>

THRough

"TRANsmission" mode: calibration with direct connection between external generator and device input
 "REFLection" mode: calibration with short circuit at the input

OPEN

only allowed in "REFLection" mode: calibration with open input

Example:

```
INIT:CONT OFF
```

Selects single sweep operation

```
CORR:METH TRAN
```

Selects a transmission measurement.

```
CORR:COLL THR;*WAI
```

Starts the measurement of reference data using direct connection between generator and device input and waits for the sweep end.

Usage:

Setting only

SCPI confirmed

Manual operation:

See ["Calibrate Reflection Short"](#) on page 79

See ["Calibrate Reflection Open"](#) on page 79

[SENSe:]CORRection:METHod

This command selects the type of measurement to be performed with the external generator.

This command is only available if external generator control is active (see [SOURCE:EXTernal\[:STATe\]](#) on page 222).

Parameters:**REFLection**

Selects reflection measurements.

TRANsmission

Selects transmission measurements.

```
*RST: TRANsmission
```

Example:

```
CORR:METH TRAN
```

Sets the type of measurement to "transmission".

Manual operation:

See ["Calibrate Transmission"](#) on page 79

See ["Calibrate Reflection Short"](#) on page 79

See ["Calibrate Reflection Open"](#) on page 79

[SENSe:]CORRection:RECall

This command restores the measurement configuration used for calibration.

This command is only available if external generator control is active (see [SOURCE:EXTernal\[:STATe\]](#) on page 222).

Example: CORR:REC
Usage: Event
Manual operation: See "[Recall](#)" on page 79

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

This command turns correction of measurement results (normalization) on and off.

The command is available after you have created a reference trace for the selected measurement type with [SENSe:]CORRection:COLLect[:ACQuire] on page 225.

This command is only available if external generator control is active (see SOURce:EXTeRnal[:STATe] on page 222).

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

Example: CORR ON
 Activates normalization.

Usage: SCPI confirmed

Manual operation: See "[Source Calibration Normalize](#)" on page 79

[SENSe:]CORRection:TRANsducer:GENerator <Name>

This command uses the normalized measurement data to generate a transducer factor with up to 1001 points. The trace data is converted to a transducer with unit dB and stored in a file with the specified name and the suffix .trd under c:\r_s\instr\trd. The frequency points are allocated in equidistant steps between start and stop frequency.

The generated transducer factor can be further adapted using the commands described in the "Remote Commands > Configuring the R&S FSW > Working with Transducers" section in the R&S FSW User Manual.

Parameters:
 <Name> '<name>'

Example: CORR:TRAN:GEN 'SMU01'
 Creates the transducer file C:\r_s\instr\trd\SMU01.trd.

Usage: SCPI confirmed

Manual operation: See "[Save As Trd Factor](#)" on page 80

Programming Example for External Generator Control

The following example demonstrates how to work with an external generator in a remote environment.

It assumes a signal generator of the type SMU04 is connected to the R&S FSW, including TTL synchronization, as described in [chapter 4.7.4.1, "External Generator Connections"](#), on page 36.

```
//-----Preparing the instrument -----

//Reset the instrument
*RST

//Set the frequency span.
SENS:FREQ:STAR 10HZ
SENS:FREQ:STOP 1MHZ

//-----Configuring the interface -----

//Set the generator type to SMU04 with a frequency range of 100 kHz to 4GHz
SYST:COMM:RDEV:GEN:TYPE 'SMU04'

//Set the interface used to the GPIB address 28
SYST:COMM:RDEV:GEN:INT GPIB
SYST:COMM:GPIB:RDEV:GEN:ADDR 28

//Activate the use of TTL synchronization to optimize measurement speed
SYST:COMM:RDEV:GEN:LINK TTL

//Activate the use of the external reference frequency at 10 MHz on the generator
SOUR:EXT:ROSC EXT

//-----Configuring the calibration measurement -----

//Activate external generator control.
SOUR:EXT:STAT ON
//Set the generator output level to -10 dBm.
SOUR:EXT:POW -10DBM
//Set the frequency coupling to automatic
SOUR:EXT:FREQ:COUP:STAT ON

//-----Configuring the generator frequency range -----

//Define a series of frequencies (one for each sweep point) based on the current
//frequency at the RF input of the analyzer; the generator frequency is half the
//frequency of the analyzer, with an offset of 100 kHz;
// analyzer start:          10 Hz
// analyzer stop:           1 MHz
// analyzer span:           999.99 KHz
// generator frequency start: 100.005 KHz
// generator frequency stop: 600 KHz
// generator span:          499.995 KHz

SOUR:EXT:FREQ:FACT:NUM 1
```

```

SOUR:EXT:FREQ:FACT:DEN 2
SOUR:EXT:FREQ:OFFS 100KHZ

//-----Performing the calibration measurement -----

//Perform a transmission measurement with direct connection between the generator
//and the analyzer and wait till the end
SENS:CORR:METH TRAN
SENS:CORR:COLL:ACQ THR; *WAI

//-----Retrieving the calibration trace results -----

//Retrieve the measured frequencies (10 Hz - 600 kHz)
TRAC:DATA:X? TRACE1

//Retrieve the measured power levels; = 0 between 10 Hz and 100 kHz (below
//generator minimum frequency); nominal -5dBm as of 100 kHz;
TRAC:DATA? TRACE1

//-----Normalizing the calibration trace results -----

//Retrieve the normalized power levels (= power offsets from calibration results)
//Should be 0 for all sweep points directly after calibration
SENS:CORR:STAT ON
TRAC:DATA? TRACE1

//-----Changing the display of the calibration results -----
//Shift the reference line so the -5 dB level is displayed in the center
DISP:TRAC:Y:SCAL:RVAL -5DB
DISP:TRAC:Y:SCAL:RPOS 50PCT

```

11.4.3 Configuring the Output



Configuring trigger input/output is described in [chapter 11.4.7.2, "Configuring the Trigger Output"](#), on page 253.

DIAGnostic:SERVice:NSource	229
OUTPut:ADEMod[:ONLine][:STATE]	230
OUTPut:ADEMod[:ONLine]:SOURce	230
OUTPut:ADEMod[:ONLine]:AF[:CFrequency]	230
OUTPut:ADEMod[:ONLine]:PHONes	231

DIAGnostic:SERVice:NSource <State>

This command turns the 28 V supply of the BNC connector labeled NOISE SOURCE CONTROL on the front panel on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: DIAG:SERV:NSO ON

Manual operation: See "[Noise Source](#)" on page 122

OUTPut:ADEMod[:ONLine][:STATe] <State>

This command enables or disables online demodulation output to the IF/VIDEO/DEMODO output connector on the rear panel of the R&S FSW.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: OUTP:ADEM ON

Manual operation: See "[Online Demodulation Output State](#)" on page 124

OUTPut:ADEMod[:ONLine]:SOURce <WindowName>

This command selects the result display whose results are output. Only active time domain results can be selected.

Parameters:

<WindowName> **<string>**
 String containing the name of the window.
 By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the [LAYout:CATalog\[:WINDow\]? query](#).

FOCUS

Dynamically switches to the currently selected window. If a window is selected that does not contain a time-domain result display, the selection is ignored and the previous setting is maintained.

Example: OUTP:ADEM:ONL:SOUR 'AnalogDemod'
 OR:
 DISP:WIND1:SEL
 OUTP:ADEM:SOUR FOC

Manual operation: See "[Output Selection](#)" on page 124

OUTPut:ADEMod[:ONLine]:AF[:CFRequency] <Frequency>

This command defines the cutoff frequency for the AC highpass filter (for AC coupling only, see [\[SENSe:\]ADEMod<n>:AF:COUpling](#) on page 255).

Parameters:

<Frequency> numeric value
 Range: 10 Hz to DemodBW/10 (= 300 kHz for active demodulation output)
 *RST: 100 Hz

Example: OUTP:ADEM:ONL:AF:CFR 100Hz

Manual operation: See "[AC Cutoff Frequency](#)" on page 125

OUTPut:ADEMod[:ONLine]:PHONes <State>

In addition to sending the output to the IF/VIDEO/DEMODO output connector (on the rear panel of the R&S FSW), it can also be output to headphones connected on the front panel (PHONES connector).

CAUTION: To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.

If you do not hear output on the connected headphones despite having enabled both general online demod output [OUTPut:ADEMod\[:ONLine\]\[:STATE\]](#) on page 230 and this command, adjust the volume setting using the rotary knob on the front panel.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: OUTP:ADEM:PHON ON

Manual operation: See "[Phones Output](#)" on page 125

11.4.4 Frequency Settings

[SENSe:]FREQuency:CENTer	231
[SENSe:]FREQuency:CENTer:STEP	232
[SENSe:]FREQuency:CENTer:STEP:LINK	232
[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor	233

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency.

Parameters:

<Frequency>

The allowed range and f_{\max} is specified in the data sheet.**UP**

Increases the center frequency by the step defined using the

`[SENSe:]FREQuency:CENTer:STEP` command.**DOWN**

Decreases the center frequency by the step defined using the

`[SENSe:]FREQuency:CENTer:STEP` command.***RST:** $f_{\max}/2$

Default unit: Hz

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

Sets the center frequency to 110 MHz.

Usage:

SCPI confirmed

Manual operation:See "[Center Frequency](#)" on page 72See "[Center frequency](#)" on page 93**[SENSe:]FREQuency:CENTer:STEP <StepSize>**

This command defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the `SENS:FREQ UP` AND `SENS:FREQ DOWN` commands, see `[SENSe:]FREQuency:CENTer` on page 231.

Parameters:

<StepSize>

 f_{\max} is specified in the data sheet.**Range:** 1 to f_{\max} ***RST:** 0.1 x span

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 Stepsize](#)" on page 93**[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>**

This command couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

<CouplingType>

SPAN

Couples the step size to the span. Available for measurements in the frequency domain.
(for RF spectrum result display)

RBW

Couples the step size to the resolution bandwidth. Available for measurements in the time domain.
(for all result displays except RF spectrum)

OFF

Decouples the step size.

*RST: SPAN

Example:

FREQ:CENT:STEP:LINK SPAN

Manual operation: See "[Center Frequency Stepsize](#)" on page 93

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

This command defines a step size factor if the center frequency step size is coupled to the span or the resolution bandwidth.

Parameters:

<Factor>

1 to 100 PCT

*RST: 10

Example:

FREQ:CENT:STEP:LINK:FACT 20PCT

Manual operation: See "[Center Frequency Stepsize](#)" on page 93

11.4.5 Configuring the Vertical Axis (Amplitude, Scaling)

The following commands are required to configure the amplitude and vertical axis settings in a remote environment.

- [Amplitude Settings](#)..... 233
- [Configuring the Attenuation](#)..... 235
- [Configuring a Preamplifier](#)..... 237
- [Scaling the Y-Axis](#)..... 238

11.4.5.1 Amplitude Settings

Useful commands for amplitude configuration described elsewhere:

- [\[SENSe:\]ADJust:LEVel](#) on page 269

Remote commands exclusive to amplitude configuration:

CALCulate<n>:MARKer<m>:FUNction:REFerence	234
CALCulate<n>:UNIT:POWer	234
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel	234
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet	235

CALCulate<n>:MARKer<m>:FUNction:REFerence

This command matches the reference level to the power level of a marker.

If you use the command in combination with a delta marker, that delta marker is turned into a normal marker.

Example: `CALC:MARK2:FUNC:REF`
Sets the reference level to the level of marker 2.

Usage: Event

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit of the y-axis.

The unit applies to all measurement windows.

Parameters:

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

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

Manual operation: See "Unit" on page 87

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level.

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Parameters:

<ReferenceLevel> The unit is variable.
Range: see datasheet
*RST: 0 dBm

Example: `DISP:TRAC:Y:RLEV -60dBm`

Usage: SCPI confirmed

Manual operation: See "Reference Level" on page 86

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet <Offset>

This command defines a reference level offset.

Parameters:

<Offset> Range: -200 dB to 200 dB
 *RST: 0dB

Example: DISP:TRAC:Y:RLEV:OFFS -10dB

Manual operation: See "[Shifting the Display \(Offset\)](#)" on page 87

11.4.5.2 Configuring the Attenuation

INPut:ATTenuation.....	235
INPut:ATTenuation:AUTO.....	235
INPut:EATT.....	236
INPut:EATT:AUTO.....	236
INPut:EATT:STATe.....	237

INPut:ATTenuation <Attenuation>

This command defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see [INPut:EATT:STATe](#) on page 237).

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.

This function is not available if the Digital Baseband Interface (R&S FSW-B17) is active.

Parameters:

<Attenuation> Range: see data sheet
 Increment: 5 dB
 *RST: 10 dB (AUTO is set to ON)

Example: INP:ATT 30dB
 Defines a 30 dB attenuation and decouples the attenuation from the reference level.

Usage: SCPI confirmed

Manual operation: See "[Attenuation Mode / Value](#)" on page 88

INPut:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FSW determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

This function is not available if the Digital Baseband Interface (R&S FSW-B17) is active.

Parameters:

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

Example:

INP:ATT:AUTO ON
Couples the attenuation to the reference level.

Usage:

SCPI confirmed

Manual operation: See "[Attenuation Mode / Value](#)" on page 88

INPut:EATT <Attenuation>

This command defines an electronic attenuation manually. Automatic mode must be switched off (INP:EATT:AUTO OFF, see [INPut:EATT:AUTO](#) on page 236).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This command is only available with option R&S FSW-B25.

It is not available if R&S FSW-B17 is active.

Parameters:

<Attenuation> attenuation in dB
Range: see data sheet
Increment: 1 dB
*RST: 0 dB (OFF)

Example:

INP:EATT:AUTO OFF
INP:EATT 10 dB

Manual operation: See "[Using Electronic Attenuation \(Option B25\)](#)" on page 88

INPut:EATT:AUTO <State>

This command turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

This command is only available with option R&S FSW-B25.

It is not available if R&S FSW-B17 is active.

Parameters:

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

Example:

INP:EATT:AUTO OFF

Manual operation: See "[Using Electronic Attenuation \(Option B25\)](#)" on page 88

INPut:EATT:STATe <State>

This command turns the electronic attenuator on and off.

This command is only available with option R&S FSW-B25.

It is not available if R&S FSW-B17 is active.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

INP:EATT:STAT ON
Switches the electronic attenuator into the signal path.

Manual operation: See ["Using Electronic Attenuation \(Option B25\)"](#) on page 88

11.4.5.3 Configuring a Preamplicifier

INPut:GAIN:STATe.....	237
INPut:GAIN[:VALue].....	237

INPut:GAIN:STATe <State>

This command turns the preamplifier on and off.

The command requires option R&S FSW-B24.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

For R&S FSW 26 or higher models, the input signal is amplified by 30 dB if the preamplifier is activated.

For R&S FSW 8 or 13 models, the preamplification is defined by `INPut:GAIN[:VALue]`.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

INP:GAIN:STAT ON
Switches on 30 dB preamplification.

Usage: SCPI confirmed

Manual operation: See ["Preamplicifier \(option B24\)"](#) on page 89

INPut:GAIN[:VALue] <Gain>

This command selects the preamplification level if the preamplifier is activated (`INP:GAIN:STAT ON`, see [INPut:GAIN:STATe](#) on page 237).

The command requires option R&S FSW-B24.

Parameters:

<Gain> 15 dB | 30 dB
 The availability of preamplification levels depends on the R&S FSW model.
 R&S FSW8/13: 15dB and 30 dB
 R&S FSW26 or higher: 30 dB
 All other values are rounded to the nearest of these two.
 *RST: OFF

Example:

INP:GAIN:VAL 30
 Switches on 30 dB preamplification.

Usage:

SCPI confirmed

Manual operation: See "Preamplifier (option B24)" on page 89

11.4.5.4 Scaling the Y-Axis

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe].....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE.....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MODE.....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RPOsition.....	239
DISPlay[:WINDow<n>]:TRACe:Y:SPACing.....	239

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe] <Range>

This command defines the display range of the y-axis.

Parameters:

<Range> If the y-axis shows the power, the unit is dB with a range from 10 dB to 200 dB.
 If the y-axis shows the frequency, the unit is Hz with a variable range.
 *RST: 100 dB (frequency domain), 500 kHz (time domain)

Example:

DISP:TRAC:Y 110dB

Usage:

SCPI confirmed

Manual operation: See "Range" on page 120

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again.

Usage:

SCPI confirmed

Manual operation: See "Auto Scale Once" on page 120

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MODE <Mode>

This command selects the type of scaling of the y-axis.

When the display update during remote control is off, this command has no immediate effect.

Parameters:

<Mode>

ABSolute
absolute scaling of the y-axis

RELative
relative scaling of the y-axis

*RST: ABSolute

Example: DISP:TRAC:Y:MODE REL

Manual operation: See "Scaling" on page 120

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RPOSition <Position>

This command defines the vertical position of the reference level on the display grid.

The R&S FSW adjusts the scaling of the y-axis accordingly.

For measurements with the external generator (R&S FSW-B10) the command defines the position of the reference value.

Parameters:

<Position>

*RST: 100 PCT = AF spectrum display; 50 PCT = time display

Example: DISP:TRAC:Y:RPOS 50PCT

Usage: SCPI confirmed

Manual operation: See "Reference Position" on page 80
See "Reference Value Position" on page 118
See "Ref Level Position" on page 120

DISPlay[:WINDow<n>]:TRACe:Y:SPACing <ScalingType>

This command selects the scaling of the y-axis.

For AF spectrum displays, only the parameters "LINear" and "LOGarithmic" are permitted.

Parameters:

<ScalingType>

LOGarithmic
Logarithmic scaling.

LINear
Linear scaling in %.

LDB
Linear scaling in the specified unit.

PERCent
Linear scaling in %.

*RST: LOGarithmic

Example:	DISP:TRAC:Y:SPAC LIN Selects linear scaling in %.
Usage:	SCPI confirmed
Manual operation:	See " Deviation " on page 119 See " Scaling " on page 120

11.4.6 Configuring Data Acquisition

The following remote commands are required to configure which data is to be acquired and then demodulated in a remote environment.



MSRA/MSRT operating mode

In MSRA/MSRT operating mode, only the MSRA/MSRT Master channel actually captures data from the input signal. The data acquisition commands for the Analog Demodulation application in MSRA/MSRT mode define the analysis interval.

For details on the MSRA operating mode see the R&S FSW MSRA User Manual. For details on the MSRT operating mode see the R&S FSW Realtime Spectrum Application and MSRT Operating Mode User Manual.

[SENSe:]ADEMod:MTIME.....	240
[SENSe:]ADEMod:RLENgth?.....	240
[SENSe:]ADEMod:SET.....	241
[SENSe:]ADEMod:SPECtrum:BANDwidth BWIDth[:RESolution].....	242
[SENSe:]ADEMod:SRATE?.....	242
[SENSe:]BANDwidth BWIDth:DEMod.....	242
[SENSe:]BANDwidth BWIDth:DEMod:TYPE.....	243
[SENSe:]BANDwidth BWIDth[:RESolution].....	243
[SENSe:]SWEep:COUNT.....	243
[SENSe:]SWEep:POINts.....	244

[SENSe:]ADEMod:MTIME <Time>

This command defines the measurement time for analog demodulation.

Parameters:

<Time> *RST: 62.5us

Example:

ADEMod:MTIM 62.5us

Sets the measurement time to 62.5 μs.

Manual operation: See "[Measurement Time \(AQT\)](#)" on page 103

[SENSe:]ADEMod:RLENgth?

This command returns the record length set up for the current analog demodulation measurement.

Example: ADEM:RLEN?
Returns the current record length.

Usage: Query only

[SENSe:]ADEMod:SET <SampleRate> | <RecordLength> | <TriggerSource> |
<TriggerSlope> | <OffsetSamples> | <NoOfMeas>

This command configures the analog demodulator of the instrument.

Parameters:

<SampleRate>	<p>numeric value</p> <p>The frequency at which measurement values are taken from the A/D-converter and stored in I/Q memory. Allowed range: refer to chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset", on page 29.</p> <p>*RST: 8 MHz</p>
<RecordLength>	<p>Number of samples to be stored in I/Q memory.</p> <p>Range: 1 to 400001 with AF filter or AF trigger active, 1 to 480001 with both AF filter and AF trigger deactive</p> <p>*RST: 501)</p>
<TriggerSource>	<p>Selection of the trigger source to use for the demodulator. For details on trigger sources see "Trigger Source" on page 95.</p> <p>IMMediate EXTernal EXT2 EXT3 IFPower RFPower AF AM AMRelative FM PM</p> <p>Note: After selecting IF Power, the trigger threshold can be set with the <code>TRIGger[:SEquence]:LEVel:IFPower</code> command.</p> <p>*RST: IMMediate</p>
<TriggerSlope>	<p>POSitive NEGative</p> <p>Used slope of the trigger signal. The value indicated here will be ignored for <trigger source> = IMMediate.</p> <p>*RST: POSitive</p>
<OffsetSamples>	<p>Number of samples to be used as an offset to the trigger signal. For details refer to chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset", on page 29. The value indicated here is ignored for <trigger source> = "IMMediate".</p> <p>*RST: 0</p>
<NoOfMeas>	<p>Number of repetitions of the measurement to be executed. The value indicated here is especially necessary for the average/maxhold/minhold function.</p> <p>Range: 0 to 32767</p> <p>*RST: 0</p>

Example: `ADEM:SET 8MHz,32000,EXT,POS,-500,30`
 Performs a measurement at:
 sample rate = 8 MHz
 record length = 32000
 trigger source = EXTERNAL
 trigger slope = POSitive
 offset samples = -500 (500 samples before trigger occurred)
 # of meas = 30

[SENSe:]ADEMod:SPECTrum:BANDwidth|BWIDth[:RESolution] <Bandwidth>

Defines the resolution bandwidth for data acquisition.

From the specified RBW and the demodulation span set by `[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum]` on page 260 or `[SENSe:]BANDwidth|BWIDth:DEMod` on page 242, the required measurement time is calculated. If the available measurement time is not sufficient for the given bandwidth, the measurement time is set to its maximum and the resolution bandwidth is increased to the resulting bandwidth.

This command is identical to `SENS:BAND:RES`, see the R&S FSW User Manual.

Parameters:

<Bandwidth> refer to data sheet
 *RST: 61.2 kHz

Example: `ADEM:SPEC:BAND 61.2kHz`
 Sets the resolution bandwidth to 61.2 kHz.

[SENSe:]ADEMod:SRATe?

This command returns the sample rate set up for the current analog demodulation measurement.

Example: `ADEM:SRAT?`
 Returns the current sample rate.

Usage: Query only

[SENSe:]BANDwidth|BWIDth:DEMod <Bandwidth>

This command sets the bandwidth for analog demodulation. Depending on the selected demodulation bandwidth, the instrument selects the required sampling rate.

For details on the correlation between demodulation bandwidth and sampling rate refer to [chapter 4.3, "Sample Rate, Measurement Time and Trigger Offset"](#), on page 29.

This command is identical to `SENS:ADEM:BAND:DEM`.

Parameters:

<Bandwidth> *RST: 5 MHz

Example: `BAND:DEM 1MHz`
Sets demodulation bandwidth to 1 MHz

Manual operation: See "[Demodulation Bandwidth](#)" on page 102

[SENSe:]BANDwidth|BWIDth:DEMod:TYPE <FilterType>

This command defines the type of demodulation filter to be used.

This command is identical to `SENS:ADEM:BAND:DEM:TYPE:`

Parameters:

<FilterType> **FLAT**
Standard flat demodulation filter

GAUSs
Gaussian filter for optimized settling behaviour

*RST: FLAT

Manual operation: See "[Demodulation Filter](#)" on page 102

[SENSe:]BANDwidth|BWIDth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth and decouples the resolution bandwidth from the span.

For statistics measurements, this command defines the **demodulation** bandwidth.

For measurements on I/Q data in the frequency domain, the maximum RBW is 1 MHz.

Parameters:

<Bandwidth> refer to data sheet

*RST: RBW: AUTO is set to ON; DBW: 3MHz

Example: `BAND 1 MHz`
Sets the resolution bandwidth to 1 MHz

Usage: SCPI confirmed

Manual operation: See "[Resolution Bandwidth](#)" on page 103

[SENSe:]SWEep:COUNT <SweepCount>

This command defines the number of sweeps that the application uses to average traces.

In case of continuous sweeps, the application calculates the moving average over the average count.

In case of single sweeps, the application stops the measurement and calculates the average after the average count has been reached.

Parameters:

<SweepCount>

When you set a sweep count of 0 or 1, the R&S FSW performs one single sweep in single sweep mode.

In continuous sweep mode, if the sweep count is set to 0, a moving average over 10 sweeps is performed.

Range: 0 to 200000

*RST: 0

Example:

SWE:COUN 64

Sets the number of sweeps to 64.

INIT:CONT OFF

Switches to single sweep mode.

INIT;*WAI

Starts a sweep and waits for its end.

Usage:

SCPI confirmed

Manual operation: See "[Sweep/Average Count](#)" on page 106**[SENSe:]SWEep:POINts** <SweepPoints>

This command defines the number of measurement points analyzed during a sweep.

Parameters:

<SweepPoints>

Range: 101 to 100001

*RST: 1001

Example:

SWE:POIN 251

Usage:

SCPI confirmed

Manual operation: See "[Sweep Points](#)" on page 106

11.4.7 Triggering

The following remote commands are required to configure a triggered measurement in a remote environment. More details are described for manual operation in [chapter 5.5, "Trigger Configuration"](#), on page 94.



*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.

- [Configuring the Triggering Conditions](#).....245
- [Configuring the Trigger Output](#).....253

11.4.7.1 Configuring the Triggering Conditions

TRIGger[:SEquence]:BBPower:HOLDoff.....	245
TRIGger[:SEquence]:DTIME.....	245
TRIGger[:SEquence]:HOLDoff[:TIME].....	246
TRIGger[:SEquence]:IFPower:HOLDoff.....	246
TRIGger[:SEquence]:IFPower:HYSteresis.....	246
TRIGger[:SEquence]:LEVel:BBPower.....	247
TRIGger[:SEquence]:LEVel[:EXternal<port>].....	247
TRIGger[:SEquence]:LEVel:IFPower.....	247
TRIGger[:SEquence]:LEVel:IQPower.....	248
TRIGger[:SEquence]:LEVel:RFPower.....	248
TRIGger[:SEquence]:LEVel:AM:RELative.....	248
TRIGger[:SEquence]:LEVel:AM[:ABSolute].....	249
TRIGger[:SEquence]:LEVel:FM.....	249
TRIGger[:SEquence]:LEVel:PM.....	249
TRIGger[:SEquence]:SLOPe.....	250
TRIGger[:SEquence]:SOURce.....	250
TRIGger[:SEquence]:TIME:RINTerval.....	252

TRIGger[:SEquence]:BBPower:HOLDoff <Period>

This command defines the holding time before the baseband power trigger event.

The command requires the **Digital Baseband Interface (R&S FSW-B17)** or the **Analog Baseband Interface (R&S FSW-B71)**.

Note that this command is maintained for compatibility reasons only. Use the [TRIGger\[:SEquence\]:IFPower:HOLDoff](#) on page 246 command for new remote control programs.

Parameters:

<Period>	Range:	150 ns to 1000 s
	*RST:	150 ns

Example:

```
TRIG:SOUR BBP
Sets the baseband power trigger source.
TRIG:BBP:HOLD 200 ns
Sets the holding time to 200 ns.
```

TRIGger[:SEquence]:DTIME <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

For input from the Analog Baseband Interface (R&S FSW-B71) using the baseband power trigger (BBP), the default drop out time is set to 100 ns to avoid unintentional trigger events (as no hysteresis can be configured in this case).

Parameters:

<DropoutTime> Dropout time of the trigger.
 Range: 0 s to 10.0 s
 *RST: 0 s

Manual operation: See "[Drop-Out Time](#)" on page 99

TRIGger[:SEquence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the sweep (data capturing).

Parameters:

<Offset> *RST: 0 s

Example: TRIG:HOLD 500us

Manual operation: See "[Trigger Offset](#)" on page 99

TRIGger[:SEquence]:IFPower:HOLDoff <Period>

This command 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).

Note: If you perform gated measurements in combination with the IF Power trigger, the R&S FSW ignores the holding time for frequency sweep, FFT sweep, zero span and I/Q data measurements.

Parameters:

<Period> Range: 0 s to 10 s
 *RST: 0 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 99

TRIGger[:SEquence]:IFPower:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

Parameters:

<Hysteresis> Range: 3 dB to 50 dB
 *RST: 3 dB

Example:

```
TRIG:SOUR IFP
Sets the IF power trigger source.
TRIG:IFP:HYST 10DB
Sets the hysteresis limit value.
```

Manual operation: See "[Hysteresis](#)" on page 99

TRIGger[:SEquence]:LEVel:BBPower <Level>

This command sets the level of the baseband power trigger.

This command is available for the **Digital Baseband Interface (R&S FSW-B17)** and the **Analog Baseband Interface (R&S FSW-B71)**.

Parameters:

<Level> Range: -50 dBm to +20 dBm
 *RST: -20 dBm

Example: TRIG:LEV:BB -30DBM

TRIGger[:SEquence]:LEVel[:EXternal<port>] <TriggerLevel>

This command defines the level the external signal must exceed to cause a trigger event.

Note that the variable INPUT/OUTPUT connectors (ports 2+3) must be set for use as input using the [OUTPut:TRIGger<port>:DIRection](#) command.

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

Example: TRIG:LEV 2V

Manual operation: See "[Trigger Level](#)" on page 98

TRIGger[:SEquence]:LEVel:IFPower <TriggerLevel>

This command defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

For compatibility reasons, this command is also available for the "baseband power" trigger source when using the Analog Baseband Interface (R&S FSW-B71).

Parameters:

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

*RST: -10 dBm

Example:

TRIG:LEV:IFP -30DBM

Manual operation: See "[Trigger Level](#)" on page 98

TRIGger[:SEquence]:LEVel:IQPower <TriggerLevel>

This command 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.

Parameters:

<TriggerLevel> Range: -130 dBm to 30 dBm

*RST: -20 dBm

Example:

TRIG:LEV:IQP -30DBM

Manual operation: See "[Trigger Level](#)" on page 98

TRIGger[:SEquence]:LEVel:RFPower <TriggerLevel>

This command 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

Example:

TRIG:LEV:RFP -30dBm

Manual operation: See "[Trigger Level](#)" on page 98

TRIGger[:SEquence]:LEVel:AM:RELative <Level>

The command sets the level when AM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -100 to +100

*RST: 0 %

Default unit: %

Example:

TRIG:LEV:AM:REL -20 %

Sets the AM trigger threshold to -20 %

Manual operation: See ["Trigger Level"](#) on page 98

TRIGger[:SEQuence]:LEVel:AM[:ABSolute] <Level>

The command sets the level when RF power signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -100 to +30
 *RST: -20 dBm
 Default unit: dBm

Example: TRIG:LEV:AM -30 dBm
 Sets the RF power signal trigger threshold to -30 dBm

Manual operation: See ["Trigger Level"](#) on page 98

TRIGger[:SEQuence]:LEVel:FM <Level>

The command sets the level when FM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -10 to +10
 *RST: 0 Hz
 Default unit: MHz

Example: TRIG:LEV:FM 10 kHz
 Sets the FM trigger threshold to 10 kHz

Manual operation: See ["Trigger Level"](#) on page 98

TRIGger[:SEQuence]:LEVel:PM <Level>

The command sets the level when PM-modulated signals are used as trigger source.

For triggering to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameters:

<Level> Range: -1000 to +1000
 *RST: 0 RAD
 Default unit: RAD | DEG

Example: TRIG:LEV:PM 1.2 RAD
 Sets the PM trigger threshold to 1.2 rad

Manual operation: See ["Trigger Level"](#) on page 98

TRIGger[:SEQuence]:SLOPe <Type>

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.

For external and time domain trigger sources you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

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 99

TRIGger[:SEQuence]:SOURce <Source>

This command selects the trigger source.

For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal. For details on trigger sources see "[Trigger Source](#)" on page 95.

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 this situation is avoided in your remote control programs.

Parameters:

<Source>

IMMediate

Free Run

EXTernal

Trigger signal from the TRIGGER INPUT connector.

EXT2

Trigger signal from the TRIGGER INPUT/OUTPUT connector.

Note: Connector must be configured for "Input".

EXT3

Trigger signal from the TRIGGER 3 INPUT/ OUTPUT connector.

Note: Connector must be configured for "Input".

RFPower

First intermediate frequency

Not available for input from the Digital Baseband Interface (R&S FSW-B17) or the Analog Baseband Interface (R&S FSW-B71).

IFPower

Second intermediate frequency

Not available for input from the Digital Baseband Interface (R&S FSW-B17). For input from the Analog Baseband Interface (R&S FSW-B71), this parameter is interpreted as **BBPower** for compatibility reasons.**IQPower**

Magnitude of sampled I/Q data

For applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Not available for input from the Digital Baseband Interface (R&S FSW-B17) or the Analog Baseband Interface (R&S FSW-B71).

TIME

Time interval

BBPower

Baseband power (for digital input via the Digital Baseband Interface R&S FSW-B17)

Baseband power (for digital input via the Digital Baseband Interface R&S FSW-B17 or the Analog Baseband interface R&S FSW-B71)

PSEN

External power sensor

AF

AF power signal

FM

FM power signal

AM

corresponds to the RF power signal

AMRelative

corresponds to the AM signal

PM

PM power signal

GP0 | GP1 | GP2 | GP3 | GP4 | GP5

For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the Digital Baseband Interface (R&S FSW-B17) is available.

Defines triggering of the measurement directly via the LVDS connector. The parameter specifies which general purpose bit (0 to 5) will provide the trigger data.

The assignment of the general purpose bits used by the Digital IQ trigger to the LVDS connector pins is provided in ["Digital I/Q"](#) on page 97.

*RST: IMMEDIATE

Example:

```
TRIG:SOUR EXT
```

Selects the external trigger input as source of the trigger signal

Manual operation:

See ["Using the power sensor as an external trigger"](#) on page 84

See ["Trigger Source"](#) on page 95

See ["Free Run"](#) on page 95

See ["External Trigger 1/2/3"](#) on page 95

See ["I/Q Power"](#) on page 96

See ["IF Power"](#) on page 96

See ["Baseband Power"](#) on page 96

See ["Digital I/Q"](#) on page 97

See ["FM / AM / PM / RF \(Offline\)"](#) on page 97

See ["Time"](#) on page 97

See ["RF Power"](#) on page 98

See ["Power Sensor"](#) on page 98

TRIGger[:SEquence]:TIME:RINTerval <Interval>

This command defines the repetition interval for the time trigger.

Parameters:

<Interval> 2.0 ms to 5000
 Range: 2 ms to 5000 s
 *RST: 1.0 s

Example:

```
TRIG:SOUR TIME
```

Selects the time trigger input for triggering.

```
TRIG:TIME:RINT 50
```

The sweep starts every 50 s.

11.4.7.2 Configuring the Trigger Output

The following commands are required to send the trigger signal to one of the variable TRIGGER INPUT/OUTPUT connectors. The tasks for manual operation are described in "Trigger 2/3" on page 100.

OUTPut:TRIGger<port>:DIRection.....	253
OUTPut:TRIGger<port>:LEVel.....	253
OUTPut:TRIGger<port>:OTYPe.....	254
OUTPut:TRIGger<port>:PULSe:IMMEDIATE.....	254
OUTPut:TRIGger<port>:PULSe:LENGth.....	254

OUTPut:TRIGger<port>:DIRection <Direction>

This command selects the trigger direction.

Suffix:

<port> Selects the trigger port to which the output is sent.
 2 = trigger port 2 (front)
 3 = trigger port 3 (rear)

Parameters:

<Direction> **INPut**
 Port works as an input.

OUTPut
 Port works as an output.

*RST: INPut

Manual operation: See "Trigger 2/3" on page 100

OUTPut:TRIGger<port>:LEVel <Level>

This command defines the level of the signal generated at the trigger output.

This command works only if you have selected a user defined output with `OUTPut:TRIGger<port>:OTYPe`.

Suffix:

<port> Selects the trigger port to which the output is sent.
 2 = trigger port 2 (front)
 3 = trigger port 3 (rear)

Parameters:

<Level> **HIGH**
 TTL signal.

LOW
 0 V

*RST: LOW

Manual operation: See "Trigger 2/3" on page 100
 See "Level" on page 100

OUTPut:TRIGger<port>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

Note: For offline AF or RF triggers, no output signal is provided.

Suffix:

<port> Selects the trigger port to which the output is sent.
 2 = trigger port 2 (front)
 3 = trigger port 3 (rear)

Parameters:

<OutputType> **DEvice**
 Sends a trigger signal when the R&S FSW 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:TRIGger<port>:LEVel](#).

*RST: DEvice

Manual operation: See "[Output Type](#)" on page 100

OUTPut:TRIGger<port>:PULSe:IMMediate

This command generates a pulse at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.
 2 = trigger port 2 (front)
 3 = trigger port 3 (rear)

Usage: Event

Manual operation: See "[Send Trigger](#)" on page 101

OUTPut:TRIGger<port>:PULSe:LENGth <Length>

This command defines the length of the pulse generated at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.
 2 = trigger port 2 (front)
 3 = trigger port 3 (rear)

Parameters:

<Length> Pulse length in seconds.

Manual operation: See "[Pulse Length](#)" on page 101

11.4.8 Configuring Demodulation

The following remote commands are required to configure the demodulation parameters in a remote environment. The tasks for manual operation are described in [chapter 5.8, "Demodulation"](#), on page 106.

• Basic Demodulation Settings	255
• Time Domain Zoom Settings	256
• Configuring the Demodulation Spectrum	258
• (Post-processing) AF Filters	261
• Defining the Scaling and Units	265
• Scaling for AF Evaluation	265
• Scaling for RF Evaluation	266
• Units	266

11.4.8.1 Basic Demodulation Settings

The basic demodulation measurement parameters define how the measurement is performed.

Useful commands described elsewhere:

- [chapter 11.4.8.2, "Time Domain Zoom Settings"](#), on page 256

Basic demodulation commands:

[SENSe:]ADEMod<n>:AF:COUPling	255
[SENSe:]ADEMod:PM:RPOint[:X]	255
[SENSe:]ADEMod:SQUelch[:STATe]	256
[SENSe:]ADEMod:SQUelch:LEVel	256

[\[SENSe:\]ADEMod<n>:AF:COUPling](#) <Coupling>

This command selects the coupling of the AF path of the analyzer in the specified window.

Parameters:

<Coupling> AC | DC
*RST: AC (PM); DC (FM)

Example:

ADEM:AF:COUP DC
Switches on DC coupling.

Manual operation: See ["AF Coupling"](#) on page 108

[\[SENSe:\]ADEMod:PM:RPOint\[:X\]](#) <Time>

This command determines the position where the phase of the PM-demodulated signal is set to 0 rad. The maximum possible value depends on the measurement time selected in the instrument; this value is output in response to the query

ADEM:PM:RPO:X? MAX.

Parameters:

<Time> 0 s to measurement time
 *RST: 0 s

Example:

ADEM:PM:RPO 500us
 Sets the position where the phase to 0 rad setting to 500 µs.

Usage:

SCPI confirmed

Manual operation:

See "[Zero Phase Reference Position \(PM Time Domain only\)](#)" on page 110

[SENSe:]ADEMod:SQUelch[:STATe] <State>

This command activates the squelch function, i.e. if the signal falls below a defined threshold (see [\[SENSe:\]ADEMod:SQUelch:LEVel](#) on page 256), the demodulated data is automatically set to 0.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

DEM:SQU ON
 Signals below the level threshold are squelched.

Manual operation:

See "[Squelch State](#)" on page 108

[SENSe:]ADEMod:SQUelch:LEVel <Threshold>

This command defines the level threshold below which the demodulated data is set to 0 if squelching is enabled (see [\[SENSe:\]ADEMod:SQUelch\[:STATe\]](#) on page 256).

Parameters:

<Threshold> numeric value
 The absolute threshold level
 Range: -150 dBm to 30 dBm
 *RST: -40 dBm

Example:

DEM:SQU:LEV -80
 If the signal drops below -80 dBm, the demodulated data is set to 0.

Manual operation:

See "[Squelch Level](#)" on page 108

11.4.8.2 Time Domain Zoom Settings

Using the time domain zoom, the demodulated data for a particular time span is extracted and displayed in more detail.

Parameters:

<Time> Range: 0 s to (measurement time – zoom length)
 *RST: 0 s

Example:

ADEM:ZOOM:STAT ON
 Switches on the zoom function
 ADEM:ZOOM:STAR 500us
 Sets the starting point of the display to 500 µs.

Manual operation: See "Start" on page 109

[SENSe:]ADEMod<n>:ZOOM[:STATe] <State>

The command enables or disables the time domain zoom function for the analog-demodulated measurement data in the specified window.

If the zoom function is enabled, the defined number of sweep points are displayed from the start time specified with [SENSe:]ADEMod<n>:ZOOM:STARt on page 257.

If the zoom function is disabled, data reduction is used to adapt the measurement points to the number of points available on the display.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

ADEM:ZOOM ON
 Switches on the zoom function

Manual operation: See "State" on page 109

11.4.8.3 Configuring the Demodulation Spectrum

The demodulation spectrum defines which span of the demodulated data is evaluated.

- AF evaluation..... 258
- RF evaluation..... 260

AF evaluation

These settings are only available for AF Spectrum evaluations, not in the time domain.

[SENSe:]ADEMod:AF:CENTer..... 258
 [SENSe:]ADEMod:AF:SPAN..... 259
 [SENSe:]ADEMod:AF:SPAN:FULL..... 259
 [SENSe:]ADEMod:AF:STARt..... 259
 [SENSe:]ADEMod:AF:STOP..... 259

[SENSe:]ADEMod:AF:CENTer <Frequency>

This command sets the center frequency for AF spectrum result display.

Parameters:

<Frequency> *RST: 1.25 MHz

Manual operation: See "AF Center" on page 111

**[SENSe:]ADEMod:AF:SPAN **

This command sets the span (around the center frequency) for AF spectrum result display.

The span is limited to DBW/2 (see [SENSe:]BANDwidth|BWIDth:DEMod on page 242).

Parameters:

 *RST: 9 MHz

Example: ADEMod:AF:SPAN 200 kHz
Sets the AF span to 200 kHz

Manual operation: See "AF Span" on page 111

[SENSe:]ADEMod:AF:SPAN:FULL

This command sets the maximum span for AF spectrum result display.

The maximum span corresponds to DBW/2 (see [SENSe:]BANDwidth|BWIDth:DEMod on page 242).

Example: ADEMod:BAND 5 MHz
Sets the demodulation bandwidth to 5 MHz
ADEMod:AF:SPAN:FULL
Sets the AF span to 2.5 MHz

Manual operation: See "AF Full Span" on page 112

[SENSe:]ADEMod:AF:START <Frequency>

This command sets the start frequency for AF spectrum result display.

Parameters:

<Frequency> *RST: 0 MHz

Example: ADEMod:AF:STAR 0 kHz
Sets the AF start frequency to 0 kHz
ADEMod:AF:STOP 500 kHz
Sets the AF stop frequency to 500 kHz

Manual operation: See "AF Start" on page 111

[SENSe:]ADEMod:AF:STOP <Frequency>

This command sets the stop frequency for AF spectrum result display.

Parameters:

<Frequency> *RST: 9 MHz

Example: ADEM:AF:STAR 0 kHz
 Sets the AF start frequency to 0 kHz
 ADEM:AF:STOP 500 kHz
 Sets the AF stop frequency to 500 kHz

Manual operation: See "AF Stop" on page 111

RF evaluation

These settings are only available for RF evaluation, both in time and frequency domain.

Useful commands described elsewhere

- [SENSe:]FREQUENCY:CENTer on page 231
- [SENSe:]BANDwidth|BWIDth:DEMod on page 242

Specific commands:

[SENSe:]ADEMod:SPEC:SPAN:ZOOM.....	260
[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum].....	260

[SENSe:]ADEMod:SPEC:SPAN:ZOOM

This command sets the span (around the center frequency) for RF spectrum result display.

The span is limited to the demodulation bandwidth (see [SENSe:]BANDwidth|BWIDth:DEMod on page 242).

Parameters:

 *RST: 5 MHz

Example: ADEM:SPEC:SPAN:ZOOM 200 kHz
 Sets the rF span to 200 kHz

Manual operation: See "Span" on page 112

[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum] <FreqRange>

Sets the DBW to the specified value and the span (around the center frequency) of the RF data to be evaluated to its new maximum (the demodulation bandwidth).

Parameters:

<FreqRange> *RST: 5 MHz
 Default unit: Hz

Manual operation: See "Span" on page 112
 See "RF Full Span" on page 113

11.4.8.4 (Post-processing) AF Filters

The AF filter reduces the evaluated bandwidth of the demodulated signal and can define a weighting function. AF filters are only available for AM or FM time domain evaluations.

[SENSe:]FILTer<n>:AWEighted[:STATe].....	261
[SENSe:]FILTer<n>:AOFF.....	261
[SENSe:]FILTer<n>:CCIR:WEIGhted[:STATe].....	261
[SENSe:]FILTer<n>:CCIR:[UNWeighted][:STATe].....	262
[SENSe:]FILTer<n>:CCIT.....	262
[SENSe:]FILTer<n>:DEMPHasis:TCONstant.....	262
[SENSe:]FILTer<n>:DEMPHasis[:STATe].....	263
[SENSe:]FILTer<n>:HPASs:FREQUency[:ABSolute].....	263
[SENSe:]FILTer<n>:HPASs:FREQUency:MANual.....	263
[SENSe:]FILTer<n>:HPASs[:STATe].....	264
[SENSe:]FILTer<n>:LPASs:FREQUency[:ABSolute].....	264
[SENSe:]FILTer<n>:LPASs:FREQUency:MANual.....	264
[SENSe:]FILTer<n>:LPASs:FREQUency:RELative.....	264
[SENSe:]FILTer<n>:LPASs[:STATe].....	265

[SENSe:]FILTer<n>:AWEighted[:STATe] <State>

This command activates/deactivates the "A" weighting filter for the specified evaluation.

For details on weighting filters see ["Weighting"](#) on page 115.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

FILT:AWE ON
 Activates the A weighting filter.

Manual operation: See ["Weighting"](#) on page 115

[SENSe:]FILTer<n>:AOFF

This command switches all AF filters for the selected evaluation off.

Usage: Setting only

Manual operation: See ["Deactivating all AF Filters"](#) on page 116

[SENSe:]FILTer<n>:CCIR:WEIGhted[:STATe] <State>

This command activates/deactivates the weighted CCIR filter for the specified evaluation.

For details on weighting filters see ["Weighting"](#) on page 115.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

FILT:CCIR:WEIG ON
 Activates the weighted CCIR filter.

Manual operation: See "[Weighting](#)" on page 115

[SENSe:]FILTer<n>:CCIR[:UNWeighted][:STATe] <State>

This command activates/deactivates the unweighted CCIR filter in the specified window.

For details on weighting filters see "[Weighting](#)" on page 115.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

FILT:CCIR:UNW ON
 Activates the unweighted CCIR filter.

Manual operation: See "[Weighting](#)" on page 115

[SENSe:]FILTer<n>:CCIT <State>

This command activates/deactivates the CCITT (CCITT P.53) weighting filter for the specified evaluation.

For details on weighting filters see "[Weighting](#)" on page 115.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

FILT:CCIT ON
 Activates the CCITT weighting filter.

Manual operation: See "[Weighting](#)" on page 115

[SENSe:]FILTer<n>:DEMPhasis:TCONstant

This command selects the deemphasis for the specified evaluation.

For details on deemphasis refer to "[Deemphasis](#)" on page 116.

Parameters:

25 us | 50 us | 75 us | 750 us
 *RST: 50 us

Example:

FILT:DEMP:TCON 750us
 Selects the deemphasis for the demodulation bandwidth range from 800 Hz to 4 MHz with a time constant of 750 μ s.

Manual operation: See ["Deemphasis"](#) on page 116

[SENSe:]FILTer<n>:DEMPHasis[:STATe] <State>

This command activates/deactivates the selected deemphasis for the specified evaluation.

For details about deemphasis refer to ["Deemphasis"](#) on page 116.

Parameters:

<State> ON | OFF
*RST: OFF

Example: `FILT:DEMP ON`
Activates the selected deemphasis.

Manual operation: See ["Deemphasis"](#) on page 116

[SENSe:]FILTer<n>:HPASs:FREQUency[:ABSolute] <FilterType>

This command selects the high pass filter type for the specified evaluation.

For details on the high pass filters refer to ["High Pass"](#) on page 114.

Parameters:

<FilterType> 20 Hz | 50 Hz | 300 Hz
*RST: 300Hz
Default unit: Hz

Example: `FILT:HPAS:FREQ 300Hz`
Selects the high pass filter for the demodulation bandwidth range from 800 Hz to 8 MHz.

Manual operation: See ["High Pass"](#) on page 114

[SENSe:]FILTer<n>:HPASs:FREQUency:MANual <Frequency>

This command selects the cutoff frequency of the high pass filter for the specified evaluation.

For details on the high pass filters refer to ["High Pass"](#) on page 114.

Parameters:

<Frequency> numeric value
Range: 0 to 3 MHz
*RST: 15kHz

Example: `FILT:HPAS:FREQ:MAN 3MHz`
The AF results are restricted to frequencies lower than 3 MHz.

Manual operation: See ["High Pass"](#) on page 114

[SENSe:]FILTer<n>:HPASs[:STATe] <State>

This command activates/deactivates the selected high pass filter for the specified evaluation.

For details on the high pass filter refer to ["High Pass"](#) on page 114.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

FILT:HPAS ON
Activates the selected high pass filter.

Manual operation: See ["High Pass"](#) on page 114

[SENSe:]FILTer<n>:LPASs:FREQuency[:ABSolute] <FilterType>

This command selects the absolute low pass filter type for the specified evaluation

For details on the low pass filter refer to ["Low Pass"](#) on page 114.

Parameters:

<FilterType> 3kHz | 15kHz | 150kHz
*RST: 15kHz

Example:

FILT:LPAS:FREQ 150kHz
Selects the low pass filter for the demodulation bandwidth range from 400 kHz to 16 MHz.

Manual operation: See ["Low Pass"](#) on page 114

[SENSe:]FILTer<n>:LPASs:FREQuency:MANual <Frequency>

This command selects the cutoff frequency of the low pass filter for the specified evaluation.

For details on the low pass filter refer to ["Low Pass"](#) on page 114.

Parameters:

<Frequency> numeric value
Range: 0 to 3 MHz
*RST: 15kHz

Example:

FILT:LPAS:FREQ:MAN 150kHz
The AF results are restricted to frequencies lower than 150 kHz.

Manual operation: See ["Low Pass"](#) on page 114

[SENSe:]FILTer<n>:LPASs:FREQuency:RELative <FilterType>

This command selects the relative low pass filter type for the specified evaluation

For details on the low pass filter refer to ["Low Pass"](#) on page 114.

Parameters:

<FilterType> 5PCT | 10PCT | 25PCT
 *RST: 25PCT

Example:

FILT:LPAS:FREQ:REL 25PCT

Selects the low pass filter as 25 % of the demodulation bandwidth.

Manual operation: See "[Low Pass](#)" on page 114

[SENSe:]FILTer<n>:LPASs[:STATe] <State>

This command activates/deactivates the selected low pass filter for the specified evaluation.

For details on the low pass filter refer to "[Low Pass](#)" on page 114.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

FILT:LPAS ON

Activates the selected low pass filter.

Manual operation: See "[Low Pass](#)" on page 114

11.4.8.5 Defining the Scaling and Units

The scaling parameters define the range of the demodulated data to be displayed.

11.4.8.6 Scaling for AF Evaluation

These settings are only available for AF evaluations.

Useful commands described elsewhere:

- [\[SENSe:\]ADJust:SCALe:Y:AUTO\[:CONTinuous\]](#) on page 269
- [\[SENSe:\]ADEMod<n>:AF:COUPLing](#) on page 255
- [DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:RPOSition](#) on page 239
- [DISPlay\[:WINDow<n>\]:TRACe:Y:SPACing](#) on page 239

Specific commands:

[DISPlay\[:WINDow<n>\]:TRACe:Y\[:SCALe\]:RVALue](#)..... 265

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue <Value>

This command defines the reference value assigned to the reference position in the specified window. Separate reference values are maintained for the various displays.

Parameters:

<Value> *RST: AM time domain: 0 PCT; FM time domain: 0 Hz;
PM time domain: 0 rad; AM spectrum: 100 PCT;
FM spectrum: 250 kHz; PM spectrum: 10 rad;

Example:

DISP:TRAC:Y:RVAL 0
Sets the value assigned to the reference position to 0 Hz

Manual operation: See "Reference Value" on page 118

11.4.8.7 Scaling for RF Evaluation

These commands are required for RF evaluations and the result summary.

- `DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RPOSition` on page 239
- `DISPlay[:WINDow<n>]:TRACe:Y:SPACing` on page 239
- `DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]` on page 238
- `DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MODE` on page 238

11.4.8.8 Units

The units define how the demodulated data is displayed.

<code>UNIT:ANGLE</code>	266
<code>UNIT:THD</code>	266

UNIT:ANGLE <Unit>

This command selects the unit for angles (for PM display).

This command is identical to `CALC:UNIT:ANGL`

Parameters:

<Unit> DEG | RAD
*RST: RAD

Example:

UNIT:ANGL DEG

Manual operation: See "Phase Unit (Rad/Deg)" on page 121

UNIT:THD <Mode>

Selects the unit for THD measurements.

This command is identical to `CALC:UNIT:THD`

Parameters:

<Mode> DB | PCT
*RST: DB

Example:

UNIT:THD PCT

Manual operation: See "THD Unit (% / DB)" on page 121

11.4.9 Adjusting Settings Automatically

The following remote commands are required to adjust settings automatically in a remote environment. The tasks for manual operation are described in [chapter 5.10](#), "Automatic Settings", on page 126.



MSRA/MSRT operating mode

In MSRA/MSRT operating mode, settings related to data acquisition cannot be adjusted for Analog Demodulation applications.

[SENSe:]ADJust:ALL.....	267
[SENSe:]ADJust:CONFigure:DURation.....	267
[SENSe:]ADJust:CONFigure:DURation:MODE.....	268
[SENSe:]ADJust:FREQuency.....	268
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer.....	268
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer.....	269
[SENSe:]ADJust:LEVel.....	269
[SENSe:]ADJust:SCALe:Y:AUTO[:CONTInuous].....	269

[SENSe:]ADJust:ALL

This command initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Center frequency
- Reference level
- Scaling

Example: ADJ:ALL

Usage: Event

Manual operation: See "Adjusting all Determinable Settings Automatically (Auto All)" on page 126

[SENSe:]ADJust:CONFigure:DURation <Duration>

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command defines the length of the measurement if [SENSe:]ADJust:CONFigure:DURation:MODE is set to MANual.

Parameters:

<Duration> Numeric value in seconds
 Range: 0.001 to 16000.0
 *RST: 0.001
 Default unit: s

Example: ADJ:CONF:DUR:MODE MAN
 Selects manual definition of the measurement length.
 ADJ:CONF:LEV:DUR 5ms
 Length of the measurement is 5 ms.

Manual operation: See ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 127

[SENSe:]ADJust:CONFigure:DURation:MODE <Mode>

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command selects the way the R&S FSW determines the length of the measurement .

Parameters:

<Mode>

AUTO

The R&S FSW determines the measurement length automatically according to the current input data.

MANual

The R&S FSW uses the measurement length defined by [\[SENSe:\]ADJust:CONFigure:DURation](#) on page 267.

*RST: AUTO

Manual operation: See ["Resetting the Automatic Measurement Time \(Meastime Auto\)"](#) on page 127
 See ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 127

[SENSe:]ADJust:FREQuency

This command sets the center frequency to the highest signal level in the current frequency range.

Example: ADJ:FREQ

Usage: Event

Manual operation: See ["Adjusting the Center Frequency Automatically \(Auto Freq\)"](#) on page 126

[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>

When the reference level is adjusted automatically using the [\[SENSe:\]ADJust:LEVe1](#) on page 269 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Parameters:

<Threshold> Range: 0 dB to 200 dB
 *RST: +1 dB
 Default unit: dB

Example:

```
SENS:ADJ:CONF:HYST:LOW 2
```

For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level falls below 18 dBm.

Manual operation: See "[Lower Level Hysteresis](#)" on page 127

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>

When the reference level is adjusted automatically using the [\[SENSe:\]ADJust:LEVel](#) on page 269 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

Parameters:

<Threshold> Range: 0 dB to 200 dB
 *RST: +1 dB
 Default unit: dB

Example:

```
SENS:ADJ:CONF:HYST:UPP 2
```

Example:

For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level rises above 22 dBm.

Manual operation: See "[Upper Level Hysteresis](#)" on page 127

[SENSe:]ADJust:LEVel

This command initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSW or limiting the dynamic range by an S/N ratio that is too small.

Example: `ADJ:LEV`

Usage: Event

Manual operation: See "[Setting the Reference Level Automatically \(Auto Level\)](#)" on page 87

[SENSe:]ADJust:SCALe:Y:AUTO[:CONTInuous] <State>

Activates automatic scaling of the y-axis in all diagrams according to the current measurement results. Currently auto-scaling is only available for AF measurements. RF power and RF spectrum measurements are not affected by the auto-scaling.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: SENS:ADJ:SCAL:Y:AUTO ON

Manual operation: See "AF Auto Scale" on page 119

11.4.10 Configuring Standard Traces

Useful commands for trace configuration described elsewhere

- `DISPlay[:WINDow<n>]:TRACe:Y:SPACing` on page 239
- `DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]` on page 238

Remote commands exclusive to trace configuration

<code>DISPlay[:WINDow<n>]:TRACe<t>:MODE</code>	270
<code>DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous</code>	271
<code>DISPlay[:WINDow<n>]:TRACe<t>:SElect</code>	272
<code>DISPlay[:WINDow<n>]:TRACe<t>[:STATe]</code>	272
<code>[SENSe:]ADEMod:AM[:ABSolute][:TDOMain][:TYPE]</code>	272
<code>[SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE]</code>	272
<code>[SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE]</code>	272
<code>[SENSe:]ADEMod:FM[:TDOMain][:TYPE]</code>	272
<code>[SENSe:]ADEMod:FM:AFSPectrum[:TYPE]</code>	272
<code>[SENSe:]ADEMod:PM[:TDOMain][:TYPE]</code>	272
<code>[SENSe:]ADEMod:PM:AFSPectrum[:TYPE]</code>	273
<code>[SENSe:]ADEMod:SPECtrum[:TYPE]</code>	273
<code>[SENSe:]AVERage:COUNT</code>	274
<code>[SENSe:]AVERage<n>[:STATe<t>]</code>	275
<code>[SENSe:]AVERage<n>:TYPE</code>	275
<code>[SENSe:][:WINDow<n>]:DETEctor<trace>[:FUNction]</code>	275
<code>[SENSe:][:WINDow<n>]:DETEctor<t>[:FUNction]:AUTO</code>	276

`DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>`

This command selects the trace mode.

In case of max hold, min hold or average trace mode, you can set the number of single measurements with `[SENSe:]SWEep:COUNT`. Note that synchronization to the end of the measurement is possible only in single sweep mode.

In the Analog Demodulation application when you configure the traces for a window with a specific evaluation (e.g. AM time domain), the traces in all windows with the same evaluation are configured identically.

Parameters:

<Mode>

WRITe

Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

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 FSW 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 FSW 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 130

DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONTinuous <State>

This command turns an automatic reset of a trace on and off after a parameter has changed.

The reset works for trace modes min hold, max hold and average.

Note that the command has no effect if critical parameters like the span have been changed to avoid invalid measurement results

Parameters:

<State> **ON**
 The automatic reset is off.

OFF
 The automatic reset is on.

*RST: OFF

Example:

DISP:WIND:TRAC3:MODE:HCON ON
 Switches off the reset function.

Manual operation: See "[Hold](#)" on page 131

DISPlay[:WINDow<n>]:TRACe<t>:SElect

This command selects the trace specified by the index <t> in the window specified by the index <n>. Only traces that are active in the specified result display can be selected. The selected trace is used to determine the "Result Summary" for the corresponding result display (see "[Result Summary](#)" on page 23).

The query returns the number of the currently selected trace in the window specified by the index <n> (trace index is ignored). Traces can only be queried for graphical result displays (not Result Summary, Marker Table or Peak Marker List).

Return values:

<TraceNo> Number of the currently selected trace.

Example:

DISP:TRAC3:SEL

Usage:

SCPI confirmed

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command turns a trace on and off.

The measurement continues in the background.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1 for TRACe1, 0 for TRACe 2 to 6

Example:

DISP:TRAC3 ON

Usage:

SCPI confirmed

Manual operation: See "[Trace 1/Trace 2/Trace 3/Trace 4 \(Softkeys\)](#)" on page 132

[SENSe:]ADEMod:AM[:ABSolute][:TDOMain][:TYPE]
 [SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE]
 [SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE]
 [SENSe:]ADEMod:FM[:TDOMain][:TYPE]
 [SENSe:]ADEMod:FM:AFSPectrum[:TYPE]
 [SENSe:]ADEMod:PM[:TDOMain][:TYPE]

[SENSe:]ADEMod:PM:AFSPeCtrum[:TYPE]

[SENSe:]ADEMod:SPEctrum[:TYPE] <TraceMode1>, <TraceMode2>,
<TraceMode3>, <TraceMode4>, <TraceMode5>, <TraceMode6>

This command selects the trace modes of the evaluated signal to be measured simultaneously. For each of the six available traces a mode can be defined.

The trace modes are configured identically for all windows with a specific evaluation. The following table indicates which command syntax refers to which evaluation method.

Command syntax	Evaluation method
AM[:ABSolute][:TDOMain]	RF time domain
AM:RELative[:TDOMain]	AM time domain
AM:RELative:AFSPeCtrum	AM spectrum
FM[:TDOMain]	FM time domain
FM:AFSPeCtrum	FM spectrum
PM[:TDOMain]	PM time domain
PM:AFSPeCtrum	PM spectrum
SPEctrum	RF spectrum

Note: The trace modes for each trace and each window can also be configured individually using the `DISP:TRAC:MODE` command, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 270.

Parameters:

<TraceMode>

WRITE

Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

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 FSW 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 FSW 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.

OFF

Hides the selected trace.

*RST: WRITE,OFF,OFF,OFF,OFF,OFF

Example:

ADEM:AM AVER,MAXH,MINH,OFF,OFF,OFF

Determines average, max hold and min hold values simultaneously for the traces 1-3 of the RF time domain evaluation.

ADEM:AM WRIT,OFF,OFF,OFF,OFF,OFF

Determines only the current measurement values for trace 1.

ADEM:AM OFF,OFF,OFF,OFF,OFF,OFF

Switches AM demodulation off.

[SENSe:]AVERage:COUNT <AverageCount>

This command defines the number of sweeps that the application uses to average traces.

In case of continuous sweeps, the application calculates the moving average over the average count.

In case of single sweep measurements, the application stops the measurement and calculates the average after the average count has been reached.

Parameters:

<AverageCount>

If you set a average count of 0 or 1, the application performs one single sweep in single sweep mode.

In continuous sweep mode, if the average count is set to 0, a moving average over 10 sweeps is performed.

Range: 0 to 200000

*RST: 0

Usage: SCPI confirmed

Manual operation: See "[Sweep/Average Count](#)" on page 106
See "[Average Count](#)" on page 132

[SENSe:]AVERAge<n>[:STATe<t>] <State>

This command turns averaging for a particular trace in a particular window on and off.

Parameters:
<State> ON | OFF

Usage: SCPI confirmed

[SENSe:]AVERAge<n>:TYPE <Mode>

This command selects the trace averaging mode.

Parameters:
<Mode>

VIDeo
The logarithmic power values are averaged.

LINear
The power values are averaged before they are converted to logarithmic values.

POWER
The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

*RST: VIDEO

Example: AVER:TYPE LIN
Switches to linear average calculation.

Usage: SCPI confirmed

Manual operation: See "[Average Mode](#)" on page 131

[SENSe:][WINDow<n>:]DETEctor<trace>[:FUNCTion] <Detector>

Defines the trace detector to be used for trace analysis.

Parameters:

<Detector>	APEak Autopeak
	NEGative Negative peak
	POSitive Positive peak
	QPEak Quasipeak (CISPR filter only)
	SAMPlE First value detected per trace point
	RMS RMS value
	AVERage Average
	CAVerage CISPR Average (CISPR filter only)
	CRMS CISPR RMS (CISPR filter only)
	*RST: APEak (I/Q Analyzer: RMS)

Example:

DET POS
Sets the detector to "positive peak".

Manual operation: See "[Detector](#)" on page 131

[SENSe:][WINDow<n>:]DETEctor<t>[:FUNction]:AUTO <State>

This command couples and decouples the detector to the trace mode.

Parameters:

<State>	ON OFF 0 1
	*RST: 1

Example:

DET:AUTO OFF
The selection of the detector is not coupled to the trace mode.

Manual operation: See "[Detector](#)" on page 131

11.5 Capturing Data and Performing Sweeps



MSRA/MSRT operating mode

Note that in MSRA/MSRT operating mode, capturing data is only possible for the MSRA/MSRT Master channel. In Analog Demodulation application channels, the sweep configuration commands define the **analysis interval**. Be sure to select the correct measurement channel before using these commands.

ABORT.....	277
INITiate:CONMeas.....	278
INITiate:CONTinuous.....	278
INITiate[:IMMediate].....	279
INITiate:REFResh.....	279
INITiate:SEQuencer:ABORT.....	280
INITiate:SEQuencer:IMMediate.....	280
INITiate:SEQuencer:MODE.....	280
INITiate:SEQuencer:REFResh[:ALL].....	281
SYSTem:SEQuencer.....	281

ABORT

This command aborts a current measurement and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the *OPC? or *WAI command after ABORT and before the next command.

For details see the "Remote Basics" chapter in the R&S FSW User Manual.

To abort a sequence of measurements by the Sequencer, use the `INITiate:SEQuencer:ABORT` on page 280 command.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S FSW is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the R&S FSW on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa:** `viClear()`
- **GPIB:** `ibclr()`
- **RSIB:** `RSDLLibclr()`

Now you can send the `ABORT` command on the remote channel performing the measurement.

Example:	ABOR; :INIT:IMM Aborts the current measurement and immediately starts a new one.
Example:	ABOR; *WAI INIT:IMM Aborts the current measurement and starts a new one once abortion has been completed.
Usage:	SCPI confirmed

INITiate:CONMeas

This command restarts a (single) measurement that has been stopped (using `INIT:CONT OFF`) or finished in single sweep mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate[:IMMediate]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

Manual operation: See "[Continue Single Sweep](#)" on page 105

INITiate:CONTinuous <State>

This command controls the sweep mode.

Note that in single sweep mode, you can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`. In continuous sweep mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous sweep mode in remote control, as results like trace data or markers are only valid after a single sweep end synchronization.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

If the sweep mode is changed for a measurement channel while the Sequencer is active (see `INITiate:SEQuencer:IMMediate` on page 280) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

Parameters:

<State>	ON OFF 0 1
	ON 1 Continuous sweep
	OFF 0 Single sweep
	*RST: 1

Example: INIT:CONT OFF
Switches the sweep mode to single sweep .
 INIT:CONT ON
Switches the sweep mode to continuous sweep .

Manual operation: See "[Continuous Sweep/RUN CONT](#)" on page 104

INITiate[:IMMEDIATE]

This command starts a (single) new measurement.

With sweep count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

Manual operation: See "[Single Sweep/ RUN SINGLE](#)" on page 104

INITiate:REFresh

This function is only available if the Sequencer is deactivated ([SYSTem:SEQuencer SYST:SEQ:OFF](#)) and only for applications in MSRA/MSRT mode, not the MSRA/MSRT Master.

The data in the capture buffer is re-evaluated by the currently active application only. The results for any other applications remain unchanged.

The application channel must be selected before this command can be executed (see [INSTrument\[:SElect\]](#) on page 179).

Example: SYST:SEQ:OFF
Deactivates the scheduler
 INIT:CONT OFF
Switches to single sweep mode.
 INIT;*WAI
Starts a new data measurement and waits for the end of the sweep.
 INST:SEL 'IQ ANALYZER'
Selects the IQ Analyzer channel.
 INIT:REFR
Refreshes the display for the I/Q Analyzer channel.

Usage: Event

Manual operation: See "[Refresh](#)" on page 105

INITiate:SEQuencer:ABORt

This command stops the currently active sequence of measurements. The Sequencer itself is not deactivated, so you can start a new sequence immediately using [INITiate:SEQuencer:IMMediate](#) on page 280.

To deactivate the Sequencer use [SYSTem:SEQuencer](#) on page 281.

Usage: Event

INITiate:SEQuencer:IMMediate

This command starts a new sequence of measurements by the Sequencer. Its effect is similar to the [INITiate\[:IMMediate\]](#) command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see [SYSTem:SEQuencer](#) on page 281).

Example:

```
SYST:SEQ ON
Activates the Sequencer.
INIT:SEQ:MODE SING
Sets single sequence mode so each active measurement will be
performed once.
INIT:SEQ:IMM
Starts the sequential measurements.
```

Usage: Event

INITiate:SEQuencer:MODE <Mode>

This command selects the way the R&S FSW application performs measurements sequentially.

Before this command can be executed, the Sequencer must be activated (see [SYSTem:SEQuencer](#) on page 281).

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FSW User Manual.

Note: In order to synchronize to the end of a sequential measurement using *OPC, *OPC? or *WAI you must use `SINGLE` Sequence mode.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

Parameters:

<Mode>

SINGle

Each measurement is performed once (regardless of the channel's sweep mode), considering each channels' sweep count, until all measurements in all active channels have been performed.

CONTInuous

The measurements in each active channel are performed one after the other, repeatedly (regardless of the channel's sweep mode), in the same order, until the Sequencer is stopped.

CDEFined

First, a single sequence is performed. Then, only those channels in continuous sweep mode (`INIT:CONT ON`) are repeated.

*RST: CONTInuous

Example:

`SYST:SEQ ON`

Activates the Sequencer.

`INIT:SEQ:MODE SING`

Sets single sequence mode so each active measurement will be performed once.

`INIT:SEQ:IMM`

Starts the sequential measurements.

INITiate:SEQuencer:REFResh[:ALL]

This function is only available if the Sequencer is deactivated (`SYSTEM:SEQuencer SYST:SEQ:OFF`) and only in MSRA or MSRT mode.

The data in the capture buffer is re-evaluated by all active MSRA/MSRT applications.

Example:

`SYST:SEQ:OFF`

Deactivates the scheduler

`INIT:CONT OFF`

Switches to single sweep mode.

`INIT;*WAI`

Starts a new data measurement and waits for the end of the sweep.

`INIT:SEQ:REFR`

Refreshes the display for all channels.

Usage:

Event

SYSTEM:SEQuencer <State>

This command turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error will occur.

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FSW User Manual.

Parameters:

<State>

ON | OFF | 0 | 1

ON | 1

The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0

The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example:

SYST:SEQ ON

Activates the Sequencer.

INIT:SEQ:MODE SING

Sets single Sequencer mode so each active measurement will be performed once.

INIT:SEQ:IMM

Starts the sequential measurements.

SYST:SEQ OFF

11.6 Configuring the Result Display

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

- [General Window Commands](#)..... 282
- [Working with Windows in the Display](#)..... 283

11.6.1 General Window Commands

The following commands are required to configure general window layout, independent of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see `INSTrument[:SElect]` on page 179).

DISPlay:FORMat..... 282

DISPlay[:WINDow<n>]:SIZE..... 283

DISPlay:FORMat <Format>

This command determines which tab is displayed.

Parameters:

<Format>

SPLit

Displays the MultiView tab with an overview of all active channels

SINGle

Displays the measurement channel that was previously focused.

*RST: SING

Example:

DISP:FORM SPL

DISPlay[:WINDow<n>]:SIZE <Size>

This command maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the `LAY:SPL` command (see `LAYout:SPLitter` on page 286).

Parameters:

<Size>

LARGe

Maximizes the selected window to full screen. Other windows are still active in the background.

SMALI

Reduces the size of the selected window to its original size. If more than one measurement window was displayed originally, these are visible again.

*RST: SMALI

Example:

DISP:WIND2:LARG

11.6.2 Working with Windows in the Display

The following commands are required to change the evaluation type and rearrange the screen layout for a measurement channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected measurement channel.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see `INSTrument[:SElect]` on page 179).

<code>LAYout:ADD[:WINDow]?</code>	284
<code>LAYout:CATalog[:WINDow]?</code>	285
<code>LAYout:IDENtify[:WINDow]?</code>	285
<code>LAYout:REMove[:WINDow]</code>	286
<code>LAYout:REPLace[:WINDow]</code>	286
<code>LAYout:SPLitter</code>	286
<code>LAYout:WINDow<n>:ADD?</code>	288
<code>LAYout:WINDow<n>:IDENtify?</code>	288
<code>LAYout:WINDow<n>:REMove</code>	288
<code>LAYout:WINDow<n>:REPLace</code>	289

LAYout:ADD[:WINDow]? <WindowName>,<Direction>,<WindowType>

This command adds a window to the display.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the [LAYout:REPLace\[:WINDow\]](#) command.

Parameters:

<WindowName>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the LAYout:CATalog[:WINDow]? query.
<Direction>	LEFT RIGHT ABOVE BELOW Direction the new window is added relative to the existing window.
<WindowType>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values.

Return values:

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

Example:

LAY:ADD? '1', LEFT, MTAB

Result:

'2'

Adds a new window named '2' with a marker table to the left of window 1.

Example:

LAY:ADD? '1', BEL, 'XTIM:AM:RELative[:TDOMain]'

Adds an AM Time Domain display below window 1.

Usage:

Query only

Manual operation:

See ["AM Time Domain"](#) on page 15
 See ["FM Time Domain"](#) on page 16
 See ["PM Time Domain"](#) on page 17
 See ["AM Spectrum"](#) on page 18
 See ["FM Spectrum"](#) on page 19
 See ["PM Spectrum"](#) on page 20
 See ["RF Time Domain"](#) on page 21
 See ["RF Spectrum"](#) on page 22
 See ["Result Summary"](#) on page 23
 See ["Marker Table"](#) on page 24
 See ["Marker Peak List"](#) on page 25

Table 11-3: <WindowType> parameter values for AnalogDemod application

Parameter value	Window type
MTABle	Marker table
PEAKlist	Marker peak list
RSUMmary	Result summary
'XTIM:AM'	RF Time Domain (= RF power)
'XTIM:AM:RELative'	AM Time Domain
'XTIM:AM:RELative:AFSPec-trum'	AM Spectrum
'XTIM:FM'	FM Time Domain
'XTIM:FM:AFSPpectrum'	FM Spectrum
'XTIM:PM'	PM Time Domain
'XTIM:PM:AFSPpectrum'	PM Spectrum
'XTIM:SPEctrum'	RF Spectrum

LAYout:CATalog[:WINDow]?

This command queries the name and index of all active windows from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..*n*<WindowName_1>,<WindowIndex_1>

Return values:

<WindowName> **string**
Name of the window.
In the default state, the name of the window is its index.

<WindowIndex> **numeric value**
Index of the window.

Example:

LAY:CAT?

Result:

'2',2,'1',1

Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

Usage: Query only

LAYout:IDENtify[:WINDow]? <WindowName>

This command queries the **index** of a particular display window.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

Query parameters:

<WindowName> String containing the name of a window.

Return values:

<WindowIndex> Index number of the window.

Usage: Query only

LAYout:REMove[:WINDow] <WindowName>

This command removes a window from the display.

Parameters:

<WindowName> String containing the name of the window.
In the default state, the name of the window is its index.

Usage: Event

LAYout:REPLace[:WINDow] <WindowName>, <WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

Parameters:

<WindowName> String containing the name of the existing window.
By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType> Type of result display you want to use in the existing window.
See `LAYout:ADD[:WINDow]?` on page 284 for a list of available window types.

Example:

```
LAY:REPL:WIND '1',MTAB
```

Replaces the result display in window 1 with a marker table.

LAYout:SPLitter <Index1>, <Index2>, <Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

As opposed to the `DISPlay[:WINDow<n>]:SIZE` on page 283 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command will not work, but does not return an error.

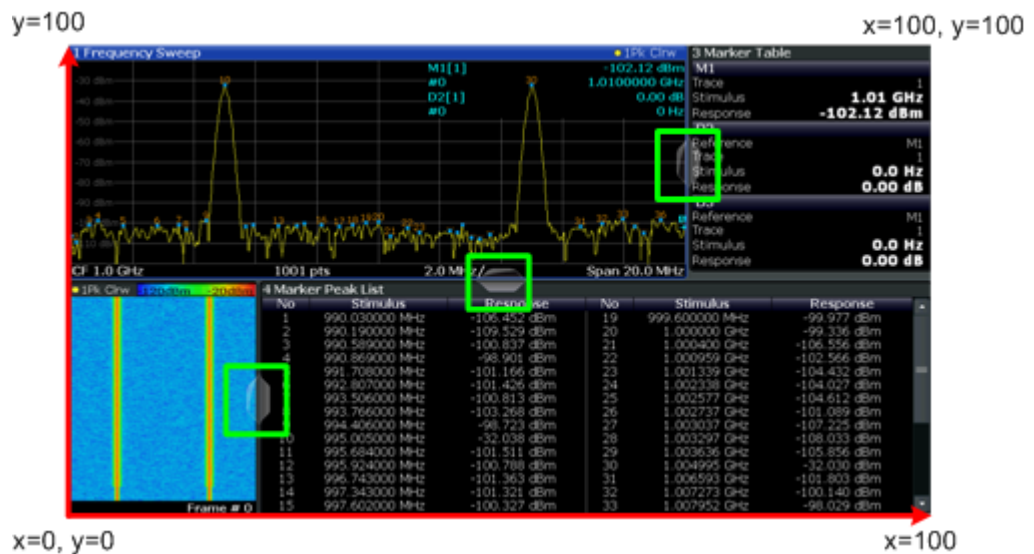


Fig. 11-1: SmartGrid coordinates for remote control of the splitters

Parameters:

- <Index1> The index of one window the splitter controls.
- <Index2> The index of a window on the other side of the splitter.
- <Position> New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu).
The point of origin ($x = 0$, $y = 0$) is in the lower left corner of the screen. The end point ($x = 100$, $y = 100$) is in the upper right corner of the screen. (See figure 11-1.)
The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically.

Range: 0 to 100

Example:

LAY:SPL 1, 3, 50

Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Table') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example:

LAY:SPL 1, 4, 70

Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Peak List') towards the top (70%) of the screen.

The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.

LAY:SPL 3, 2, 70

LAY:SPL 4, 1, 70

LAY:SPL 2, 1, 70

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

This command adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added, as opposed to `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

Parameters:

<Direction> LEFT | RIGHT | ABOVE | BELOW

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 284 for a list of available window types.

Return values:

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

Example:

```
LAY:WIND1:ADD? LEFT,MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

Usage: Query only

LAYout:WINDow<n>:IDENTify?

This command queries the **name** of a particular display window (indicated by the <n> suffix).

Note: to query the **index** of a particular window, use the `LAYout:IDENTify[:WINDow]?` command.

Return values:

<WindowName> String containing the name of a window.
In the default state, the name of the window is its index.

Usage: Query only

LAYout:WINDow<n>:REMOve

This command removes the window specified by the suffix <n> from the display.

The result of this command is identical to the `LAYout:REMOve[:WINDow]` command.

Usage: Event

LAYout:WINDow<n>:REPLace <WindowType>

This command changes the window type of an existing window (specified by the suffix <n>).

The result of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

Parameters:

<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 284 for a list of available window types.

11.7 Retrieving Results

The following remote commands are required to retrieve the results from an Analog Demodulation measurement in a remote environment.



In the Analog Demodulation application when you configure the traces for a window with a specific evaluation (e.g. AM time domain), the traces in all windows with the same evaluation are configured identically.

Specific commands:

- [Retrieving Trace Results](#).....289
- [Exporting Trace Results](#).....292
- [Retrieving Result Summary Values](#)..... 294
- [Formats for Returned Values: ASCII Format and Binary Format](#).....297
- [Reference: ASCII File Export Format](#).....297

11.7.1 Retrieving Trace Results

The following remote commands are required to retrieve the trace results in a remote environment.

<code>[SENSe:]ADEMod:AM[:ABSolute][:TDOMain]:RESult?</code>	290
<code>[SENSe:]ADEMod:AM:RELative[:TDOMain]:RESult?</code>	290
<code>[SENSe:]ADEMod:AM:RELative:AFSPectrum:RESult?</code>	290
<code>[SENSe:]ADEMod:FM[:TDOMain]:RESult?</code>	290
<code>[SENSe:]ADEMod:FM:AFSPectrum:RESult?</code>	290
<code>[SENSe:]ADEMod:PM[:TDOMain]:RESult?</code>	290
<code>[SENSe:]ADEMod:PM:AFSPectrum:RESult?</code>	290
<code>[SENSe:]ADEMod:SPEctrum:RESult?</code>	290
<code>FORMat[:DATA]</code>	291
<code>TRACe<n>[:DATA]</code>	291

```
[SENSe:]ADEMod:AM[:ABSolute][:TDOMain]:RESult? <TraceMode>
[SENSe:]ADEMod:AM:RELative[:TDOMain]:RESult? <TraceMode>
[SENSe:]ADEMod:AM:RELative:AFSPectrum:RESult? <TraceMode>
[SENSe:]ADEMod:FM[:TDOMain]:RESult? <TraceMode>
[SENSe:]ADEMod:FM:AFSPectrum:RESult? <TraceMode>
[SENSe:]ADEMod:PM[:TDOMain]:RESult? <TraceMode>
[SENSe:]ADEMod:PM:AFSPectrum:RESult? <TraceMode>
[SENSe:]ADEMod:SPECTrum:RESult? <TraceMode>
```

This command reads the result data of the evaluated signal in the specified trace mode. The data format of the output data block is defined by the `FORMat [: DATA]` on page 291).

The trace results are configured for a specific evaluation. The following table indicates which command syntax refers to which evaluation method, as well as the output unit of the results.

Command syntax	Evaluation method	Output unit
AM[:ABSolute][:TDOMain]	RF time domain	dBm
AM:RELative[:TDOMain]	AM time domain	%
AM:RELative:AFSPectrum	AM spectrum	%
FM[:TDOMain]	FM time domain	kHz
FM:AFSPectrum	FM spectrum	kHz
PM[:TDOMain]	PM time domain	rad or °
PM:AFSPectrum	PM spectrum	rad or °
SPECTrum	RF spectrum	dBm (logarithmic display) or V (linear display).

Query parameters:

<TraceMode> WRITe | AVERage | MAXHold | MINHold | VIEW

The specified trace mode must be one of those configured by `SENS:ADEM:<Evaluation>:TYPE`, see `[SENSe:]ADEMod:SPECTrum[:TYPE]` on page 273. Otherwise a query error is generated.

Example:

```
ADEM:AM AVER,MAXH,MINH
Sets up RF time domain results to be measured
INIT; *WAI
Starts measurement and waits for sync
FORM ASC
Selects output format
ADEM:AM:RES? AVER
Reads RF time domain average results
ADEM:AM:RES? MAXH
Reads RF time domain max hold results
ADEM:AM:RES? MINH
Reads RF time domain min hold results
```

Usage: Query only

FORMat[:DATA] <Format>

This command selects the data format that is used for transmission of trace data from the R&S FSW to the controlling computer.

Note that the command has no effect for data that you send to the R&S FSW. The R&S FSW automatically recognizes the data it receives, regardless of the format.

Parameters:

<Format>

ASCIi

ASCIi format, separated by commas.

This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats may be.

REAL,32

32-bit IEEE 754 floating-point numbers in the "definite length block format".

In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.

For I/Q data, 8 bytes per sample are returned for this format setting.

*RST: ASCII

Example: `FORM REAL,32`

Usage: SCPI confirmed

TRACe<n>[:DATA]

This command queries current trace data and measurement results.

The data format depends on `FORMat[:DATA]`.

Query parameters:

<ResultType>

Selects the type of result to be returned.

TRACE1 | ... | TRACE6

Returns the trace data for the corresponding trace.

Return values:

<TraceData>

The trace data consists of a list of power levels that have been measured. The number of power levels in the list depends on the currently selected number of sweep points. The unit depends on the measurement and on the unit you have currently set.

If you are measuring with the auto peak detector, the command returns positive peak values only.

Example: `TRAC? TRACE3`
Queries the data of trace 3.

Usage: SCPI confirmed

11.7.2 Exporting Trace Results

Trace results can be exported to a file.

For more commands concerning data and results storage see the R&S FSW User Manual.

MMEMory:STORe<n>:TRACe	292
FORMat:DEXPort:DSEParator	292
FORMat:DEXPort:HEADer	293
FORMat:DEXPort:TRACes	293

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data from the specified window to an ASCII file.

Secure User Mode

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Parameters:

<Trace>	Number of the trace to be stored (This parameter is ignored if the option "Export all Traces and all Table Results" is activated in the Export configuration settings, see FORMat:DEXPort:TRACes on page 293).
<FileName>	String containing the path and name of the target file.

Example: `MMEM:STOR1:TRAC 3, 'C:\TEST.ASC'`
Stores trace 3 from window 1 in the file TEST.ASC.

Usage: SCPI confirmed

Manual operation: See "[Export Trace to ASCII File](#)" on page 134

FORMat:DEXPort:DSEParator <Separator>

This command selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator>

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 134See "[Exporting the Peak List](#)" on page 147**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.

See [chapter 11.7.5, "Reference: ASCII File Export Format"](#), on page 297 for details.**Parameters:**

<State>

ON | OFF | 0 | 1

*RST: 1

Usage:

SCPI confirmed

Manual operation:See "[Include Instrument Measurement Settings](#)" on page 133**FORMat:DEXPort:TRACes <Selection>**

This command selects the data to be included in a data export file (see [MMEMory:STORe<n>:TRACe](#) on page 292).

Parameters:

<Selection>

SINGLE

Only a single trace is selected for export, namely the one specified by the [MMEMory:STORe<n>:TRACe](#) command.

ALL

Selects all active traces and result tables (e.g. Result Summary, marker peak list etc.) in the current application for export to an ASCII file.

The <trace> parameter for the [MMEMory:STORe<n>:TRACe](#) command is ignored.

*RST: SINGLE

Usage:

SCPI confirmed

Manual operation:See "[Export all Traces and all Table Results](#)" on page 133

11.7.3 Retrieving Result Summary Values

The result summary contains measurement values that are calculated from the trace data.

For details see "Result Summary" on page 23.

CALCulate<n>:MARKer:FUNCTion:ADEMod:AFRequency[:RESult]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:AM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:FM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:PM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:CARRier[:RESult]?.....	295
CALCulate:MARKer:FUNCTion:ADEMod:FERRor[:RESult<t>]?.....	295
CALCulate<n>:MARKer:FUNCTion:ADEMod:SINad:RESult<t>?.....	295
CALCulate<n>:MARKer:FUNCTion:ADEMod:THD:RESult<t>?.....	295
[SENSe:]ADEMod:FM:OFFSet?.....	296
[SENSe:]ADEMod:PM:RPOint[:X].....	297

CALCulate<n>:MARKer:FUNCTion:ADEMod:AFRequency[:RESult]?

This command queries the modulation (audio) frequency for the demodulation method in the selected window.

Parameters:

<ModFreq> Modulation frequency in Hz.

Usage: Query only

CALCulate:MARKer:FUNCTion:ADEMod:AM[:RESult<t>]? <MeasType>

CALCulate:MARKer:FUNCTion:ADEMod:FM[:RESult<t>]? <MeasType>

CALCulate:MARKer:FUNCTion:ADEMod:PM[:RESult<t>]? <MeasType>

This command queries the current value of the demodulated signal for the specified trace (as displayed in the Result Summary in manual operation).

Note that all windows with the same evaluation method have the same traces, thus the window is irrelevant.

Query parameters:

<MeasType> PPEak | MPEak | MIDDLE | RMS

PPEak

Postive peak (+PK)

MPEak | NPEak

Negative peak (-PK)

MIDDLE

Average of positive and negative peaks $\pm PK/2$

RMS

Root mean square value

Example: `CALC:FEED 'XTIM:PM:TDOM'`
 Switches on the PM time domain result display.
 `DISP:TRAC ON`
 Switches on the trace.
 `CALC:MARK:FUNC:ADEM:PM? PPE`
 Queries the peak value of the demodulated PM trace.

Usage: Query only

Manual operation: See "Result Summary" on page 23

CALCulate:MARKer:FUNCTION:ADEMod:CARRier[:RESult]?

This command queries the carrier power, which is determined from the Clr/Write data.

Return values:

<CPower> Power of the carrier without modulation in dBm.

Usage: Query only

CALCulate:MARKer:FUNCTION:ADEMod:FERRor[:RESult<t>]?

This command queries the carrier offset (= frequency error) for FM and PM demodulation. The carrier offset is determined from the current measurement data (CLR/WRITE). The modulation is removed using low pass filtering.

The offset thus determined differs from that calculated in the [\[SENSe:\]ADEMod:FM:OFFSet?](#) command which uses averaging to determine the frequency deviation.

Return values:

<CarrOffset> The deviation of the calculated carrier frequency to the ideal carrier frequency in Hz.

Usage: Query only

CALCulate<n>:MARKer:FUNCTION:ADEMod:SINad:RESult<t>?

This command queries the result of the signal-to-noise-and-distortion (SINAD) measurement in the specified window for the specified trace.

Note that this value is only calculated if an AF Spectrum window is displayed.

Parameters:

<SINAD> The signal-to-noise-and-distortion ratio in dB.

Usage: Query only

CALCulate<n>:MARKer:FUNCTION:ADEMod:THD:RESult<t>?

This command queries the result of the total harmonic distortion (THD) measurement in the specified window.

Note that this value is only calculated if an AF Spectrum window is displayed.

Parameters:

<THD> Total harmonic distortion of the demodulated signal in dB.

Usage:

Query only

[SENSe:]ADEMod:FM:OFFSet? <ResultType>

This command calculates the FM carrier offset from the currently available measurement data set.

If averaging has been activated before acquiring the data set (using [SENSe:]ADEMod:FM[:TDOMain][:TYPE] on page 272, the averaged FM offset over several measurements can also be obtained by setting <ResultType> = AVERAge.

The offset thus determined differs from the one calculated by the CALCulate:MARKer:FUNCTion:ADEMod:FERRor[:RESult<t>]? on page 295 command since, for determination of the frequency deviation, the modulation is removed by means of low pass filtering, producing results that are different from those obtained by averaging.

Query parameters:

<ResultType> IMMEDIATE | AVERAge

IMMEDIATE

The current measurement results are used to calculate the FM offset

AVERAge

The measurement results that were averaged over the given number of measurements are used to calculate the FM offset
If no average measurement was active during the last measurement sequence only the [SENSe:]ADEMod:FM:OFFSet?

IMMEDIATE command will return a correct result (data to calculate the offset are taken from the last measured data set).

[SENSe:]ADEMod:FM:OFFSet? AVERAge will cause a query error in this case.

Example:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters to execute 30 measurements

```
ADEM:FM AVER,OFF,OFF
```

Selects FM results to perform averaging

```
INIT;WAI
```

Starts measurement and waits for sync

```
ADEM:FM:OFFS? IMM
```

Reads FM offset of last measurement of the sequence of 30

```
ADEM:FM:OFFS? AVER
```

Reads FM offset averaged over 30 measurements

Usage:

Query only

[SENSe:]ADEMod:PM:RPOint[:X] <Time>

This command determines the position where the phase of the PM-demodulated signal is set to 0 rad. The maximum possible value depends on the measurement time selected in the instrument; this value is output in response to the query

ADEM:PM:RPO:X? MAX.

Parameters:

<Time> 0 s to measurement time
*RST: 0 s

Example:

ADEM:PM:RPO 500us
Sets the position where the phase to 0 rad setting to 500 µs.

11.7.4 Formats for Returned Values: ASCII Format and Binary Format

When trace data is retrieved using the `TRAC:DATA` or `TRAC:IQ:DATA` command, the data is returned in the format defined using the `FORMat[:DATA]`. The possible formats are described here.

- ASCII Format (FORMat ASCII):
The data is stored as a list of comma separated values (CSV) of the measured values in floating point format.
- Binary Format (FORMat REAL,32):
The data is stored as binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format.
The schema of the result string is as follows:
#41024<value1><value2>...<value n> with

#4	number of digits (= 4 in the example) of the following number of data bytes
1024	number of following data bytes (= 1024 in the example)
<Value>	4-byte floating point value



Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

11.7.5 Reference: ASCII File Export Format

Trace data can be exported to a file in ASCII format for further evaluation in other applications. This reference describes in detail the format of the export files for result data.

The file consists of the header containing important scaling parameters and a data section containing the trace data. Optionally, the header can be excluded from the file (see ["Include Instrument Measurement Settings"](#) on page 133).

The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit. The data section starts with the keyword "Trace <n>" (<n> = number of stored trace), followed by the measured data in one or several columns (depending on the measurement) which are also separated by a semicolon.

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.

Generally, the format of this ASCII file can be processed by spreadsheet calculation programs, e.g. MS-Excel. Different language versions of evaluation programs may require a different handling of the decimal point. Thus you can define the decimal separator to be used (decimal point or comma, see "[Decimal Separator](#)" on page 134).

Table 11-4: ASCII file format for trace export

File contents	Description
Header data	
Type;R&S FSW;	Instrument model
Version;5.00;	Firmware version
Date;01.Oct 2006;	Date of data set storage
Mode;ANALYZER;	Operating mode
Preamplifier;OFF	Preamplifier status
Transducer; OFF	Transducer status
Center Freq;55000;Hz	Center frequency
Freq Offset;0;Hz	Frequency offset
Start;10000;Hz Stop;100000;Hz	Start/stop of the display range. Unit: Hz for span > 0, s for span = 0, dBm/dB for statistics measurements
Span;90000;Hz	Frequency range (0 Hz in zero span and statistics measurements)
Ref Level;-30;dBm	Reference level
Level Offset;0;dB	Level offset
Rf Att;20;dB	Input attenuation
EI Att;2.0;dB	Electrical attenuation
RBW;100000;Hz	Resolution bandwidth
VBW;30000;Hz	Video bandwidth
SWT;0.005;s	Sweep time
Sweep Count;20;	Number of sweeps set
Ref Position;75;%	Position of reference level referred to diagram limits (0 % = lower edge)
Level Range;100;dB	Display range in y direction. Unit: dB with x-axis LOG, % with x-axis LIN

File contents	Description
x-Axis;LIN;	Scaling of x-axis linear (LIN) or logarithmic (LOG)
y-Axis;LOG;	Scaling of y-axis linear (LIN) or logarithmic (LOG)
x-Unit;Hz;	Unit of x values: Hz with span > 0; s with span = 0; dBm/dB with statistics measurements
y-Unit;dBm;	Unit of y values: dB*V/A/W depending on the selected unit with y-axis LOG or % with y-axis LIN
Data section for individual window	
Window;1;Frequency Sweep	Window number and name
Trace 1;;	Selected trace
Trace Mode;AVERAGE;	Display mode of trace: CLR/WRITE,AVERAGE,MAXHOLD,MINHOLD
Detector;AUTOPEAK;	Detector set: AUTOPEAK,MAXPEAK,MINPEAK,AVERAGE,RMS,SAMPLE,QUASPEAK
Values; 1001;	Number of measurement points
10000;-10.3;-15.7 10130;-11.5;-16.9 10360;-12.0;-17.4 ...;...;	Measured values: <x value>, <y1>, <y2>; <y2> being available only with detector AUTOPEAK and containing in this case the smallest of the two measured values for a measurement point.
Data section for individual trace	
Trace 2;;	Next trace in same window
...	
Data section for individual window	
Window;2 ..;	Name of next window
Data section for individual trace	
Trace 1;;	First trace
...	

11.8 Analyzing Results

The following remote commands are required to configure general result analysis settings concerning the trace, markers, lines etc. in a remote environment. They are identical to the analysis functions in the base unit except for some special marker functions and spectrograms, which are not available in the Analog Demodulation application.

More details are described for manual operation in [chapter 6, "Analysis"](#), on page 129.

• Working with Markers Remotely.....	300
• Defining Limit Checks.....	322
• Zooming into the Display.....	334
• Configuring an Analysis Interval and Line (MSRA mode only).....	336
• Configuring an Analysis Interval and Line (MSRT mode only).....	338

11.8.1 Working with Markers Remotely

In the Analog Demodulation application, up to 16 markers or delta markers can be activated for each window simultaneously.

More details are described for manual operation in [chapter 6.5, "Marker Function Configuration"](#), on page 142.

• Setting Up Individual Markers.....	300
• General Marker Settings.....	306
• Marker Search Settings.....	308
• Positioning the Marker.....	308
• Configuring Special Marker Functions.....	312

11.8.1.1 Setting Up Individual Markers

The following commands define the position of markers in the diagram.

CALCulate<n>:MARKer<m>:AOFF.....	300
CALCulate<n>:MARKer<m1>:LINK:TO:MARKer<m2>.....	301
CALCulate<n>:MARKer<m>[:STATe].....	301
CALCulate<n>:MARKer<m>:TRACe.....	301
CALCulate<n>:MARKer<m>:X.....	301
CALCulate<n>:MARKer<m>:Y?.....	302
CALCulate<n>:DELTamarker:AOFF.....	303
CALCulate<n>:DELTamarker<m>:LINK.....	303
CALCulate<n>:DELTamarker<m1>:LINK:TO:MARKer<m2>.....	303
CALCulate<n>:DELTamarker:MODE.....	303
CALCulate<n>:DELTamarker<m>:MREF.....	304
CALCulate<n>:DELTamarker<m>[:STATe].....	304
CALCulate<n>:DELTamarker<m>:TRACe.....	304
CALCulate<n>:DELTamarker<m>:X.....	305
CALCulate<n>:DELTamarker<m>:X:RELative?.....	305
CALCulate<n>:DELTamarker<m>:Y?.....	305

CALCulate<n>:MARKer<m>:AOFF

This command turns all markers off.

Example: CALC:MARK:AOFF
Switches off all markers.

Usage: Event

Manual operation: See "[All Markers Off](#)" on page 137

CALCulate<n>:MARKer<m1>:LINK:TO:MARKer<m2> <State>

This command links normal marker <m1> to any active normal marker <m2>.

If you change the horizontal position of marker <m2>, marker <m1> changes its horizontal position to the same value.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

CALC:MARK4:LINK:TO:MARK2 ON
Links marker 4 to marker 2.

Manual operation: See ["Linking to Another Marker"](#) on page 136

CALCulate<n>:MARKer<m>[:STATE] <State>

This command turns markers on and off. If the corresponding marker number is currently active as a deltamarker, it is turned into a normal marker.

Parameters:

<State> ON | OFF
*RST: OFF

Example:

CALC:MARK3 ON
Switches on marker 3.

Manual operation: See ["Marker State"](#) on page 136
See ["Marker Type"](#) on page 136

CALCulate<n>:MARKer<m>:TRACe <Trace>

This command 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.

Parameters:

<Trace> **1 to 6**
Trace number the marker is assigned to.

Example:

CALC:MARK3:TRAC 2
Assigns marker 3 to trace 2.

Manual operation: See ["Assigning the Marker to a Trace"](#) on page 137

CALCulate<n>:MARKer<m>:X <Position>

This command moves a marker to a particular 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.

Parameters:

<Position> Numeric value that defines the marker position on the x-axis. The unit is either Hz (frequency domain) or s (time domain) or dB (statistics).
Range: The range depends on the current x-axis range.

Example:

`CALC:MARK2:X 1.7MHz`
Positions marker 2 to frequency 1.7 MHz.

Manual operation:

See "[Marker Table](#)" on page 24
See "[Marker Peak List](#)" on page 25
See "[Marker Position \(X-value\)](#)" on page 136

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

This command queries the position of a marker on the y-axis.

If necessary, the command activates the marker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also `INITiate:CONTinuous` on page 278.

If the analog demodulator (option Analog Demodulation, R&S FSW-K7) is activated, the query result is output in the following units in the specified window:

Result display	Output unit
AM	%
FM	Hz
PM	rad/deg (defined with <code>UNIT:ANGLE</code> on page 266)
RF	dB (Range Log or Range Linear %) % (Range Linear dB)

Return values:

<Result> Result at the marker position.

Example:

`INIT:CONT OFF`
Switches to single measurement mode.
`CALC:MARK2 ON`
Switches marker 2.
`INIT;*WAI`
Starts a measurement and waits for the end.
`CALC:MARK2:Y?`
Outputs the measured value of marker 2.

Usage:

Query only

Manual operation: See ["Marker Table"](#) on page 24
See ["Marker Peak List"](#) on page 25

CALCulate<n>:DELTamarker:AOff

This command turns all delta markers off.

Example: `CALC:DELT:AOff`
Turns all delta markers off.

Usage: Event

CALCulate<n>:DELTamarker<m>:LINK <State>

This command links delta marker <m> to marker 1.

If you change the horizontal position (x-value) of marker 1, delta marker <m> changes its horizontal position to the same value.

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

Example: `CALC:DELT2:LINK ON`

Manual operation: See ["Linking to Another Marker"](#) on page 136

CALCulate<n>:DELTamarker<m1>:LINK:TO:MARKer<m2> <State>

This command links delta marker <m1> to any active normal marker <m2>.

If you change the horizontal position of marker <m2>, delta marker <m1> changes its horizontal position to the same value.

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

Example: `CALC:DELT4:LINK:TO:MARK2 ON`
Links the delta marker 4 to the marker 2.

Manual operation: See ["Linking to Another Marker"](#) on page 136

CALCulate<n>:DELTamarker:MODE <Mode>

This command defines whether the position of a delta marker is provided as an absolute value or relative to a reference marker. Note that when the position of a delta marker is *queried*, the result is always an absolute value (see [CALCulate<n>:DELTamarker<m>:X](#) on page 305)!

Parameters:

<Mode>

ABSolute

Delta marker position in absolute terms.

RELative

Delta marker position in relation to a reference marker.

*RST: RELative

Example:

CALC:DELT:MODE ABS

Absolute delta marker position.

CALCulate<n>:DELTamarker<m>:MREF <Reference>

This command selects a reference marker for a delta marker other than marker 1.

The reference may be another marker or the fixed reference.

Parameters:

<Reference>

1 to 16

Selects markers 1 to 16 as the reference.

FIXed

Selects the fixed reference as the reference.

Example:

CALC:DELT3:MREF 2

Specifies that the values of delta marker 3 are relative to marker 2.

Manual operation: See ["Reference Marker"](#) on page 136**CALCulate<n>:DELTamarker<m>[:STATe] <State>**

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

Parameters:

<State>

ON | OFF

*RST: OFF

Example:

CALC:DELT2 ON

Turns on delta marker 2.

Manual operation: See ["Marker State"](#) on page 136See ["Marker Type"](#) on page 136**CALCulate<n>:DELTamarker<m>:TRACe <Trace>**

This command 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.

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>

This command 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.

Parameters:

<Position> Numeric value that defines the marker position on the x-axis. The position is relative to the reference marker. To select an absolute position you have to change the delta marker mode with `CALCulate<n>:DELTamarker:MODE` on page 303. A query returns the absolute position of the delta marker.
Range: The value range and unit depend on the measurement and scale of the x-axis.

Example:

`CALC:DELT:X?`
Outputs the absolute x-value of delta marker 1.

Manual operation: See "[Marker Position \(X-value\)](#)" on page 136

CALCulate<n>:DELTamarker<m>:X:RELative?

This command queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

Return values:

<Position> Position of the delta marker in relation to the reference marker or the fixed reference.

Example:

`CALC:DELT3:X:REL?`
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Usage:

Query only

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

This command queries the relative position of a delta marker on the y-axis.

If necessary, the command activates the delta marker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also `INITiate:CONTinuous` on page 278.

The unit depends on the application of the command.

Table 11-5: Analog demodulation measurements

Parameter, measuring function or result display	Output unit
AM result display (R&S FSW-K7)	% (lin) dB (log)
FM result display (R&S FSW-K7)	Hz (lin) dB (log)
PM result display (R&S FSW-K7)	rad deg (lin) dB (log)
RF result display (R&S FSW-K7)	dB (Range Log or Range Linear %) % (Range Linear %)

Return values:

<Position> Position of the delta marker in relation to the reference marker or the fixed reference.

Example:

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

Usage: Query only

11.8.1.2 General Marker Settings

The following commands control general marker functionality.

See also "[Fixed Reference Marker Settings](#)" on page 312

CALCulate:MARKer:X:SSIZE	306
CALCulate:MARKer<m>:LINK	307
DISPlay:MTABLE	307

CALCulate:MARKer:X:SSIZE <StepSize>

This command selects the marker step size mode.

The step size defines the distance the marker moves when you move it with the rotary knob. It therefore takes effect in manual operation only.

Parameters:

<StepSize>

STANDARD

the marker moves from one pixel to the next

POINTS

the marker moves from one sweep point to the next

*RST: POINTs

Example:

CALC:MARK:X:SSIZ STAN

Sets the marker step size to one pixel.

Manual operation: See "[Marker Stepsize](#)" on page 138**CALCulate:MARKer<m>:LINK <DisplayType>**

Links the specified marker in all displays of the specified type.

Parameters:

<DisplayType>

TIME | SPECTrum | BOTH | NONE

TIME

Links the markers in all time domain diagrams

SPECTrum

Links the markers in all AF Spectrum displays

BOTH

Links the markers both in the time domain diagrams and in the AF Spectrum displays

NONE

Markers are not linked.

*RST: NONE

Manual operation: See "[Link Time Marker](#)" on page 139
See "[Link AF Spectrum Marker](#)" on page 139**DISPlay:MTABLE <DisplayMode>**

This command turns the marker table on and off.

Parameters:

<DisplayMode>

ON

Turns the marker table on.

OFF

Turns the marker table off.

AUTO

Turns the marker table on 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 138

11.8.1.3 Marker Search Settings

The following commands define criteria for searches.

CALCulate<n>:MARKer:PEXCursion..... 308

CALCulate<n>:MARKer:PEXCursion <Excursion>

This command defines the peak excursion.

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

The unit depends on the measurement.

Application/Result display	Unit
Spectrum	dB
ADEMOD, RF	dB
ADEMOD, AM	PCT
ADEMOD, FM	kHz
ADEMOD, PM	RAD

Parameters:

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

*RST: 5 PCT in AM displays, 50 kHz in FM displays, (0.5 RAD in PM displays)

Example: CALC:MARK:PEXC 10dB
 Defines peak excursion as 10 dB.

Manual operation: See "Peak Excursion" on page 140

11.8.1.4 Positioning the Marker

The following remote commands are required to position the marker on a trace.

- Positioning Markers308
- Positioning Delta Markers..... 310

Positioning Markers

The following commands position markers on the trace.

CALCulate<n>:MARKer<m>:MAXimum:LEFT.....309

CALCulate<n>:MARKer<m>:MAXimum:NEXT..... 309

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]..... 309

CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....309

CALCulate<n>:MARKer<m>:MINimum:LEFT.....309

CALCulate<n>:MARKer<m>:MINimum:NEXT.....	310
CALCulate<n>:MARKer<m>:MINimum[:PEAK].....	310
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	310

CALCulate<n>:MARKer<m>:MAXimum:LEFT

This command moves a marker to the next lower peak.

The search includes only measurement values to the left of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command moves a marker to the next lower peak.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140
See ["Search Next Peak"](#) on page 141

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See ["Peak Search"](#) on page 141

CALCulate<n>:MARKer<m>:MAXimum:RIGHT

This command moves a marker to the next lower peak.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command moves a marker to the next minimum value.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140
See ["Search Next Minimum"](#) on page 142

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See ["Search Minimum"](#) on page 141

CALCulate<n>:MARKer<m>:MINimum:RIGHT

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

Positioning Delta Markers

The following commands position delta markers on the trace.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT	310
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT	311
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]	311
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT	311
CALCulate<n>:DELTamarker<m>:MINimum:LEFT	311
CALCulate<n>:DELTamarker<m>:MINimum:NEXT	311
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]	311
CALCulate<n>:DELTamarker<m>:MINimum:RIGHT	312

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command moves a delta marker to the next higher value.

The search includes only measurement values to the left of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command moves a marker to the next higher value.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140
See ["Search Next Peak"](#) on page 141

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See ["Peak Search"](#) on page 141

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT

This command moves a delta marker to the next higher value.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command moves a marker to the next higher minimum value.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140
See ["Search Next Minimum"](#) on page 142

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Usage: Event

Manual operation: See ["Search Minimum"](#) on page 141

CALCulate<n>:DELTamarker<m>:MINimum:RIGHT

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

Usage: Event

Manual operation: See ["Search Mode for Next Peak"](#) on page 140

11.8.1.5 Configuring Special Marker Functions

The following commands are required to configure the special marker functions that are available in the Analog Demodulation application

- [Fixed Reference Marker Settings](#).....312
- [Marker Peak Lists](#)..... 314
- [n dB Down Marker](#)..... 317
- [Phase Noise Measurement Marker](#).....320

Fixed Reference Marker Settings

The following commands configure a fixed reference marker.

- [CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:MAXimum\[:PEAK\]](#)..... 312
- [CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:X](#)..... 312
- [CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:Y](#)..... 313
- [CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:Y:OFFSet](#)..... 313
- [CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed\[:STATE\]](#)..... 313

CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:MAXimum[:PEAK]

This command moves the fixed reference marker to the peak power.

Example: `CALC:DELT:FUNC:FIX:RPO:MAX`
Sets the reference point level for delta markers to the peak of the selected trace.

Usage: Event

Manual operation: See ["Defining a Fixed Reference"](#) on page 138
See ["Defining a Reference Point"](#) on page 144

CALCulate<n>:DELTamarker<m>:FUNCTION:FIXed:RPOint:X <RefPoint>

This command defines the horizontal position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

Parameters:

<RefPoint> Numeric value that defines the horizontal position of the reference.
 For frequency domain measurements, it is a frequency in Hz.
 For time domain measurements, it is a point in time in s.
 *RST: Fixed Reference: OFF

Example:

```
CALC:DELT:FUNC:FIX:RPO:X 128 MHz
```

Sets the frequency reference to 128 MHz.

Manual operation: See ["Defining a Fixed Reference"](#) on page 138
 See ["Defining a Reference Point"](#) on page 144

CALCulate<n>:DELTaMarker<m>:FUNCTION:FIXed:RPOint:Y <RefPointLevel>

This command defines the vertical position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

Parameters:

<RefPoint> Numeric value that defines the vertical position of the reference.
 The unit and value range is variable.
 *RST: Fixed Reference: OFF

Example:

```
CALC:DELT:FUNC:FIX:RPO:Y -10 dBm
```

Sets the reference point level for delta markers to -10 dBm.

Manual operation: See ["Defining a Fixed Reference"](#) on page 138
 See ["Defining a Reference Point"](#) on page 144

CALCulate<n>:DELTaMarker<m>:FUNCTION:FIXed:RPOint:Y:OFFSet <Offset>

This command defines a level offset for the fixed delta marker reference point.

Parameters:

<Offset> Numeric value
 *RST: 0
 Default unit: dB

CALCulate<n>:DELTaMarker<m>:FUNCTION:FIXed[:STATe] <State>

This command activates or deactivates a marker that defines a fixed reference point for relative marker analysis.

If necessary, the command activates a marker and positions it on the peak power.

Subsequently, you can change the coordinates of the fixed reference independent of the marker. The fixed reference is independent of the trace and is applied to all active delta markers.

Parameters:

<State> ON | OFF
 *RST: OFF

Example: `CALC:DELT:FUNC:FIX ON`
Switches on the measurement with fixed reference value for all delta markers.
`CALC:DELT:FUNC:FIX:RPO:X 128 MHZ`
Sets the frequency reference to 128 MHz.
`CALC:DELT:FUNC:FIX:RPO:Y 30 DBM`
Sets the reference level to +30 dBm.

Manual operation: See ["Defining a Fixed Reference"](#) on page 138

Marker Peak Lists

Useful commands for peak lists described elsewhere

- [CALCulate<n>:MARKer:PEXCursion](#) on page 308
- [MMEMory:STORe:PEAK](#) on page 317
- [chapter 11.8.1.3, "Marker Search Settings"](#), on page 308

Remote commands exclusive to peak lists

CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:ANNOtation:LABel[:STATe]	314
CALCulate:MARKer:FUNCTion:FPEaks:COUNT?	314
CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:[IMMEDIATE]	315
CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:LIST:SIZE	315
CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:SORT	315
CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:STAT	316
CALCulate:MARKer:FUNCTion:FPEaks:X?	316
CALCulate:MARKer:FUNCTion:FPEaks:Y?	316
MMEMory:STORe:LIST	317
MMEMory:STORe:PEAK	317

CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:ANNOtation:LABel[:STATe] <State>

This command turns labels for peaks found during a peak search on and off.

The labels correspond to the marker number in the marker peak list.

Parameters:

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

Example: `CALC:MARK:FUNC:FPE:ANN:LAB:STAT OFF`
Removes the peak labels from the diagram

Manual operation: See ["Displaying Marker Numbers"](#) on page 147

CALCulate:MARKer:FUNCTion:FPEaks:COUNT?

This command queries the number of peaks that have been found during a peak search.

The actual number of peaks that have been found may differ from the number of peaks you have set to be found because of the peak excursion.

Return values:

<NumberOfPeaks>

Example:

```
CALC:MARK:FUNC:FPE:COUN?
```

Queries the number of peaks.

Usage:

Query only

CALCulate<n>:MARKer<m>:FUNction:FPEaks[:IMMediate] <Peaks>

This command initiates a peak search.

Parameters:

<Peaks>

This parameter defines the number of peaks to find during the search.

Note that the actual number of peaks found during the search also depends on the peak excursion you have set with

[CALCulate<n>:MARKer:PEXCursion](#).

Range: 1 to 200

Example:

```
CALC:MARK:PEXC 5
```

Defines a peak excursion of 5 dB, i.e. peaks must be at least 5 dB apart to be detected as a peak.

```
CALC:MARK:FUNC:FPE 10
```

Initiates a search for 10 peaks on the current trace.

CALCulate<n>:MARKer<m>:FUNction:FPEaks:LIST:SIZE <MaxNoPeaks>

This command defines the maximum number of peaks that the R&S FSW looks for during a peak search.

Parameters:

<MaxNoPeaks>

Maximum number of peaks to be determined.

Range: 1 to 200

*RST: 50

Example:

```
CALC:MARK:FUNC:FPE:LIST:SIZE 10
```

The marker peak list will contain a maximum of 10 peaks.

Manual operation:

See "[Maximum Number of Peaks](#)" on page 146

CALCulate<n>:MARKer<m>:FUNction:FPEaks:SORT <SortMode>

This command selects the order in which the results of a peak search are returned.

Parameters:

<SortMode> **X**
Sorts the peaks according to increasing position on the x-axis.

Y
Sorts the peaks according to decreasing position on the y-axis.

*RST: X

Example:

CALC:MARK:FUNC:FPE:SORT Y
Sets the sort mode to decreasing y values

Manual operation: See "[Sort Mode](#)" on page 146

CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:STAT <State>

This command turns a peak search on and off.

Parameters:

<State> ON | OFF

*RST: OFF

Example:

CALC:MARK:FUNC:FPE:STAT ON
Activates marker peak search

Manual operation: See "[Peak List State](#)" on page 146

CALCulate:MARKer:FUNCTion:FPEeaks:X?

This command queries the position of the peaks on the x-axis.

The order depends on the sort order that has been set with [CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:SORT](#).

Return values:

<PeakPosition> Position of the peaks on the x-axis. The unit depends on the measurement.

Usage: Query only

CALCulate:MARKer:FUNCTion:FPEeaks:Y?

This command queries the position of the peaks on the y-axis.

The order depends on the sort order that has been set with [CALCulate<n>:MARKer<m>:FUNCTion:FPEaks:SORT](#).

Return values:

<PeakPosition> Position of the peaks on the y-axis. The unit depends on the measurement.

Usage: Query only

MMEMory:STORe:LIST <FileName>

This command exports the SEM and spurious emission list evaluation to a file.

The file format is *.dat.

Secure User Mode

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Parameters:

<FileName> String containing the path and name of the target file.

Example:

```
MMEM:STOR:LIST 'test'
```

Stores the current list evaluation results in the test.dat file.

MMEMory:STORe:PEAK <FileName>

This command exports the marker peak list to a file.

The file format is *.dat.

Secure User Mode

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Parameters:

<FileName> String containing the path and name of the target file.

Example:

```
MMEM:STOR:PEAK 'test'
```

Saves the current marker peak list in the file test.dat.

Usage:

Event

Manual operation: See ["Exporting the Peak List"](#) on page 147

n dB Down Marker

The following commands control the n dB down markers.

CALCulate<n>:MARKer<m>:FUNction:NDBDown.....	318
CALCulate<n>:MARKer<m>:FUNction:NDBDown:FREQuency?.....	318
CALCulate:MARKer:FUNction:NDBDown:QFACtor?.....	319
CALCulate<n>:MARKer<m>:FUNction:NDBDown:RESult?.....	319
CALCulate<n>:MARKer<m>:FUNction:NDBDown:STATe.....	319
CALCulate<n>:MARKer<m>:FUNction:NDBDown:TIME?.....	320

CALCulate<n>:MARKer<m>:FUNction:NDBDown <Distance>

This command defines the distance of the n dB down markers to the reference marker.

Parameters:

<Distance>	Distance of the temporary markers to the reference marker in dB. For a positive offset, the markers T1 and T2 are placed <i>below</i> the active reference point. For a negative offset (for example for notch filter measurements), the markers T1 and T2 are placed <i>above</i> the active reference point.
*RST:	6dB

Example:

```
CALC:MARK:FUNC:NDBD 3dB
```

Sets the distance to the reference marker to 3 dB.

CALCulate<n>:MARKer<m>:FUNction:NDBDown:FREQuency?

This command queries the position of the n dB down markers on the x-axis when measuring in the frequency domain.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also [INITiate:CONTinuous](#) on page 278.

Return values:

<Frequency>	<frequency 1> absolute frequency of the n dB marker to the left of the reference marker in Hz
	<frequency 2> absolute frequency of the n dB marker to the right of the reference marker in Hz.

Example:

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:NDBD ON
```

Switches on the n dB down function.

```
INIT; *WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:NDBD:FREQ?
```

This command would return, for example, 100000000, 200000000, meaning that the first marker position is at 100 MHz, the second marker position is at 200 MHz

Usage: Query only
Manual operation: See "[n dB down Delta Value](#)" on page 145

CALCulate:MARKer:FUNCtion:NDBDown:QFACTOR?

This command queries the Q factor of n dB down measurements.

Return values:
 <QFactor>

Usage: Query only

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown:RESult?

This command queries the distance of the n dB down markers from each other.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also [INITiate:CONTinuous](#) on page 278.

Return values:
 <Distance>

The result depends on the span.

In case of frequency domain measurements, the command returns the bandwidth between the two n dB down markers in Hz.

In case of time domain measurements, the command returns the pulse width between the two n dB down markers in seconds.

Example:

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:NDBD ON
```

Switches on the n dB down function.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:NDBD:RES?
```

Outputs the measured value.

Usage: Query only

Manual operation: See "[n dB down Marker State](#)" on page 145

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown:STATe <State>

This command turns the n dB Down marker function on and off.

Parameters:

<State> ON | OFF

*RST: OFF

Example:

```
CALC:MARK:FUNC:NDBD:STAT ON
```

Turns the n dB Down marker on.

Manual operation: See "[n dB down Marker State](#)" on page 145

CALCulate<n>:MARKer<m>:FUNCTion:NDBDown:TIME?

This command queries the position of the n dB down markers on the x-axis when measuring in the time domain.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also `INITiate:CONTinuous` on page 278.

Return values:

<TimeX1>	absolute position in time of the n dB marker to the left of the reference marker in seconds
<TimeX2>	absolute position in time of the n dB marker to the right of the reference marker in seconds

Example:

```
INIT:CONT OFF
Switches to single sweep mode
CALC:MARK:FUNC:NDBD ON
Switches on the n dB down function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:NDBD:TIME?
Outputs the time values of the temporary markers.
```

Usage: Query only

Manual operation: See "[n dB down Delta Value](#)" on page 145

Phase Noise Measurement Marker

The following commands control the phase noise measurement marker function.

Useful commands for phase noise markers described elsewhere

- `CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:MAXimum[:PEAK]`
- `CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:X`
- `CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:Y`

Remote commands exclusive to phase noise markers

<code>CALCulate<n>:DELTamarker<m>:FUNCTion:PNOise:AUTO</code>	320
<code>CALCulate<n>:DELTamarker<m>:FUNCTion:PNOise:RESult?</code>	321
<code>CALCulate<n>:DELTamarker<m>:FUNCTion:PNOise[:STATe]</code>	321

CALCulate<n>:DELTamarker<m>:FUNCTion:PNOise:AUTO <State>

This command turns an automatic peak search for the fixed reference marker at the end of a sweep on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

CALC:DELT:FUNC:PNO:AUTO ON

Activates an automatic peak search for the reference marker in a phase-noise measurement.

Manual operation: See ["Defining a Reference Point"](#) on page 144

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:RESult?

This command queries the result of a phase noise measurement.

If necessary, the command activates the measurement first.

Return values:

<PhaseNoise>

Example:

CALC:DELT2:FUNC:PNO:RES?

Outputs the result of phase-noise measurement of the delta-marker 2.

Usage:

Query only

Manual operation: See ["Phase Noise Measurement State"](#) on page 144

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] <State>

This command turns the phase noise measurement at the delta marker position on and off.

The reference marker for phase noise measurements is either a normal marker or a fixed reference. If necessary, the command turns on the reference marker.

The correction values for the bandwidth and the log amplifier are taken into account in the measurement.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

CALC:DELT:FUNC:PNO ON

Switches on the phase-noise measurement with all delta markers.

CALC:DELT:FUNC:FIX:RPO:X 128 MHZ

Sets the frequency reference to 128 MHz.

CALC:DELT:FUNC:FIX:RPO:Y 30 DBM

Sets the reference level to +30 dBm

Manual operation: See ["Phase Noise Measurement State"](#) on page 144
 See ["Switching All Phase Noise Measurements Off"](#) on page 144

11.8.2 Defining Limit Checks

Note that in remote control, upper and lower limit lines are configured using separate commands. Thus, you must decide in advance which you want to configure. The x-values for both upper and lower limit lines are defined as a common control line. This control line is the reference for the y-values for both upper and lower limit lines.

- [Configuring Limit Lines](#).....322
- [Managing Limit Lines](#)..... 329
- [Checking the Results of a Limit Check](#)..... 331
- [Programming Example: Using Limit Lines](#)..... 332

11.8.2.1 Configuring Limit Lines

CALCulate:LIMit:COMMeNt	322
CALCulate:LIMit<k>:CONTRol[:DATA]	323
CALCulate:LIMit<k>:CONTRol:DOMain	323
CALCulate:LIMit<k>:CONTRol:MODE	323
CALCulate:LIMit<k>:CONTRol:OFFSet	323
CALCulate:LIMit<k>:CONTRol:SHIFt	324
CALCulate:LIMit<k>:CONTRol:SPACing	324
CALCulate:LIMit<k>:LOWer[:DATA]	324
CALCulate:LIMit<k>:LOWer:MARGin	325
CALCulate:LIMit<k>:LOWer:MODE	325
CALCulate:LIMit<k>:LOWer:OFFSet	325
CALCulate:LIMit<k>:LOWer:SHIFt	325
CALCulate:LIMit<k>:LOWer:SPACing	326
CALCulate:LIMit<k>:LOWer:STATe	326
CALCulate:LIMit<k>:LOWer:THReshold	326
CALCulate:LIMit<k>:NAME	326
CALCulate:LIMit<k>:UNIT	327
CALCulate:LIMit<k>:UPPer[:DATA]	327
CALCulate:LIMit<k>:UPPer:MARGin	327
CALCulate:LIMit<k>:UPPer:MODE	327
CALCulate:LIMit<k>:UPPer:OFFSet	328
CALCulate:LIMit<k>:UPPer:SHIFt	328
CALCulate:LIMit<k>:UPPer:SPACing	328
CALCulate:LIMit<k>:UPPer:STATe	329
CALCulate:LIMit<k>:UPPer:THReshold	329

CALCulate:LIMit:COMMeNt <Comment>

This command defines a comment for a limit line.

Parameters:

<Comment> String containing the description of the limit line. The comment may have up to 40 characters.

Manual operation: See "[Comment](#)" on page 151

CALCulate:LIMit<k>:CONTrol[:DATA] <LimitLinePoints>

This command defines the horizontal definition points of a limit line.

Parameters:

<LimitLinePoints> Variable number of x-axis values.
 Note that the number of horizontal values has to be the same as the number of vertical values set with `CALCulate:LIMit<k>:LOWer[:DATA]` or `CALCulate:LIMit<k>:UPPer[:DATA]`. If not, the R&S FSW either adds missing values or ignores surplus values.
 The unit is Hz or s.
 *RST: -

Usage: SCPI confirmed

Manual operation: See "[Data points](#)" on page 152

CALCulate:LIMit<k>:CONTrol:DOMain <SpanSetting>

This command selects the domain of the limit line.

Parameters:

<SpanSetting> FREQUENCY | TIME
 *RST: FREQUENCY

Manual operation: See "[X-Axis](#)" on page 152

CALCulate:LIMit<k>:CONTrol:MODE <Mode>

This command selects the horizontal limit line scaling.

Parameters:

<Mode> **ABSolute**
 Limit line is defined by absolute physical values (Hz or s).
RELative
 Limit line is defined by relative values related to the center frequency (frequency domain) or the left diagram border (time domain).
 *RST: ABSolute

CALCulate:LIMit<k>:CONTrol:OFFSet <Offset>

This command defines an offset for a complete limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Parameters:

<Offset> Numeric value.
 The unit depends on the scale of the x-axis.
 *RST: 0

Manual operation: See "[X-Offset](#)" on page 149

CALCulate:LIMit<k>:CONTrol:SHIFt <Distance>

This command moves a complete limit line horizontally.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Parameters:

<Distance> Numeric value.
 The unit depends on the scale of the x-axis.

Manual operation: See "[Shift x](#)" on page 153

CALCulate:LIMit<k>:CONTrol:SPACing <InterpolMode>

This command selects linear or logarithmic interpolation for the calculation of limit lines from one horizontal point to the next.

Parameters:

<InterpolMode> LINear | LOGarithmic
 *RST: LIN

Example: CALC:LIM:CONT:SPAC LIN

CALCulate:LIMit<k>:LOWer[:DATA] <LimitLinePoints>

This command defines the vertical definition points of a lower limit line.

Parameters:

<LimitLinePoints> Variable number of level values.
 Note that the number of vertical values has to be the same as the number of horizontal values set with [CALCulate:LIMit<k>:CONTrol\[:DATA\]](#). If not, the R&S FSW either adds missing values or ignores surplus values.
 The unit depends on [CALCulate:LIMit<k>:UNIT](#) on page 327.
 *RST: Limit line state is OFF

Usage: SCPI confirmed

Manual operation: See "[Data points](#)" on page 152

CALCulate:LIMit<k>:LOWer:MARGin <Margin>

This command defines an area around a lower limit line where limit check violations are still tolerated.

Parameters:

<Margin> **numeric value**
 *RST: 0
 Default unit: dB

Manual operation: See "[Margin](#)" on page 152

CALCulate:LIMit<k>:LOWer:MODE <Mode>

This command selects the vertical limit line scaling.

Parameters:

<Mode> **ABSolute**
 Limit line is defined by absolute physical values.
 The unit is variable.

RELative
 Limit line is defined by relative values related to the reference
 level (dB).
 *RST: ABSolute

Manual operation: See "[X-Axis](#)" on page 152

CALCulate:LIMit<k>:LOWer:OFFSet <Offset>

This command defines an offset for a complete lower limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Parameters:

<Offset> Numeric value.
 *RST: 0
 Default unit: dB

Manual operation: See "[Y-Offset](#)" on page 149

CALCulate:LIMit<k>:LOWer:SHIFt <Distance>

This command moves a complete lower limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Parameters:

<Distance> Defines the distance that the limit line moves.
 The unit depends on [CALCulate:LIMit<k>:UNIT](#)
 on page 327.

Manual operation: See ["Shift y"](#) on page 153

CALCulate:LIMit<k>:LOWer:SPACing <InterpolType>

This command selects linear or logarithmic interpolation for the calculation of a lower limit line from one horizontal point to the next.

Parameters:

<InterpolType> LINear | LOGarithmic
 *RST: LIN

Manual operation: See ["X-Axis"](#) on page 152
 See ["Y-Axis"](#) on page 152

CALCulate:LIMit<k>:LOWer:STATe <State>

This command turns a lower limit line on and off.

Before you can use the command, you have to select a limit line with [CALCulate:LIMit<k>:NAME](#) on page 326.

Parameters:

<State> ON | OFF
 *RST: OFF

Usage: SCPI confirmed

Manual operation: See ["Visibility"](#) on page 149

CALCulate:LIMit<k>:LOWer:THReshold <Threshold>

This command defines a threshold for relative limit lines.

The R&S FSW uses the threshold for the limit check, if the limit line violates the threshold.

Parameters:

<Threshold> Numeric value.
 The unit depends on [CALCulate:LIMit<k>:UNIT](#)
 on page 327.
 *RST: -200 dBm

Manual operation: See ["Threshold"](#) on page 151

CALCulate:LIMit<k>:NAME <Name>

This command selects a limit line that already exists or defines a name for a new limit line.

Parameters:

<Name> String containing the limit line name.
 *RST: REM1 to REM8 for lines 1 to 8

Manual operation: See "Name" on page 151

CALCulate:LIMit<k>:UNIT <Unit>

This command defines the unit of a limit line.

Parameters:

<Unit> If you select dB as the limit line unit, the command automatically turns the limit line into a relative limit line.

*RST: DBM

Manual operation: See "Y-Axis" on page 152

CALCulate:LIMit<k>:UPPer[:DATA] <LimitLinePoints>

This command defines the vertical definition points of an upper limit line.

Parameters:

<LimitLinePoints> Variable number of level values.
Note that the number of vertical values has to be the same as the number of horizontal values set with `CALCulate:LIMit<k>:CONTRol[:DATA]`. If not, the R&S FSW either adds missing values or ignores surplus values.

The unit depends on `CALCulate:LIMit<k>:UNIT` on page 327.

*RST: Limit line state is OFF

Usage: SCPI confirmed

Manual operation: See "Data points" on page 152

CALCulate:LIMit<k>:UPPer:MARGIN <Margin>

This command defines an area around an upper limit line where limit check violations are still tolerated.

Parameters:

<Margin> **numeric value**

*RST: 0

Default unit: dB

Manual operation: See "Margin" on page 152

CALCulate:LIMit<k>:UPPer:MODE <Mode>

This command selects the vertical limit line scaling.

Parameters:

<Mode>

ABSolute

Limit line is defined by absolute physical values.
The unit is variable.

RELative

Limit line is defined by relative values related to the reference level (dB).

*RST: ABSolute

Manual operation: See "[X-Axis](#)" on page 152**CALCulate:LIMit<k>:UPPer:OFFSet <Offset>**

This command defines an offset for a complete upper limit line.

Compared to shifting the limit line, an offset does not actually change the limit line definition points.

Parameters:

<Offset>

Numeric value.

*RST: 0

Default unit: dB

Manual operation: See "[Y-Offset](#)" on page 149**CALCulate:LIMit<k>:UPPer:SHIFt <Distance>**

This command moves a complete upper limit line vertically.

Compared to defining an offset, this command actually changes the limit line definition points by the value you define.

Parameters:

<Distance>

Defines the distance that the limit line moves.

The unit depends on [CALCulate:LIMit<k>:UNIT](#)
on page 327.

Usage:

Event

Manual operation: See "[Shift y](#)" on page 153**CALCulate:LIMit<k>:UPPer:SPACing <InterpolType>**

This command selects linear or logarithmic interpolation for the calculation of an upper limit line from one horizontal point to the next.

Parameters:

<InterpolType>

LINear | LOGarithmic

*RST: LIN

Manual operation: See "[X-Axis](#)" on page 152
See "[Y-Axis](#)" on page 152

CALCulate:LIMit<k>:UPPer:STATe <State>

This command turns an upper limit line on and off.

Before you can use the command, you have to select a limit line with `CALCulate:LIMit<k>:NAME` on page 326.

Parameters:

<State> ON | OFF
*RST: OFF

Usage: SCPI confirmed

Manual operation: See "[Visibility](#)" on page 149

CALCulate:LIMit<k>:UPPer:THReshold <Limit>

This command defines an absolute limit for limit lines with a relative scale.

The R&S FSW uses the threshold for the limit check, if the limit line violates the threshold.

Parameters:

<Limit> Numeric value.
The unit depends on `CALCulate:LIMit<k>:UNIT` on page 327.
*RST: -200
Default unit: dBm

Manual operation: See "[Threshold](#)" on page 151

11.8.2.2 Managing Limit Lines

Useful commands for managing limit lines described in the R&S FSW User Manual:

- `MMEM:SEL[:ITEM]:LIN:ALL`
- `MMEM:STOR:TYPE`
- `MMEM:LOAD:TYPE`

Remote commands exclusive to managing limit lines:

<code>CALCulate:LIMit:ACTive?</code>	329
<code>CALCulate:LIMit<k>:COPY</code>	330
<code>CALCulate:LIMit<k>:DELeTe</code>	330
<code>CALCulate:LIMit<k>:STATe</code>	330
<code>CALCulate:LIMit<k>:TRACe<t>:CHECK</code>	331

CALCulate:LIMit:ACTive?

This command queries the names of all active limit lines.

Return values:

<LimitLines> String containing the names of all active limit lines in alphabetical order.

Example:

```
CALC:LIM:ACT?
```

Queries the names of all active limit lines.

Usage:

Query only

Manual operation: See "[Visibility](#)" on page 149

CALCulate:LIMit<k>:COPY <Line>

This command copies a limit line.

Parameters:

<Line> **1 to 8**
number of the new limit line

<name>

String containing the name of the limit line.

Example:

```
CALC:LIM1:COPY 2
```

Copies limit line 1 to line 2.

```
CALC:LIM1:COPY 'FM2'
```

Copies limit line 1 to a new line named FM2.

Manual operation: See "[Copy Line](#)" on page 150

CALCulate:LIMit<k>:DELeTe

This command deletes a limit line.

Usage:

Event

Manual operation: See "[Delete Line](#)" on page 150

CALCulate:LIMit<k>:STATe <State>

This command turns the limit check for a specific limit line on and off.

To query the limit check result, use `CALCulate:LIMit<k>:FAIL?`.

Note that a new command exists to activate the limit check and define the trace to be checked in one step (see `CALCulate:LIMit<k>:TRACe<t>:CHECK` on page 331).

Parameters:

<State> ON | OFF
*RST: OFF

Example:

```
CALC:LIM:STAT ON
```

Switches on the limit check for limit line 1.

Usage:

SCPI confirmed

Manual operation: See "[Disable All Lines](#)" on page 150

CALCulate:LIMit<k>:TRACe<t>:CHECK <State>

This command turns the limit check for a specific trace on and off.

To query the limit check result, use `CALCulate:LIMit<k>:FAIL?`.

Note that this command replaces the two commands from previous signal and spectrum analyzers (which are still supported, however):

- `CALC:LIM:TRAC`; see the description of commands for compatibility in the R&S FSW User Manual
- `CALCulate:LIMit<k>:STATe` on page 330

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

`CALC:LIM3:TRAC2:CHEC ON`
 Switches on the limit check for limit line 3 on trace 2.

Manual operation: See "Traces to be Checked" on page 149

11.8.2.3 Checking the Results of a Limit Check

<code>CALCulate:LIMit:CLEar[:IMMediate]</code>	331
<code>CALCulate:LIMit<k>:FAIL?</code>	331

CALCulate:LIMit:CLEar[:IMMediate]

This command deletes the result of the current limit check.

The command works on all limit lines in all measurement windows at the same time.

Example:

`CALC:LIM:CLE`
 Deletes the result of the limit check.

Usage:

SCPI confirmed

CALCulate:LIMit<k>:FAIL?

This command queries the result of a limit check.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also `INITiate:CONTinuous` on page 278.

Return values:

<Result> 0
 PASS
 1
 FAIL

Example:	INIT;*WAI Starts a new sweep and waits for its end. CALC:LIM3:FAIL? Queries the result of the check for limit line 3.
Usage:	Query only SCPI confirmed

11.8.2.4 Programming Example: Using Limit Lines

The following examples demonstrate how to work with limit lines in a remote environment.

- [Example: Configuring Limit Lines](#).....332
- [Example: Performing a Limit Check](#).....333

Example: Configuring Limit Lines

This example demonstrates how to configure 2 limit lines - an upper and a lower limit - for a measurement in a remote environment.

```
//----- Configuring the limit lines -----
CALC:LIM1:NAME 'FM1'
//Names limit line 1 'FM1'.

CALC:LIM1:CONT:MODE ABS
//Selects absolute scaling for the horizontal axis.
CALC:LIM1:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 1.
CALC:LIM1:UPP:MODE ABS
//Selects an absolute vertical scale for limit line 1.
CALC:LIM1:UNIT DBM
//Selects the unit dBm for limit line 1.
CALC:LIM1:UPP -10,-5,0,-5,-10
//Defines 5 definition points for limit line 1.

CALC:LIM1:UPP:MARG 5dB
//Defines an area of 5 dB around limit line 1 where limit check violations
//are still tolerated.

CALC:LIM1:UPP:SHIF -10DB
//Shifts the limit line 1 by -10 dB.
CALC:LIM1:UPP:OFFS -3dB
//Defines an additional -3 dB offset for limit line 1.

CALC:LIM3:NAME 'FM3'
//Names limit line 3 'FM3'.

CALC:LIM3:LOW:MODE REL
//Selects a relative vertical scale for limit line 3.
CALC:LIM3:UNIT DB
```

```

CALC:LIM3:CONT 1 MHz,50MHz,100 MHz,150MHz,200MHz
//Defines 5 horizontal definition points for limit line 3.
CALC:LIM3:LOW -90,-60,-40,-60,-90
//Defines 5 definition points relative to the reference level for limit line 3.

CALC:LIM3:LOW:SHIF 2
//Shifts the limit line 3 by 2dB.
CALC:LIM3:LOW:OFFS 3
//Defines an additional 3 dB offset for limit line 3.

CALC:LIM3:LOW:THR -200DBM
//Defines a power threshold of -200dBm that must be exceeded for limit to be checked

CALC:LIM3:LOW:MARG 5dB
//Defines an area of 5dB around limit line 3 where limit check violations
//are still tolerated.

//----- Storing the limit lines -----
MMEM:SEL:CHAN:LIN:ALL ON
MMEM:STOR:TYPE CHAN
MMEM:STOR:STAT 1,'LimitLines_FM1_FM3'

```

Example: Performing a Limit Check

This example demonstrates how to perform a limit check during a basic frequency sweep measurement in a remote environment. The limit lines configured in ["Example: Configuring Limit Lines"](#) on page 332 are assumed to exist and be active.

```

//-----Preparing the instrument -----
*RST
//Resets the instrument
INIT:CONT OFF
//Selects single sweep mode.

//-----Configuring the measurement -----
FREQ:CENT 100MHz
//Defines the center frequency
FREQ:SPAN 200MHz
//Sets the span to 100 MHz on either side of the center frequency.
SENS:SWE:COUN 10
//Defines 10 sweeps to be performed in each measurement.
DISP:TRAC1:Y:RLEV 0dBm
//Sets the reference level to 0 dBm.
TRIG:SOUR IFP
TRIG:LEV:IFP -10dBm
//Defines triggering when the second intermediate frequency rises to a level
//of -10 dBm.

//-----Configuring the Trace-----
DISP:TRAC2 ON

```

```

DISP:TRAC2:MODE AVER
DISP:TRAC3 ON
DISP:TRAC3:MODE MAXH
//Configures 3 traces: 1 (default): clear/write; 2: average; 3: max hold

//----- Configuring the limit check -----
MMEM:LOAD:TYPE REPL
MMEM:LOAD:STAT 1,'LimitLines_FM1_FM3'
//Loads the limit lines stored in 'LimitLines_FM1_FM3'
CALC:LIM1:NAME 'FM1'
CALC:LIM1:UPP:STAT ON
//Activates upper limit FM1 as line 1.
CALC:LIM3:NAME 'FM3'
CALC:LIM3:LOW:STAT ON
//Activates lower limit line FM3 as line 3.
CALC:LIM:ACT?
//Queries the names of all active limit lines
//Result: 'FM1,FM3'
CALC:LIM1:TRAC3:CHEC ON
//Activates the upper limit to be checked against trace3 (maxhold trace)
CALC:LIM3:TRAC2:CHEC ON
//Activates the upper limit to be checked against trace2 (average trace)
CALC:LIM:CLE
//Clears the previous limit check results

//----- Performing the measurement-----
INIT;*WAI
//Initiates a new measurement and waits until the last sweep has finished.

//----- Retrieving limit check results-----

CALC:LIM1:FAIL?
//Queries the result of the upper limit line check
CALC:LIM3:FAIL?
//Queries the result of the lower limit line check

```

11.8.3 Zooming into the Display

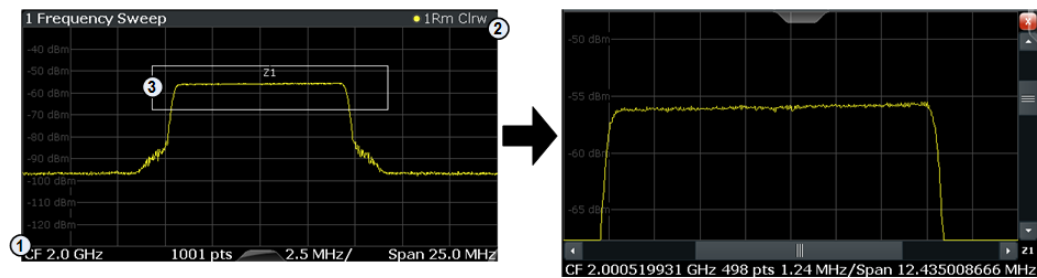
11.8.3.1 Using the Single Zoom

DISPlay[:WINDow<n>]:ZOOM:AREA..... 334
DISPlay[:WINDow<n>]:ZOOM:STATe..... 335

DISPlay[:WINDow<n>]:ZOOM:AREA <x1>,<y1>,<x2>,<y2>

This command defines the zoom area.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
 2 = end point of system (x2 = 100, y2 = 100)
 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Parameters:

<x1>,<y1>,
 <x2>,<y2>

Diagram coordinates in % of the complete diagram that define the zoom area.

The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.

Range: 0 to 100

Default unit: PCT

Manual operation: See "Single Zoom" on page 153

DISPlay[:WINDow<n>]:ZOOM:STATE <State>

This command turns the zoom on and off.

Parameters:

<State> ON | OFF
 *RST: OFF

Example:

DISP:ZOOM ON
 Activates the zoom mode.

Manual operation: See "Single Zoom" on page 153
 See "Restore Original Display" on page 154
 See "Deactivating Zoom (Selection mode)" on page 154

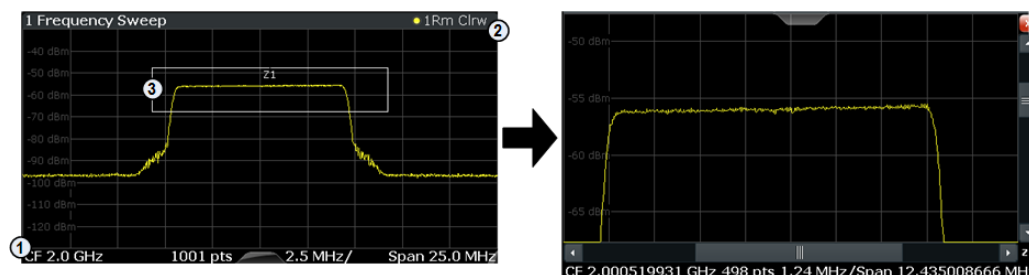
11.8.3.2 Using the Multiple Zoom

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA.....335
 DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATE..... 336

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA <x1>,<y1>,<x2>,<y2>

This command defines the zoom area for a multiple zoom.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
 2 = end point of system (x2 = 100, y2 = 100)
 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Suffix:

<zoom> 1...4
 Selects the zoom window.

Parameters:

<x1>, <y1>, <x2>, <y2>
 Diagram coordinates in % of the complete diagram that define the zoom area.
 The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.
 Range: 0 to 100
 Default unit: PCT

Manual operation: See ["Multiple Zoom"](#) on page 153

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe <State>

This command turns the multiple zoom on and off.

Suffix:

<zoom> 1...4
 Selects the zoom window.
 If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

Parameters:

<State> ON | OFF
 *RST: OFF

Manual operation: See ["Multiple Zoom"](#) on page 153
 See ["Restore Original Display"](#) on page 154
 See ["Deactivating Zoom \(Selection mode\)"](#) on page 154

11.8.4 Configuring an Analysis Interval and Line (MSRA mode only)

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA applications define an extract of the captured data for analysis, referred to as the **analysis interval**. The **analysis line** is a common time marker for all MSRA applications.

For the Analog Demodulation application, the commands to define the analysis interval are the same as those used to define the actual data acquisition (see [chapter 11.4.6, "Configuring Data Acquisition"](#), on page 240. Be sure to select the correct measurement channel before executing these commands.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the Analog Demodulation measurement.

Useful commands related to MSRA mode described elsewhere:

- `INITiate:REFresh` on page 279
- `INITiate:SEQuencer:REFresh[:ALL]` on page 281

Remote commands exclusive to MSRA applications

The following commands are only available for MSRA application channels:

<code>CALCulate:MSRA:ALINE:SHOW</code>	337
<code>CALCulate:MSRA:ALINE[:VALue]</code>	337
<code>CALCulate:MSRA:WINDow<n>:IVAL?</code>	338
<code>[SENSe:]MSRA:CAPTure:OFFSet</code>	338

`CALCulate:MSRA:ALINE:SHOW`

This command defines whether or not the analysis line is displayed in all time-based windows in all MSRA applications and the MSRA Master.

Note: even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active application remains in the window title bars.

Parameters:

<State> ON | OFF
 *RST: ON

Manual operation: See ["Show Line"](#) on page 155

`CALCulate:MSRA:ALINE[:VALue]` <Position>

This command defines the position of the analysis line for all time-based windows in all MSRA applications and the MSRA Master.

Parameters:

<Position> Position of the analysis line in seconds. The position must lie within the measurement time of the MSRA measurement.
 Default unit: s

Manual operation: See ["Position"](#) on page 155

CALCulate:MSRA:WINDow<n>:IVAL?

This command queries the analysis interval for the window specified by the index <n>. This command is only available in application measurement channels, not the MSRA View or MSRA Master.

Return values:

<IntStart> Start value of the analysis interval in seconds

Default unit: s

<IntStop> Stop value of the analysis interval in seconds

Usage: Query only

[SENSe:]MSRA:CAPTure:OFFSet <Offset>

This setting is only available for applications in MSRA mode, not for the MSRA Master. 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 application data. The offset must be a positive value, as the application can only analyze data that is contained in the capture buffer.

Range: 0 to <Record length>

*RST: 0

Manual operation: See "[Capture Offset](#)" on page 103

11.8.5 Configuring an Analysis Interval and Line (MSRT mode only)

In MSRT operating mode, only the MSRT Master actually captures data; the MSRT applications define an extract of the captured data for analysis, referred to as the **analysis interval**. The **analysis line** is a common time marker for all MSRT applications.

For the Analog Demodulation application, the commands to define the analysis interval are the same as those used to define the actual data acquisition (see [chapter 11.4.6, "Configuring Data Acquisition"](#), on page 240. Be sure to select the correct measurement channel before executing these commands.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the Analog Demodulation measurement.

Useful commands related to MSRT mode described elsewhere:

- [INITiate:REFresh](#) on page 279
- [INITiate:SEQuencer:REFresh\[:ALL\]](#) on page 281

Remote commands exclusive to MSRT applications

The following commands are only available for MSRT application channels:

CALCulate:RTMS:ALINE:SHOW.....	339
CALCulate:RTMS:ALINE[:VALue].....	339
CALCulate:RTMS:WINDow<n>:IVAL?.....	339
[SENSe:]RTMS:CAPTure:OFFSet.....	339

CALCulate:RTMS:ALINE:SHOW

This command defines whether or not the analysis line is displayed in all time-based windows in all MSRT applications and the MSRT Master.

Note: even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active application remains in the window title bars.

Parameters:

<State> ON | OFF
 *RST: ON

Manual operation: See "[Show Line](#)" on page 155

CALCulate:RTMS:ALINE[:VALue] <Position>

This command defines the position of the analysis line for all time-based windows in all MSRT applications and the MSRT Master.

Parameters:

<Position> Position of the analysis line in seconds. The position must lie within the measurement time (pretrigger + posttrigger) of the MSRT measurement.
 Default unit: s

Manual operation: See "[Position](#)" on page 155

CALCulate:RTMS:WINDow<n>:IVAL?

This command queries the analysis interval for the window specified by the index <n>. This command is only available in application measurement channels, not the MSRT View or MSRT Master.

Return values:

<IntStart> Start value of the analysis interval in seconds
 Default unit: s
 <IntStop> Stop value of the analysis interval in seconds

Usage: Query only

[SENSe:]RTMS:CAPTure:OFFSet <Offset>

This setting is only available for applications in MSRT mode, not for the MSRT Master. 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 application data. The offset must be a positive value, as the application can only analyze data that is contained in the capture buffer.

Range: - [pretrigger time] to min (posttrigger time; sweep time)

*RST: 0

Manual operation: See "[Capture Offset](#)" on page 103

11.9 Importing and Exporting I/Q Data and Results

The I/Q data to be evaluated in the Analog Demodulation application can not only be measured by the Analog Demodulation application itself, it can also be imported to the application, provided it has the correct format. Furthermore, the evaluated I/Q data from the Analog Demodulation application can be exported for further analysis in external applications.

For details on importing and exporting I/Q data see [chapter 7, "I/Q Data Import and Export"](#), on page 156.

MMEMory:LOAD:IQ:STATE	340
MMEMory:STORe:IQ:COMMENT	340
MMEMory:STORe:IQ:STATE	341

MMEMory:LOAD:IQ:STATE 1,<FileName>

This command restores I/Q data from a file.

Parameters:

<FileName> String containing the path and name of the source file.

Example: Loads IQ data from the specified file.

Usage: Setting only

Manual operation: See "[I/Q Import](#)" on page 157

MMEMory:STORe:IQ:COMMENT <Comment>

This command adds a comment to a file that contains I/Q data.

Parameters:

<Comment> String containing the comment.

Example: `MMEM:STOR:IQ:COMM 'Device test 1b'`
Creates a description for the export file.
`MMEM:STOR:IQ:STAT 1, 'C:`
`\R_S\Instr\user\data.iq.tar'`
Stores I/Q data and the comment to the specified file.

Manual operation: See "[I/Q Export](#)" on page 157

MMEMory:STORe:IQ:STATe 1, <FileName>

This command writes the captured I/Q data to a file.

The file extension is *.iq.tar. By default, the contents of the file are in 32-bit floating point format.

Secure User Mode

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 FSW User Manual.

Parameters:

1

<FileName> String containing the path and name of the target file.

Example:

```
MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'
```

Stores the captured I/Q data to the specified file.

Manual operation: See "[I/Q Export](#)" on page 157

11.10 Commands for Compatibility

The following commands are provided for compatibility to other signal analyzers only. For new remote control programs use the specified alternative commands.

[CALCulate<n>:FEED](#)..... 341

CALCulate<n>:FEED <Evaluation>

This command selects the evaluation method of the measured data that is to be displayed in the specified window.

Note that this command is maintained for compatibility reasons only. Use the `LAYout` commands for new remote control programs (see [chapter 11.6.2, "Working with Windows in the Display"](#), on page 283).

Parameters:

<Evaluation> Type of evaluation you want to display.
See the table below for available parameter values.

Example: INST:SEL ADEM
 Activates analog demodulator.
 CALC:FEED 'XTIM:FM'
 Selects the display of the FM signal.

Table 11-6: <Evaluation> parameter values for the AnalogDemod application

Parameter	Evaluation
'XTIM:AM:RELative'	AM Time Domain
'XTIM:AM:RELative:AFSPectrum'	AM Spectrum
'XTIM:FM'	FM Time Domain
'XTIM:FM:AFSPectrum'	FM Spectrum
'XTIM:PM'	PM Time Domain
'XTIM:PM:AFSPectrum'	PM Spectrum
'XTIM:SPECTrum'	RF Spectrum
'XTIM:AM' 'XTIM:RFPower'	RF Time Domain (= RF power)
'XTIM:AMSummary' 'XTIM:AMSummary:RELative' 'XTIM:FMSummary' 'XTIM:FMSummary:RELative' 'XTIM:PMSummary' 'XTIM:PMSummary:RELative' 'XTIM:SUMMARY'	Result summary

11.11 Programming Example

In this example we will configure and perform an analog demodulation measurement to demonstrate the remote control commands.

Signal generator settings (e.g. R&S SMU):

Frequency:	500 MHz
Level:	-10 dBm
Modulation:	FM
Modulation frequency:	10 kHz
Frequency deviation:	50 kHz

```
//-----Preparing the measurement -----
```

```
*RST
```

```

//Reset the instrument
FREQ:CENT 500 MHz
//Set the center frequency to 500 MHz
DISP:TRAC:Y:SCAL:RLEV 0
//Set the reference level to 0 dBm

//----- Activating an Analog Demod measurement channel -----

INST:CRE:NEW ADEM,'FMDemodulation'
//Activate an Analog Demodulation measurement channel named "FMDemodulation"

//----- Configuring data acquisition -----

ADEM:MTIM 1ms
//Set the measurement time to 1 ms (=10 periods)
SENS:ADJ:SCAL:Y:AUTO ON
//Optimize the scaling of the y-axis for the current measurement (continuously)
BAND:DEM 400 kHz
//Set the demodulation bandwidth to 400 kHz
TRIG:SOUR FM
//Use (offline) FM trigger
TRIG:LEV:FM 500MHz
//Trigger when signal reaches 500 MHz

//----- Configuring the result display -----

LAY:ADD:WIND? '1',BEL,'XTIM:FM:AFSP'
//Add an FM Spectrum result display below FM Time Domain
ADEM:FM:AFSP WRIT,AVER,OFF,OFF,OFF,OFF
//Defines two traces in the FM Spectrum: 1: Clear/write, 2: average
ADEM:SET 8MHz,32000,FM,POS,-500,30
//Set analog demodulator to execute 30 sweeps with 32000 samples each
//at a sample rate of 8 MHz; use FM trigger, trigger on positive slope
//with a pretrigger offset of 500 samples

//-----Performing the Measurement-----

INIT:CONT OFF
//Stop continuous sweep
INIT;*WAI
//Start a new measurement with 30 sweeps and wait for the end

//-----Retrieving Results-----

CALC:MARK:FUNC:ADEM:CARR?
//Queries the carrier power
//Result: -10.37 [dBm]
CALC2:MARK:FUNC:ADEM:SIN:RES?
//Queries the signal-to-noise-and-distortion ratio from the FM Spectrum
//Result: 65.026 [dB]

```

```
CALC2:MARK:FUNC:ADEM:THD:RES?  
//Queries the total harmonic distortion of the demodulated signal  
//from the FM Spectrum  
//Result: -66.413 [dB]  
CALC:MARK:FUNC:ADEM:FERR?  
//Queries the FM carrier offset (=frequency error) for the most recent  
//measurement (trace 1)  
//Result: 649.07 [Hz]  
ADEM:FM:OFFS? AVER  
//Queries FM carrier offset averaged over 30 measurements  
//Result: 600 [Hz]  
TRAC:DATA? TRACE1  
//Retrieve the trace data of the most recent measurement (trace 1)  
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,  
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]  
TRAC:DATA? TRACE2  
//Retrieve the averaged trace data for all 30 measurements (trace 2)  
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,  
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]
```


A Reference

A.1 Predefined Standards and Settings

You can configure the Analog Demodulation application using predefined standard settings. This allows for quick and easy configuration for commonly performed measurements.

For details see [chapter 5.2, "Configuration According to Digital Standards"](#), on page 51.

Provided standard files

The instrument comes prepared with the following standard settings:

- AM Broadcast
- FM Narrowband
- FM Broadcast
- Frequency Settling
- None (default settings)

The default storage location for the settings files is: `C:/FSW/user/predefined/AdemodPredefined`.

Predefined settings

The following parameters can be stored in a standard settings file. Any parameters that are not included in the xml file are set to their default values when the standard is loaded.

Measurement settings:

- DBW
- AQT
- Demod Filter
- Sweep Points
- Squelch (State, Level)
- Units (Phase, THD)
- RF Span

Window display settings:

- Position
- State
- Window number
- Window type (all evaluation methods supported by the Analog Demodulation application; see [chapter 3, "Measurements and Result Displays"](#), on page 15)
- Scaling (Ref Position, Dev per Division)

- Time Domain Zoom (State, Start, Length)

AF specific settings:

- AF Center
- AF Span
- AF Filters (Lowpass, Highpass, Deemphasis, Weighting)
- Scaling for Spectrum (Ref Value, Deviation)
- Scaling for Time Domain (Ref Value, AF Coupling (FM/PM only))

Table 1-1: List of predefined standards and settings

Setting	AM Broadcast	FM Narrowband	FM Broadcast	Frequency Settling *)	None (Default)
Demod. bandwidth	100 kHz	100 kHz	400 kHz	5 MHz	5 MHz
Aquisition time	100 ms	100 ms	100 ms	10 ms	62.5 μs
Input coupling	AC	AC	AC		AC
Squelch level				-30 dBm	-20 dBm
Windows	RF Spectrum AM Time Domain AM Spectrum Result Summary	RF Spectrum FM Time Domain FM Spectrum Result Summary	RF Spectrum FM Time Domain FM Spectrum Result Summary	FM Time Domain RF Time Domain	FM Time Domain Result Summary
AF filter - High-pass	20 kHz	50 Hz			-
AF filter - Low-pass	15 kHz	3 kHz	150 kHz		-
RF Spectrum					
Span	50 kHz	25 kHz	400 kHz		
AM/FM Time Domain					
Time domain zoom	10 ms	10 ms	10 ms		-
Dev per division		1 kHz	20 kHz	100 kHz	50 kHz
AM/FM Spectrum					
Start freq.	0 Hz	0 Hz	0 Hz		
Stop freq.	15 kHz	5 kHz	63.33 kHz		
Ref. value		5 kHz	75 kHz		
*) The Frequency Settling scenario requires a manually defined trigger					

A.2 I/Q Data File Format (iq-tar)

I/Q data is packed in a file with the extension `.iq.tar`. An iq-tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the iq-tar file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to preview the I/Q data in a web browser, and allows you to include user-specific data.

The iq-tar container packs several files into a single `.tar` archive file. Files in `.tar` format can be unpacked using standard archive tools (see http://en.wikipedia.org/wiki/Comparison_of_file_archivers) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.



Sample iq-tar files

If you have the optional R&S FSW VSA application (R&S FSW-K70), some sample iq-tar files are provided in the `C:/R_S/Instr/user/vsa/DemoSignals` directory on the R&S FSW.

Contained files

An iq-tar file must contain the following files:

- **I/Q parameter XML file**, e.g. `xyz.xml`
Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an iq-tar file.
- **I/Q data binary file**, e.g. `xyz.complex.float32`
Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an iq-tar file.

Optionally, an iq-tar file can contain the following file:

- **I/Q preview XSLT file**, e.g. `open_IqTar_xml_file_in_web_browser.xslt`
Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser.
A sample stylesheet is available at http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt.

A.2.1 I/Q Parameter XML File Specification



The content of the I/Q parameter XML file must comply with the XML schema `RsIqTar.xsd` available at: <http://www.rohde-schwarz.com/file/RsIqTar.xsd>.

In particular, the order of the XML elements must be respected, i.e. iq-tar uses an "ordered XML schema". For your own implementation of the iq-tar file format make sure to validate your XML file against the given schema.

The following example shows an I/Q parameter XML file. The XML elements and attributes are explained in the following sections.

Sample I/Q parameter XML file: xyz.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1"
xsi:noNamespaceSchemaLocation="RsIqTar.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>FSV-K10</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
  <Samples>68751</Samples>
  <Clock unit="Hz">6.5e+006</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>xyz.complex.float32</DataFilename>
  <UserData>
    <UserDefinedElement>Example</UserDefinedElement>
  </UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>
```

Element	Description
RS_IQ_TAR_File-Format	The root element of the XML file. It must contain the attribute <code>fileFormatVersion</code> that contains the number of the file format definition. Currently, <code>fileFormatVersion "2"</code> is used.
Name	Optional: describes the device or application that created the file.
Comment	Optional: contains text that further describes the contents of the file.
DateTime	Contains the date and time of the creation of the file. Its type is <code>xs:dateTime</code> (see <code>RsIqTar.xsd</code>).

I/Q Data File Format (iq-tar)

Element	Description
Samples	<p>Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be:</p> <ul style="list-style-type: none"> • A complex number represented as a pair of I and Q values • A complex number represented as a pair of magnitude and phase values • A real number represented as a single real value <p>See also <code>Format</code> element.</p>
Clock	<p>Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute <code>unit</code> must be set to "Hz".</p>
Format	<p>Specifies how the binary data is saved in the I/Q data binary file (see <code>DataFilename</code> element). Every sample must be in the same format. The format can be one of the following:</p> <ul style="list-style-type: none"> • <code>complex</code>: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless • <code>real</code>: Real number (unitless) • <code>polar</code>: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires <code>DataType</code> = <code>float32</code> or <code>float64</code>
DataType	<p>Specifies the binary format used for samples in the I/Q data binary file (see <code>DataFilename</code> element and chapter A.2.2, "I/Q Data Binary File", on page 351). The following data types are allowed:</p> <ul style="list-style-type: none"> • <code>int8</code>: 8 bit signed integer data • <code>int16</code>: 16 bit signed integer data • <code>int32</code>: 32 bit signed integer data • <code>float32</code>: 32 bit floating point data (IEEE 754) • <code>float64</code>: 64 bit floating point data (IEEE 754)
ScalingFactor	<p>Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the <code>ScalingFactor</code>. For polar data only the magnitude value has to be multiplied. For multi-channel signals the <code>ScalingFactor</code> must be applied to all channels.</p> <p>The attribute <code>unit</code> must be set to "V".</p> <p>The <code>ScalingFactor</code> must be > 0. If the <code>ScalingFactor</code> element is not defined, a value of 1 V is assumed.</p>
NumberOfChannels	<p>Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see chapter A.2.2, "I/Q Data Binary File", on page 351). If the <code>NumberOfChannels</code> element is not defined, one channel is assumed.</p>
DataFilename	<p>Contains the filename of the I/Q data binary file that is part of the iq-tar file.</p> <p>It is recommended that the filename uses the following convention: <code><xyz>.<Format>.<Channels>ch.<Type></code></p> <ul style="list-style-type: none"> • <code><xyz></code> = a valid Windows file name • <code><Format></code> = <code>complex</code>, <code>polar</code> or <code>real</code> (see <code>Format</code> element) • <code><Channels></code> = Number of channels (see <code>NumberOfChannels</code> element) • <code><Type></code> = <code>float32</code>, <code>float64</code>, <code>int8</code>, <code>int16</code>, <code>int32</code> or <code>int64</code> (see <code>DataType</code> element) <p>Examples:</p> <ul style="list-style-type: none"> • <code>xyz.complex.1ch.float32</code> • <code>xyz.polar.1ch.float64</code> • <code>xyz.real.1ch.int16</code> • <code>xyz.complex.16ch.int8</code>

Element	Description
UserData	Optional: contains user, application or device-specific XML data which is not part of the iq-tar specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.
PreviewData	Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an iq-tar file (e.g. R&S FSW). For the definition of this element refer to the <code>RsIqTar.xsd</code> schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet <code>open_IqTar_xml_file_in_web_browser.xslt</code> is available.

Example: ScalingFactor

Data stored as `int16` and a desired full scale voltage of 1 V

$$\text{ScalingFactor} = 1 \text{ V} / \text{maximum int16 value} = 1 \text{ V} / 2^{15} = 3.0517578125\text{e-}5 \text{ V}$$

Scaling Factor	Numerical value	Numerical value x ScalingFactor
Minimum (negative) int16 value	$-2^{15} = -32768$	-1 V
Maximum (positive) int16 value	$2^{15}-1 = 32767$	0.999969482421875 V

Example: PreviewData in XML

```
<PreviewData>
  <ArrayOfChannel length="1">
    <Channel>
      <PowerVsTime>
        <Min>
          <ArrayOfFloat length="256">
            <float>-134</float>
            <float>-142</float>
            ...
            <float>-140</float>
          </ArrayOfFloat>
        </Min>
        <Max>
          <ArrayOfFloat length="256">
            <float>-70</float>
            <float>-71</float>
            ...
            <float>-69</float>
          </ArrayOfFloat>
        </Max>
      </PowerVsTime>
      <Spectrum>
        <Min>
          <ArrayOfFloat length="256">
            <float>-133</float>
            <float>-111</float>
            ...
          </ArrayOfFloat>
        </Min>
      </Spectrum>
    </Channel>
  </ArrayOfChannel>
</PreviewData>
```

```

        <float>-111</float>
    </ArrayOfFloat>
</Min>
<Max>
    <ArrayOfFloat length="256">
        <float>-67</float>
        <float>-69</float>
        ...
        <float>-70</float>
        <float>-69</float>
    </ArrayOfFloat>
</Max>
</Spectrum>
<IQ>
    <Histogram width="64" height="64">0123456789...0</Histogram>
</IQ>
</Channel>
</ArrayOfChannel>
</PreviewData>

```

A.2.2 I/Q Data Binary File

The I/Q data is saved in binary format according to the format and data type specified in the XML file (see `Format` element and `DataType` element). To allow reading and writing of streamed I/Q data, all data is interleaved, i.e. complex values are interleaved pairs of I and Q values and multi-channel signals contain interleaved (complex) samples for channel 0, channel 1, channel 2 etc. If the `NumberOfChannels` element is not defined, one channel is presumed.

Example: Element order for real data (1 channel)

```

I[0],           // Real sample 0
I[1],           // Real sample 1
I[2],           // Real sample 2
...

```

Example: Element order for complex cartesian data (1 channel)

```

I[0], Q[0],     // Real and imaginary part of complex sample 0
I[1], Q[1],     // Real and imaginary part of complex sample 1
I[2], Q[2],     // Real and imaginary part of complex sample 2
...

```

Example: Element order for complex polar data (1 channel)

```

Mag[0], Phi[0], // Magnitude and phase part of complex sample 0
Mag[1], Phi[1], // Magnitude and phase part of complex sample 1
Mag[2], Phi[2], // Magnitude and phase part of complex sample 2
...

```

Example: Element order for complex cartesian data (3 channels)

Complex data: I[channel no][time index], Q[channel no][time index]

```

I[0][0], Q[0][0],           // Channel 0, Complex sample 0
I[1][0], Q[1][0],           // Channel 1, Complex sample 0
I[2][0], Q[2][0],           // Channel 2, Complex sample 0

I[0][1], Q[0][1],           // Channel 0, Complex sample 1
I[1][1], Q[1][1],           // Channel 1, Complex sample 1
I[2][1], Q[2][1],           // Channel 2, Complex sample 1

I[0][2], Q[0][2],           // Channel 0, Complex sample 2
I[1][2], Q[1][2],           // Channel 1, Complex sample 2
I[2][2], Q[2][2],           // Channel 2, Complex sample 2
...

```

Example: Element order for complex cartesian data (1 channel)

This example demonstrates how to store complex cartesian data in float32 format using MATLAB®.

```

% Save vector of complex cartesian I/Q data, i.e. iqiqli...
N = 100
iq = randn(1,N)+1j*randn(1,N)
fid = fopen('xyz.complex.float32','w');
for k=1:length(iq)
    fwrite(fid, single(real(iq(k))), 'float32');
    fwrite(fid, single(imag(iq(k))), 'float32');
end
fclose(fid)

```


List of Remote Commands (AnalogDemod)

[SENSe:] [WINDow<n>:] DETector<t>[:FUNCTION]:AUTO.....	276
[SENSe:] [WINDow<n>:] DETector<trace>[:FUNCTION].....	275
[SENSe:] ADEMod:AF:CENTer.....	258
[SENSe:] ADEMod:AF:SPAN.....	259
[SENSe:] ADEMod:AF:SPAN:FULL.....	259
[SENSe:] ADEMod:AF:START.....	259
[SENSe:] ADEMod:AF:STOP.....	259
[SENSe:] ADEMod:AM:RELative:AFSPectrum:RESult?.....	290
[SENSe:] ADEMod:AM:RELative:AFSPectrum[:TYPE].....	272
[SENSe:] ADEMod:AM:RELative[:TDOMain]:RESult?.....	290
[SENSe:] ADEMod:AM:RELative[:TDOMain][:TYPE].....	272
[SENSe:] ADEMod:AM[:ABSolute][:TDOMain]:RESult?.....	290
[SENSe:] ADEMod:AM[:ABSolute][:TDOMain][:TYPE].....	272
[SENSe:] ADEMod:FM:AFSPectrum:RESult?.....	290
[SENSe:] ADEMod:FM:AFSPectrum[:TYPE].....	272
[SENSe:] ADEMod:FM:OFFSet?.....	296
[SENSe:] ADEMod:FM[:TDOMain]:RESult?.....	290
[SENSe:] ADEMod:FM[:TDOMain][:TYPE].....	272
[SENSe:] ADEMod:MTIme.....	240
[SENSe:] ADEMod:PM:AFSPectrum:RESult?.....	290
[SENSe:] ADEMod:PM:AFSPectrum[:TYPE].....	273
[SENSe:] ADEMod:PM:RPoInt[:X].....	255
[SENSe:] ADEMod:PM:RPoInt[:X].....	297
[SENSe:] ADEMod:PM[:TDOMain]:RESult?.....	290
[SENSe:] ADEMod:PM[:TDOMain][:TYPE].....	272
[SENSe:] ADEMod:PRESet:RESTore.....	181
[SENSe:] ADEMod:PRESet:STORe.....	181
[SENSe:] ADEMod:PRESet[:STANdard].....	180
[SENSe:] ADEMod:RLENgth?.....	240
[SENSe:] ADEMod:SET.....	241
[SENSe:] ADEMod:SPEC:SPAN:ZOOM.....	260
[SENSe:] ADEMod:SPECtrum:BANdwidth BWIDth[:RESolution].....	242
[SENSe:] ADEMod:SPECtrum:RESult?.....	290
[SENSe:] ADEMod:SPECtrum:SPAN[:MAXimum].....	260
[SENSe:] ADEMod:SPECtrum[:TYPE].....	273
[SENSe:] ADEMod:SQUelch:LEVel.....	256
[SENSe:] ADEMod:SQUelch[:STATe].....	256
[SENSe:] ADEMod:SRATe?.....	242
[SENSe:] ADEMod<n>:AF:COUPling.....	255
[SENSe:] ADEMod<n>:ZOOM:LENGth.....	257
[SENSe:] ADEMod<n>:ZOOM:LENGth:MODE.....	257
[SENSe:] ADEMod<n>:ZOOM:START.....	257
[SENSe:] ADEMod<n>:ZOOM[:STATe].....	258
[SENSe:] ADJust:ALL.....	267
[SENSe:] ADJust:CONFigure:DURation.....	267
[SENSe:] ADJust:CONFigure:DURation:MODE.....	268
[SENSe:] ADJust:CONFigure:HYSTeresis:LOWer.....	268

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer.....	269
[SENSe:]ADJust:FREQuency.....	268
[SENSe:]ADJust:LEVel.....	269
[SENSe:]ADJust:SCALe:Y:AUTO[:CONTInuous].....	269
[SENSe:]AVERAge:COUnT.....	274
[SENSe:]AVERAge<n>:TYPE.....	275
[SENSe:]AVERAge<n>[:STATe<t>].....	275
[SENSe:]BANDwidth BWIDth:DEMod.....	242
[SENSe:]BANDwidth BWIDth:DEMod:TYPE.....	243
[SENSe:]BANDwidth BWIDth[:RESolution].....	243
[SENSe:]CORRection:COLLect[:ACQuire].....	225
[SENSe:]CORRection:CVL:BAND.....	191
[SENSe:]CORRection:CVL:BIAS.....	192
[SENSe:]CORRection:CVL:CATAlog?.....	192
[SENSe:]CORRection:CVL:CLEAr.....	192
[SENSe:]CORRection:CVL:COMMeNt.....	193
[SENSe:]CORRection:CVL:DATA.....	193
[SENSe:]CORRection:CVL:HARMonic.....	194
[SENSe:]CORRection:CVL:MIXer.....	194
[SENSe:]CORRection:CVL:PORTs.....	194
[SENSe:]CORRection:CVL:SELect.....	195
[SENSe:]CORRection:CVL:SNUMber.....	195
[SENSe:]CORRection:METhod.....	226
[SENSe:]CORRection:RECall.....	226
[SENSe:]CORRection:TRANsducer:GENerator.....	227
[SENSe:]CORRection[:STATe].....	227
[SENSe:]FILTer<n>:AOFF.....	261
[SENSe:]FILTer<n>:AWEighted[:STATe].....	261
[SENSe:]FILTer<n>:CCIR[:UNWEighted][:STATe].....	262
[SENSe:]FILTer<n>:CCIR:WEIGhted[:STATe].....	261
[SENSe:]FILTer<n>:CCIT.....	262
[SENSe:]FILTer<n>:DEMPHasis:TCONstant.....	262
[SENSe:]FILTer<n>:DEMPHasis[:STATe].....	263
[SENSe:]FILTer<n>:HPASs:FREQuency:MANual.....	263
[SENSe:]FILTer<n>:HPASs:FREQuency[:ABSolute].....	263
[SENSe:]FILTer<n>:HPASs[:STATe].....	264
[SENSe:]FILTer<n>:LPASs:FREQuency:MANual.....	264
[SENSe:]FILTer<n>:LPASs:FREQuency:RELative.....	264
[SENSe:]FILTer<n>:LPASs:FREQuency[:ABSolute].....	264
[SENSe:]FILTer<n>:LPASs[:STATe].....	265
[SENSe:]FREQuency:CENTer.....	231
[SENSe:]FREQuency:CENTer:STEP.....	232
[SENSe:]FREQuency:CENTer:STEP:LINK.....	232
[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor.....	233
[SENSe:]MIXer:BIAS:HIGH.....	185
[SENSe:]MIXer:BIAS[:LOW].....	185
[SENSe:]MIXer:FREQuency:HANDover.....	187
[SENSe:]MIXer:FREQuency:START?.....	187
[SENSe:]MIXer:FREQuency:STOP?.....	187
[SENSe:]MIXer:HARMonic:BAND:PRESet.....	188

[SENSe:]MIXer:HARMonic:BAND[:VALue].....	188
[SENSe:]MIXer:HARMonic:HIGH:STATe.....	189
[SENSe:]MIXer:HARMonic:HIGH[:VALue].....	189
[SENSe:]MIXer:HARMonic:TYPE.....	189
[SENSe:]MIXer:HARMonic[:LOW].....	189
[SENSe:]MIXer:LOPower.....	185
[SENSe:]MIXer:LOSS:HIGH.....	190
[SENSe:]MIXer:LOSS:TABLE:HIGH.....	190
[SENSe:]MIXer:LOSS:TABLE[:LOW].....	190
[SENSe:]MIXer:LOSS[:LOW].....	190
[SENSe:]MIXer:PORTs.....	191
[SENSe:]MIXer:RFOVerrange[:STATe].....	191
[SENSe:]MIXer:SIGNal.....	186
[SENSe:]MIXer:THReshold.....	186
[SENSe:]MIXer[:STATe].....	185
[SENSe:]MSRA:CAPTure:OFFSet.....	338
[SENSe:]PMETer<p>:DCYCLe:VALue.....	213
[SENSe:]PMETer<p>:DCYCLe[:STATe].....	212
[SENSe:]PMETer<p>:FREQuency.....	213
[SENSe:]PMETer<p>:FREQuency:LINK.....	213
[SENSe:]PMETer<p>:MTIme.....	214
[SENSe:]PMETer<p>:MTIme:AVERAge:COUNT.....	214
[SENSe:]PMETer<p>:MTIme:AVERAge[:STATe].....	215
[SENSe:]PMETer<p>:ROFFset[:STATe].....	215
[SENSe:]PMETer<p>:TRIGger:DTIme.....	217
[SENSe:]PMETer<p>:TRIGger:HOLDoff.....	217
[SENSe:]PMETer<p>:TRIGger:HYSTeresis.....	218
[SENSe:]PMETer<p>:TRIGger:LEVel.....	218
[SENSe:]PMETer<p>:TRIGger:SLOPe.....	218
[SENSe:]PMETer<p>:TRIGger[:STATe].....	219
[SENSe:]PMETer<p>:UPDate[:STATe].....	216
[SENSe:]PMETer<p>[:STATe].....	215
[SENSe:]PROBe<ch>:SETup:CMOFFset.....	201
[SENSe:]PROBe<p>:ID:PARTnumber?.....	206
[SENSe:]PROBe<p>:ID:SRNumber?.....	207
[SENSe:]PROBe<p>:SETup:MODE.....	207
[SENSe:]PROBe<p>:SETup:NAME?.....	207
[SENSe:]PROBe<p>:SETup:STATe?.....	208
[SENSe:]PROBe<p>:SETup:TYPE?.....	208
[SENSe:]RTMS:CAPTure:OFFSet.....	339
[SENSe:]SWEep:COUNT.....	243
[SENSe:]SWEep:POINts.....	244
ABORT.....	277
CALCulate:LIMit:ACTive?.....	329
CALCulate:LIMit:CLear[:IMMEDIATE].....	331
CALCulate:LIMit:COMMeNt.....	322
CALCulate:LIMit<k>:CONTRol:DOMain.....	323
CALCulate:LIMit<k>:CONTRol:MODE.....	323
CALCulate:LIMit<k>:CONTRol:OFFSet.....	323
CALCulate:LIMit<k>:CONTRol:SHIFt.....	324

CALCulate:LIMit<k>:CONTRol:SPACing.....	324
CALCulate:LIMit<k>:CONTRol[:DATA].....	323
CALCulate:LIMit<k>:COPY.....	330
CALCulate:LIMit<k>:DELete.....	330
CALCulate:LIMit<k>:FAIL?.....	331
CALCulate:LIMit<k>:LOWer:MARGin.....	325
CALCulate:LIMit<k>:LOWer:MODE.....	325
CALCulate:LIMit<k>:LOWer:OFFSet.....	325
CALCulate:LIMit<k>:LOWer:SHIFt.....	325
CALCulate:LIMit<k>:LOWer:SPACing.....	326
CALCulate:LIMit<k>:LOWer:STATe.....	326
CALCulate:LIMit<k>:LOWer:THReshold.....	326
CALCulate:LIMit<k>:LOWer[:DATA].....	324
CALCulate:LIMit<k>:NAME.....	326
CALCulate:LIMit<k>:STATe.....	330
CALCulate:LIMit<k>:TRACe<t>:CHECK.....	331
CALCulate:LIMit<k>:UNIT.....	327
CALCulate:LIMit<k>:UPPer:MARGin.....	327
CALCulate:LIMit<k>:UPPer:MODE.....	327
CALCulate:LIMit<k>:UPPer:OFFSet.....	328
CALCulate:LIMit<k>:UPPer:SHIFt.....	328
CALCulate:LIMit<k>:UPPer:SPACing.....	328
CALCulate:LIMit<k>:UPPer:STATe.....	329
CALCulate:LIMit<k>:UPPer:THReshold.....	329
CALCulate:LIMit<k>:UPPer[:DATA].....	327
CALCulate:MARKer:FUNCTion:ADEMod:AM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:CARRier[:RESult]?.....	295
CALCulate:MARKer:FUNCTion:ADEMod:FERRor[:RESult<t>]?.....	295
CALCulate:MARKer:FUNCTion:ADEMod:FM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:ADEMod:PM[:RESult<t>]?.....	294
CALCulate:MARKer:FUNCTion:FPEaks:COUNT?.....	314
CALCulate:MARKer:FUNCTion:FPEaks:X?.....	316
CALCulate:MARKer:FUNCTion:FPEaks:Y?.....	316
CALCulate:MARKer:FUNCTion:NDBDown:QFACtor?.....	319
CALCulate:MARKer:X:SSIZe.....	306
CALCulate:MARKer<m>:LINK.....	307
CALCulate:MSRA:ALINe:SHOW.....	337
CALCulate:MSRA:ALINe[:VALue].....	337
CALCulate:MSRA:WINDow<n>:IVAL?.....	338
CALCulate:RTMS:ALINe:SHOW.....	339
CALCulate:RTMS:ALINe[:VALue].....	339
CALCulate:RTMS:WINDow<n>:IVAL?.....	339
CALCulate<n>:DELTamarker:AOff.....	303
CALCulate<n>:DELTamarker:MODE.....	303
CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:MAXimum[:PEAK].....	312
CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:X.....	312
CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:Y.....	313
CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed:RPOint:Y:OFFSet.....	313
CALCulate<n>:DELTamarker<m>:FUNCTion:FIXed[:STATe].....	313
CALCulate<n>:DELTamarker<m>:FUNCTion:PNOise:AUTO.....	320

CALCulate<n>:DELTamarker<m>:FUNction:PNOise:RESult?	321
CALCulate<n>:DELTamarker<m>:FUNction:PNOise[:STATe]	321
CALCulate<n>:DELTamarker<m>:LINK	303
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT	310
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT	311
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT	311
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]	311
CALCulate<n>:DELTamarker<m>:MINimum:LEFT	311
CALCulate<n>:DELTamarker<m>:MINimum:NEXT	311
CALCulate<n>:DELTamarker<m>:MINimum:RIGHT	312
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]	311
CALCulate<n>:DELTamarker<m>:MREF	304
CALCulate<n>:DELTamarker<m>:TRACe	304
CALCulate<n>:DELTamarker<m>:X	305
CALCulate<n>:DELTamarker<m>:X:RELative?	305
CALCulate<n>:DELTamarker<m>:Y?	305
CALCulate<n>:DELTamarker<m>[:STATe]	304
CALCulate<n>:DELTamarker<m1>:LINK:TO:MARKer<m2>	303
CALCulate<n>:FEED	341
CALCulate<n>:MARKer:FUNction:ADEMod:AFRequency[:RESult]?	294
CALCulate<n>:MARKer:FUNction:ADEMod:SINad:RESult<t>?	295
CALCulate<n>:MARKer:FUNction:ADEMod:THD:RESult<t>?	295
CALCulate<n>:MARKer:PEXCursion	308
CALCulate<n>:MARKer<m>:AOFF	300
CALCulate<n>:MARKer<m>:FUNction:FPEaks:ANNOtation:LABel[:STATe]	314
CALCulate<n>:MARKer<m>:FUNction:FPEaks:LIST:SIZE	315
CALCulate<n>:MARKer<m>:FUNction:FPEaks:SORT	315
CALCulate<n>:MARKer<m>:FUNction:FPEaks:STAT	316
CALCulate<n>:MARKer<m>:FUNction:FPEaks[:IMMediate]	315
CALCulate<n>:MARKer<m>:FUNction:NDBDown	318
CALCulate<n>:MARKer<m>:FUNction:NDBDown:FREquency?	318
CALCulate<n>:MARKer<m>:FUNction:NDBDown:RESult?	319
CALCulate<n>:MARKer<m>:FUNction:NDBDown:STATe	319
CALCulate<n>:MARKer<m>:FUNction:NDBDown:TIME?	320
CALCulate<n>:MARKer<m>:FUNction:REFerence	234
CALCulate<n>:MARKer<m>:MAXimum:LEFT	309
CALCulate<n>:MARKer<m>:MAXimum:NEXT	309
CALCulate<n>:MARKer<m>:MAXimum:RIGHT	309
CALCulate<n>:MARKer<m>:MAXimum[:PEAK]	309
CALCulate<n>:MARKer<m>:MINimum:LEFT	309
CALCulate<n>:MARKer<m>:MINimum:NEXT	310
CALCulate<n>:MARKer<m>:MINimum:RIGHT	310
CALCulate<n>:MARKer<m>:MINimum[:PEAK]	310
CALCulate<n>:MARKer<m>:TRACe	301
CALCulate<n>:MARKer<m>:X	301
CALCulate<n>:MARKer<m>:Y?	302
CALCulate<n>:MARKer<m>[:STATe]	301
CALCulate<n>:MARKer<m1>:LINK:TO:MARKer<m2>	301
CALCulate<n>:PMETer<p>:RELative:STATe	212
CALCulate<n>:PMETer<p>:RELative[:MAGNitude]	211

CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE.....	211
CALCulate<n>:UNIT:POWer.....	234
CALibration:AIQ:DCOFFset:I.....	200
CALibration:AIQ:DCOFFset:Q.....	200
CALibration:PMETer<p>:ZERO:AUTO ONCE.....	210
DIAGnostic:SERVice:NSource.....	229
DISPlay:FORMat.....	282
DISPlay:MTABLE.....	307
DISPlay[:WINDow<n>]:SIZE.....	283
DISPlay[:WINDow<n>]:TRACe:Y:SPACing.....	239
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe].....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE.....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MODE.....	238
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel.....	234
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet.....	235
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RPOSition.....	239
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue.....	225
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RVALue.....	265
DISPlay[:WINDow<n>]:TRACe<t>:MODE.....	270
DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONTinuous.....	271
DISPlay[:WINDow<n>]:TRACe<t>:SElect.....	272
DISPlay[:WINDow<n>]:TRACe<t>[:STATe].....	272
DISPlay[:WINDow<n>]:ZOOM:AREA.....	334
DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA.....	335
DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe.....	336
DISPlay[:WINDow<n>]:ZOOM:STATe.....	335
FETCh:PMETer<p>?.....	212
FORMat:DEXPort:DSEParator.....	292
FORMat:DEXPort:HEADer.....	293
FORMat:DEXPort:TRACes.....	293
FORMat[:DATA].....	291
INITiate:CONMeas.....	278
INITiate:CONTinuous.....	278
INITiate:REFResh.....	279
INITiate:SEQuencer:ABORT.....	280
INITiate:SEQuencer:IMMediate.....	280
INITiate:SEQuencer:MODE.....	280
INITiate:SEQuencer:REFResh[:ALL].....	281
INITiate[:IMMediate].....	279
INPut:ATTenuation.....	235
INPut:ATTenuation:AUTO.....	235
INPut:ATTenuation:PROTection:RESet.....	182
INPut:CONNector.....	182
INPut:COUPling.....	182
INPut:DIQ:CDEVice.....	203
INPut:DIQ:RANGe:COUPling.....	205
INPut:DIQ:RANGe[:UPPer].....	205
INPut:DIQ:RANGe[:UPPer]:AUTO.....	204
INPut:DIQ:RANGe[:UPPer]:UNIT.....	205
INPut:DIQ:SRATe.....	205

INPut:DIQ:SRATe:AUTO.....	206
INPut:EATT.....	236
INPut:EATT:AUTO.....	236
INPut:EATT:STATe.....	237
INPut:FiLTer:HPASs[:STATe].....	183
INPut:FiLTer:YIG[:STATe].....	183
INPut:GAIn:STATe.....	237
INPut:GAIn[:VALue].....	237
INPut:IMPedance.....	183
INPut:IQ:BAListed[:STATe].....	198
INPut:IQ:FULLscale:AUTO.....	198
INPut:IQ:FULLscale[:LEVel].....	199
INPut:IQ:TYPE.....	199
INPut:SElect.....	184
INSTRument:CREate:DUPLicate.....	176
INSTRument:CREate:REPLace.....	177
INSTRument:CREate[:NEW].....	176
INSTRument:DELeTe.....	177
INSTRument:LIST?.....	177
INSTRument:REName.....	179
INSTRument[:SElect].....	179
LAYout:ADD[:WINDow]?.....	284
LAYout:CATalog[:WINDow]?.....	285
LAYout:IDENtify[:WINDow]?.....	285
LAYout:REMOve[:WINDow].....	286
LAYout:REPLace[:WINDow].....	286
LAYout:SPLitter.....	286
LAYout:WINDow<n>:ADD?.....	288
LAYout:WINDow<n>:IDENtify?.....	288
LAYout:WINDow<n>:REMOve.....	288
LAYout:WINDow<n>:REPLace.....	289
MMEMory:LOAD:IQ:STATe.....	340
MMEMory:STORE:IQ:COMMENT.....	340
MMEMory:STORE:IQ:STATe.....	341
MMEMory:STORE:LIST.....	317
MMEMory:STORE:PEAK.....	317
MMEMory:STORE<n>:TRACe.....	292
OUTPut:ADEMod[:ONLine]:AF[:CFRequency].....	230
OUTPut:ADEMod[:ONLine]:PHONes.....	231
OUTPut:ADEMod[:ONLine]:SOURce.....	230
OUTPut:ADEMod[:ONLine][:STATe].....	230
OUTPut:TRIGger<port>:DIRectioN.....	253
OUTPut:TRIGger<port>:LEVel.....	253
OUTPut:TRIGger<port>:OTYPE.....	254
OUTPut:TRIGger<port>:PULSe:IMMediate.....	254
OUTPut:TRIGger<port>:PULSe:LENGth.....	254
READ:PMETer<p>?.....	212
SOURce:EXTErnal:FREQuency.....	220
SOURce:EXTErnal:FREQuency:COUPLing[:STATe].....	220
SOURce:EXTErnal:FREQuency:OFFSet.....	221

SOURce:EXtErnal:FREQuency[:FACTOR]:DENominator.....	220
SOURce:EXtErnal:FREQuency[:FACTOR]:NUMerator.....	221
SOURce:EXtErnal:POWer[:LEVel].....	222
SOURce:EXtErnal:ROSCillator[:SOURce].....	223
SOURce:EXtErnal[:STATe].....	222
SOURce:POWer[:LEVel][:IMMediate]:OFFSet.....	222
SYSTem:COMMunicate:GPIB:RDEvice:GENerator:ADDRess.....	223
SYSTem:COMMunicate:RDEvice:GENerator:INTerface.....	223
SYSTem:COMMunicate:RDEvice:GENerator:LINK.....	224
SYSTem:COMMunicate:RDEvice:GENerator:TYPE.....	224
SYSTem:COMMunicate:RDEvice:PMETer:COUNT?.....	209
SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO[:STATe].....	209
SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine.....	209
SYSTem:COMMunicate:TCPip:RDEvice:GENerator:ADDRess.....	224
SYSTem:PRESet:CHANnel[:EXECute].....	179
SYSTem:SEQuencer.....	281
TRACe:IQ:APCon:A.....	201
TRACe:IQ:APCon:B.....	202
TRACe:IQ:APCon:RESult?.....	202
TRACe:IQ:APCon[:STATe].....	201
TRACe<n>[:DATA].....	291
TRIGger[:SEQuence]:BBPower:HOLDoff.....	245
TRIGger[:SEQuence]:DTIME.....	245
TRIGger[:SEQuence]:HOLDoff[:TIME].....	246
TRIGger[:SEQuence]:IFPower:HOLDoff.....	246
TRIGger[:SEQuence]:IFPower:HYSteresis.....	246
TRIGger[:SEQuence]:LEVel:AM:RELative.....	248
TRIGger[:SEQuence]:LEVel:AM[:ABSolute].....	249
TRIGger[:SEQuence]:LEVel:BBPower.....	247
TRIGger[:SEQuence]:LEVel:FM.....	249
TRIGger[:SEQuence]:LEVel:IFPower.....	247
TRIGger[:SEQuence]:LEVel:IQPower.....	248
TRIGger[:SEQuence]:LEVel:PM.....	249
TRIGger[:SEQuence]:LEVel:RFPower.....	248
TRIGger[:SEQuence]:LEVel[:EXtErnal<port>].....	247
TRIGger[:SEQuence]:SLOPe.....	250
TRIGger[:SEQuence]:SOURce.....	250
TRIGger[:SEQuence]:TIME:RINTerval.....	252
UNIT:ANGLE.....	266
UNIT:THD.....	266
UNIT<n>:PMETer<p>:POWer.....	216
UNIT<n>:PMETer<p>:POWer:RATIo.....	216

Index

Symbols

*OPC 244

A

A weighted filter
 AF filters 115

Aborting
 Sweep 104, 105

AC/DC coupling 28, 56, 89, 108, 118, 125

Activating
 Analog Demodulation measurements (remote) 176

Active probe
 Microbutton 73

AF 15

AF Auto Scale
 Softkey 119, 128

AF center
 Softkey 111

AF CF 14

AF coupling 108, 118, 125

AF filters 29

A weighted 115

CCIR 115

CCITT 115

Configuration (Softkey) 113

Deactivating 116

Deemphasis 116

High pass 114

Low pass 114

Weighting 115

AF full span
 Softkey 112

AF span
 Displayed 14

Manual (Softkey) 111

Remote control 259

AF spectrum 110

AF start
 Softkey 111

AF stop
 Softkey 111

AF trigger 29, 31

All Functions Off
 Softkey 145

AM (Offline)
 Softkey 97

AM Spectrum
 Evaluation method 18

AM Time Domain
 Evaluation method 15

Amplitude
 Analog Baseband Interface (B71) settings 90

Configuration (Softkey) 85

Scaling 120

Settings 85

Analog Baseband
 Amplitude settings 90

Input 58

Input settings 71

Analog Baseband (B71)
 Full scale level 92

I/Q mode 71

Input type (remote control) 199

Analog Baseband connector
 RF input 34

Analog Baseband Interface (B71)
 Amplitude settings 90

Input settings 71

Analog Demodulation
 Measurement examples 163

Output 124

Output settings 124

Analysis
 Marker functions 142

Remote control 299

Settings 129

Analysis interval
 Configuration (MSRA, remote) 336, 338

MSRA/MSRT 101, 240

Analysis line 49

Configuration 154

Configuration (MSRA, remote) 336, 338

APX
 External generator 41, 46

AQT
 see Measurement time 13

ASCII trace export 297

Attenuation 88

Auto 88

Displayed 13

Electronic 88

Manual 88

Option B25 88

Protective 34

Protective (remote) 182

Audio frequency
 see AF 15

Auto all
 Softkey 126

Auto frequency
 Softkey 126

Auto ID
 External Mixer (B21, remote control) 186

External Mixer (B21) 63

Threshold (External Mixer (B21), remote control) 186

Threshold (External Mixer, B21) 63

Auto level
 Hysteresis 127

Reference level 87, 92, 127

Softkey 87, 92, 127

Auto scaling 119, 120, 128

Auto settings 126

Meastime Auto (softkey) 127

Meastime Manual (softkey) 127

Automatic coupling
 Frequencies, external generator 44, 77

AUX control
 TTL synchronization, external generator 37

Average count 106, 132

Power sensor 84

Average mode
 Traces 131

- Averaging
 - Traces (remote control) 275
- B**
- Band
 - Conversion loss table (B21) 67
 - External Mixer (B21, remote control) 188
 - External Mixer (B21) 60
- Bandwidth settings 101
- BB Power
 - Trigger (softkey) 96
- Bias
 - Conversion loss table (B21) 64, 67
 - External Mixer (B21, remote control) 185
 - External Mixer (B21) 63
- C**
- Calibration
 - External generator 40
 - External generator, remote 225
 - Normalization, external generator 79
 - Reference trace, external generator 41
 - Reflection open measurement, external generator 79
 - Reflection short measurement, external generator 79
 - Restoring settings, external generator 42, 79
 - Storing results, external generator 41
 - Transmission measurement, external generator 79
- Capture offset
 - MSRA applications 103
 - MSRT applications 103
 - Remote 338, 339
 - Softkey 103
- Capturing
 - I/Q data (remote) 277
- Carrier
 - Offset 24, 28
 - Power 24
- CCIR filter
 - AF filters 115
- CCITT filter
 - AF filters 115
- Center frequency 93, 112
 - Analog Baseband (B71) 72
 - Automatic configuration 126
 - Displayed 13, 14
 - Softkey 93, 112
 - Step size 93
- Channel bar
 - Information, external generator 46
- Circuit description 26
- Closing
 - Channels (remote) 177
 - Windows (remote) 286, 288
- Comment
 - Limit lines 151
- Compatibility
 - Limit lines 148
- Conditions
 - Measurement 26
- Configuration
 - Measurement (remote) 180
 - Procedure 54
- Connectors
 - AUX control, external generator 37
 - External generator control 37
 - GPIB 37
- Continue single sweep
 - Softkey 105
- Continuous sweep
 - Softkey 104
- Conventions
 - SCPI commands 171
- Conversion loss
 - External Mixer (B21, remote control) 190
- Conversion loss tables 64, 65
 - Available (remote control) 192
 - Band (remote control) 191
 - Bias (remote control) 192
 - Configuring (B21) 64
 - Creating 65
 - Deleting (remote control) 192
 - External Mixer (B21, remote control) 190
 - External Mixer (B21) 61
 - Harmonic order (remote control) 194
 - Importing (External Mixer, B21) 65
 - Managing 64
 - Mixer type (remote control) 194
 - Saving (External Mixer, B21) 68
 - Selecting (remote control) 195
 - Shifting values (External Mixer, B21) 68
 - Values (External Mixer, B21) 68
- Copying
 - Measurement channel (remote) 176
- Coupling
 - Automatic, external generator 44, 77
 - Frequencies, external generator 43
 - Input (remote) 182
 - Manual, external generator 77
- D**
- Data acquisition
 - MSRA/MSRT 101, 240
 - Remote control 240
 - Settings 101
- Data format
 - ASCII 297
 - Binary 297
 - Remote 291, 293
- DB per division
 - Scaling 117
- DBW
 - see Demodulation bandwidth 13
- DC offset
 - Analog Baseband (B71, remote control) 200
- Decimal separator
 - Trace export 134
- Deemphasis filter
 - AF filters 116
 - Remote control 262, 263
- Default values
 - Preset 50
- Deleting
 - Limit line values 153
 - Settings files 53
 - Standards 53
- Delta markers 136
 - Defining 136

- Demodulation
 - AF spectrum 110
 - Configuration (Softkey) 107
 - Display 106
 - Filter types 29, 102
 - Process 26
 - RF spectrum 112
 - Scaling 113, 117
 - Settings 106, 107
 - Spectrum 110
 - Spectrum (Result Summary) 112
 - Units 120
- Demodulation bandwidth
 - Conditions 28
 - Deemphasis filter 116
 - Displayed 13
 - Maximum 29
 - Remote control 242
 - Softkey 102, 113
 - Troubleshooting 169
- Denominator
 - Frequencies, external generator 44, 77
- Detectors
 - Remote control 275
 - Trace 131
- Dev per division
 - Scaling 117
- Deviation
 - Scaling 119
- Diagram footer information 14
- Differential input
 - Analog Baseband (B71, remote control) 198
 - Analog Baseband (B71) 72
- DigIConf
 - Softkey, see also R&S DigIConf 70
- Digital Baseband Interface (B17)
 - Input settings 69
 - Input status (remote) 203
- Digital I/Q
 - Enhanced mode 97
 - Input connection information 70
 - Input settings 69
 - Triggering 97
- Digital input
 - Connection information 70
- Digital standards
 - Configuration 51
 - VSA measurements 51
- Display configuration
 - Softkey 106
- Drop-out time
 - Trigger 99
 - Trigger (Power sensor) 85
- Duplicating
 - Measurement channel (remote) 176
- Duty cycle
 - Power sensor 84
- E**
- Electronic input attenuation 88
- Enhanced mode
 - Digital I/Q 97
- Errors
 - External generator 46
 - IF OVLD 86, 91
- Evaluation
 - Data basis 15
 - Methods 15
- Evaluation methods
 - Remote 284
- Example
 - Remote control of an external generator 227
- Examples
 - Remote control 342
- Export format
 - Traces 297
- Exporting
 - Data 157
 - I/Q data 156, 157, 158, 347, 351
 - I/Q data (remote) 340
 - Measurement settings 133
 - Peak list 147
 - Softkey 157
 - Traces 133, 134, 157
- External generator
 - Activating/Deactivating 76
 - Basics 36
 - Calibration functions 78
 - Calibration measurement settings 75
 - Channel bar information 46
 - Connections 36
 - Coupling frequencies 43
 - Errors 46
 - Generators, supported 38
 - Interface 74
 - Interface settings 74
 - Normalizing 79
 - Overloading 47
 - Recalling calibration settings 79
 - Reference level 42
 - Reference line 42
 - Reference line position 80
 - Reference line value 80
 - Reference position 80
 - Reference trace 42
 - Reference value 80
 - Reflection measurement 38
 - Reflection open measurement 79
 - Reflection short measurement 79
 - Remote control 219
 - Settings 73
 - Transducer factor 42, 80
 - Transmission measurement 37, 79
 - TTL synchronization 37
- External Mixer (B21) 59
 - Activating (remote control) 185
 - Band 60, 187
 - Basic settings 62
 - Configuration 58
 - Conversion loss 61
 - Conversion loss tables 64, 65
 - Frequency range 59
 - Handover frequency 60
 - Harmonic Order 61
 - Harmonic Type 61
 - Name 67
 - Programming example 195
 - Range 60, 61
 - Restoring bands 60
 - RF overrange 60, 191
 - RF Start/RF Stop 59

- Serial number 67
- Type 60, 68, 191
- External reference
 - External generator 38
 - External generator control 75
- External trigger
 - Level (power sensor) 84
 - Level (remote) 247
 - Power sensor 84
 - Softkey 95
- F**
- Falling
 - Slope (Power sensor) 85
- File format
 - Export Files 297
 - I/Q data 347
 - Trace export 297
- File name
 - Settings 52
- Files
 - I/Q data binary XML 351
 - I/Q parameter XML 348
- Filters
 - A weighted (AF) 115
 - AF 113
 - CCIR (AF) 115
 - CCITT (AF) 115
 - Demodulation 28, 29, 102
 - High pass (AF) 114
 - High-pass (remote) 183
 - High-pass (RF input) 57
 - Low pass (AF) 114
 - Weighting (AF) 115
 - YIG (remote) 183
- Fixed reference
 - Defining 138
 - Remote control 312
- FM (Offline)
 - Softkey 97
- FM Spectrum
 - Evaluation method 19
- FM Time Domain
 - Evaluation method 16
- Format
 - Data 297
 - Data (remote) 291, 293
 - see also File format 297
- Free Run
 - Trigger (softkey) 95
- Frequency
 - Configuration (softkey) 110
 - Coupling (power sensor) 83
 - Deemphasis filter 116
 - Deviation 28
 - Deviation, scaling 117
 - External generator 77
 - Power sensor 83
 - Remote control 231
 - Settings 92
 - Span 112
- Frequency coupling
 - Automatic, external generator 44
 - External generator 43, 77
 - Reverse sweep, external generator 45
 - TTL synchronization, external generator 45
- Frequency denominator
 - External generator 77
- Frequency numerator
 - External generator 77
- Frequency offset
 - External generator 44, 77
- Frequency range
 - Calibration sweep, external generator 44, 78
- Frequency-converting measurements
 - External generator 44
- Frontend settings 55
- FRQ
 - External generator 46
- Full scale level
 - Analog Baseband (B71, remote control) 198, 199
 - Analog Baseband (B71) 92
 - Digital I/Q 70
 - Digital I/Q (remote) 204, 205
 - Unit, digital I/Q (remote) 205
- G**
- Generator
 - Frequencies, external generator 44, 77
 - Frequency coupling, external generator 77
 - Frequency offset, external generator 76
 - Output power, external generator 76
- Generator type
 - External generator 74
- Generators
 - Frequency range, external generator 75
 - Power range, external generator 75
 - Setup files, external generator 40, 74, 75
 - Supported, external generator 38
- GPIO
 - Address, External generator 75
 - External generator 74
 - TTL synchronization, External generator 75
- H**
- Handover frequency
 - External Mixer (B21, remote control) 187
 - External Mixer (B21) 60
- Hardware settings
 - Displayed 13
- Harmonics
 - Conversion loss table (B21) 67
 - External Mixer (B21, remote control) 189
 - Order (External Mixer, B21) 61
 - Type (External Mixer, B21) 61
- High pass filter
 - AF filters 114
- High-pass filter
 - Remote 183
 - RF input 57
- Hold
 - Trace setting 131
- Hysteresis
 - Lower (Auto level) 127
 - Trigger 99
 - Trigger (Power sensor) 85
 - Upper (Auto level) 127

- I**
- I/Q data
 - Export file binary data description 351
 - Export file parameter description 348
 - Exporting 157
 - Exporting (remote) 340
 - Exporting/Importing 158
 - Importing 157
 - Importing (remote) 340
 - Importing/Exporting 156
 - I/Q Power
 - Trigger (softkey) 96
 - Trigger level (remote) 248
 - IF OVLD
 - External generator 41, 46
 - IF Power
 - Trigger (softkey) 96
 - Trigger level (remote) 247
 - Impedance
 - Remote 183
 - Setting 57, 90
 - Importing
 - I/Q data 156, 157, 158, 348
 - I/Q data (remote) 340
 - Softkey 157
 - Input
 - Analog Baseband Interface (B71) settings 71
 - Connector (remote) 182
 - Coupling 56, 89
 - Coupling (remote) 182
 - Digital Baseband Interface (B17) settings 69
 - Overload 34
 - Overload (remote) 182
 - RF 56
 - Settings 55, 89
 - Signal, parameters 34
 - Source Configuration (softkey) 55
 - Source, Analog Baseband 71
 - Source, digital I/Q 69
 - Source, Radio frequency (RF) 56
 - Input sample rate (ISR)
 - Digital I/Q 69
 - Input sources 55
 - Inserting
 - Limit line values 153
 - Installation 11
- K**
- Keys
 - MKR 134
 - MKR -> 139, 140
 - MKR FUNCT 142
 - Peak Search 141
 - RUN CONT 104
 - RUN SINGLE 104, 105
- L**
- Limit check
 - Remote control 322
 - Limit lines 147
 - Activating/Deactivating 149
 - Comment 151
 - Compatibility 148
 - Copying 150
 - Creating 150
 - Data points 152
 - Deactivating 150
 - Deleting 150
 - Deleting values 153
 - Details 150
 - Editing 150
 - Inserting values 153
 - Managing 147
 - Margin 152
 - Name 151
 - Remote control 322
 - Saving 153
 - Selecting 149
 - Shifting 153
 - Threshold 151
 - Traces 149
 - View filter 149
 - Visibility 149
 - X-axis 152
 - X-Offset 149
 - Y-axis 152
 - Y-Offset 149
 - Lines
 - Configuration (Softkey) 147
 - Limit, see Limit lines 147
 - Linking
 - Markers 136, 139
 - LO
 - Level (External Mixer (B21), remote control) 185
 - Level (External Mixer, B21) 62
 - Loading
 - Settings files 53
 - Low pass filter
 - AF filters 114
 - Lower Level Hysteresis
 - Softkey 127
 - LVL
 - External generator 46
- M**
- Margins
 - Limit lines 152
 - Marker functions
 - Deactivating 145
 - Remote control 312
 - Marker peak list
 - see Peak list 146
 - Marker table
 - Evaluation method 24
 - Marker to Trace
 - Softkey 137
 - Markers
 - Assigned trace 137
 - Basic settings 135
 - Configuration (remote control) 300
 - Configuration (softkey) 135
 - Configuration (Softkey) 137
 - Deactivating 137
 - Delta markers 136
 - Fixed reference (remote control) 306, 312
 - Function configuration 142
 - Linked in AF spectrum display 139
 - Linked in time domain 139
 - Linking 136
 - Minimum 141

- Minimum (remote control) 308
- n dB down 145
- n dB down (remote control) 317
- Next minimum 142
- Next minimum (remote control) 308
- Next peak 141
- Next peak (remote control) 308
- Peak 141
- Peak (remote control) 308
- Peak list (remote control) 314
- Phase noise measurement 143
- Phase noise measurement (remote control) 320
- Position 136
- Positioning 140
- Positioning (remote control) 300
- Querying position (remote) 302
- Remote control 300
- Search settings (remote) 308
- Setting up (remote control) 300
- State 136
- Step size 138
- Step size (remote control) 306
- Table 138
- Table (evaluation method) 24
- Table (remote control) 306
- Type 136
- X-value 136
- Maximizing
 - Windows (remote) 283
- Measurement accuracy
 - External generator 41
- Measurement channel
 - Creating (remote) 176, 177
 - Deleting (remote) 177
 - Duplicating (remote) 176
 - Querying (remote) 177
 - Renaming (remote) 179
 - Replacing (remote) 177
- Measurement examples
 - Analog Demodulation 163
- Measurement time
 - Auto settings 127
 - Displayed 13
 - Effects 31
 - Power sensor 83
 - Softkey 103, 105
 - Value range 29
- Microbutton
 - Probes 73
- Minimum
 - Marker positioning 141
 - Next 142
 - Softkey 141
- Mixer Type
 - External Mixer (B21) 60
- MKR
 - Key 134
- MKR ->
 - Key 139, 140
- MKR FUNCT
 - Key 142
- Modulation
 - Depth 24
 - Depth, scaling 117
 - Frequency 23, 28
- MSRA
 - Analysis interval 240
 - Operating mode 48
 - Restriction 277
- MSRA applications
 - Capture offset 103
 - Capture offset (remote) 338
- MSRA/MSRT
 - Analysis interval 101
- MSRT
 - Analysis interval 240
 - Operating mode 48
 - Restriction 277
- MSRT applications
 - Capture offset 103
 - Capture offset (remote) 339
- Multiple
 - Measurement channels 12
- Multiple zoom 153
- N**
- n dB down
 - Delta value 145
 - Marker 145
 - Remote control 317
- Name
 - Limit lines 151
- Next Minimum
 - Marker positioning 142
 - Softkey 142
- Next Peak
 - Marker positioning 141
 - Softkey 141
- Noise
 - Source 47, 122
- NOR
 - External generator 41, 46
- Normalization
 - Approximate, external generator 41
 - External generator 41, 79
- Number of Readings
 - Power sensor 84
- Numerator
 - Frequencies, external generator 44, 77
- O**
- Offset
 - Analysis interval 103
 - Reference level 87, 91
- Open-circuit reflection measurement
 - Calibration, external generator 79
- Options
 - Electronic attenuation (B25) 88
 - High-pass filter (B13) 57, 183
 - Preamplifier (B24) 89
- Output
 - Analog Demodulation 124
 - Analog Demodulation (remote) 230, 231
 - Configuration (softkey) 121
 - Noise source 47, 122
 - Parameters 34
 - Settings 121
 - Trigger 100, 122

Overload	
External generator	41
RF input	34
RF input (remote)	182
Overloading	
External generator	47
Overview	
Configuration K7	53
Softkey	53
OVLD	
External generator	41
P	
Parameters	
Input signal	34
Output	34
Peak excursion	140, 146
Peak list	
Configuring	145
Displaying	145
Evaluation method	25
Exporting	147
Marker numbers	147
Maximum number of peaks	146
Peak excursion	140, 146
Remote control	314
Sort mode	146
State	146
Peak search	
Key	141
Mode	140
Reference marker	138
Peaks	
Marker positioning	141
Next	141
Softkey	141
Performance	
Improving	31
Performing	
Analog Demodulation measurement	161
Phase	
Deviation	28
Deviation, scaling	117
Unit	121
Phase noise measurement	
Activating/Deactivating	144
Deactivating	144
Marker	143
Reference point	144
Remote control	320
Phase Wrap	
Activating	110
PM (Offline)	
Softkey	97
PM Spectrum	
Evaluation method	20
PM Time Domain	
Evaluation method	17
Ports	
External Mixer (B21, remote control)	191
Position	
Limit line values	152
Power sensors	
Activating/Deactivating	82
Average count	84
Configuration	81
Configuration (softkey)	81
Continuous Value Update	82
Duty cycle	84
External power trigger	84
External trigger level	84
Frequency	83
Frequency Coupling	83
Measurement time	83
Number of readings	84
Reference level	83, 84
Reference level offset	84
Selecting	82
Settings	81
Trigger mode	98
Unit/Scale	83
Zeroing	82
Preamplifier	
Setting	89
Softkey	89
Preset	
Bands (External Mixer (B21), remote control)	188
External Mixer (B21)	60
Presetting	
Channels	55
Default values	50
Pretrigger	99
Probes	
Microbutton	73
Settings	72
Programming examples	
External Mixer (B21)	195
Statistics	332, 333
Protection	
RF input	34
RF input (remote)	182
Q	
Quick Config	
Traces	132
R	
R&S DigiConf	70
R&S EX-IQ-BOX	
DigiConf	70
R&S SMA	
External generator	38
R&S SMU	
External generator	38
Range	120
Scaling	120
RBW	103
Displayed	13
Remote control	242
Recalling	
Calibration settings, external generator	79
Reference	
Fixed	138
Marker	138
Phase noise measurement	144
Reference frequency	
External generator	38, 75
Reference level	
Auto level	87, 92, 127
Digital I/Q	70
Displayed	13

- External generator 42
- Offset 87, 91
- Offset (Power sensor) 84
- Offset (softkey) 87, 91
- Offset, displayed 13
- Position 120
- Power sensor 83, 84
- Softkey 86, 91
- Unit 86, 87, 91
- Value 86, 91
- Reference line
 - External generator 42
 - Position, external generator 80
 - Shifting, external generator 43, 80
 - Value, external generator 80
- Reference marker 136
- Reference trace
 - External generator 41, 42
 - Storing as transducer factor, external generator .. 42, 80
- Reference value 118
 - Position 118
- Reflection measurement
 - External generator 38
- Refreshing
 - MSRA applications 105
 - MSRA applications (remote) 279
 - MSRT applications 105
 - MSRT applications (remote) 279
 - Softkey 105
- Remote commands
 - Basics on syntax 171
 - Boolean values 174
 - Capitalization 172
 - Character data 175
 - Data blocks 175
 - Numeric values 173
 - Obsolete 341
 - Optional keywords 172
 - Parameters 173
 - Strings 175
 - Suffixes 172
- Res BW
 - Softkey 103
- Resetting
 - RF input protection 34, 182
- Residual FM 28
- Resolution bandwidth
 - see RBW 103
- Restoring
 - Channel settings 55
 - Standard files 53
- Result Display 12
- Result displays
 - Marker table 24
 - Peak list 25
- Result frequency
 - External generator 78
- Result Summary
 - Demodulation spectrum 112
 - Evaluation method 23
 - Retrieving values (remote) 294
- Results 15
 - Analyzing 129
 - Data format (remote) 291, 293
 - Exporting 133
 - Retrieving (remote control) 289
 - Stability 31
 - Updating the display 105
 - Updating the display (remote) 279
- Reverse sweep
 - External generator 45, 77
- RF (Offline)
 - Softkey 97
- RF attenuation
 - Auto (softkey) 88
 - Manual (softkey) 88
- RF full span 113
- RF input 56
 - Analog Baseband connector 34
 - Connector (remote) 182
 - Overload protection 34
 - Overload protection (remote) 182
 - Remote 181, 184
- RF overrange
 - External Mixer (B21) 60, 191
- RF OVLD
 - External generator 46
- RF Power
 - Trigger 98
 - Trigger level (remote) 248
- RF Spectrum
 - Evaluation method 22
 - Troubleshooting 169
- RF Time Domain
 - Evaluation method 21
- Rising
 - Slope (Power sensor) 85
- RUN CONT
 - Key 104
- RUN SINGLE
 - Key 104, 105
- S**
- Sample rate 29
 - Digital I/Q 69
 - Digital I/Q (remote) 205, 206
- Samples
 - Performance 31
- Saving
 - Limit lines 153
 - Settings 53
- Scalar reflection measurement
 - External generator 38
- Scaling
 - AF 117
 - Amplitude range, automatically 120
 - Automatic 119, 128
 - Configuration (Softkey) 117
 - Result Summary 119
 - RF 119
 - Y-axis 120
 - Y-axis (remote control) 239
- Screen layout 12
- Search Configuration (softkey) 139
- Search settings
 - Markers (remote) 308
- Secure user mode
 - Storage location 52
- Select Marker
 - Softkey 141
- Sequencer 12
 - Aborting (remote) 280
 - Activating (remote) 280

Mode (remote)	280	Export	157
Remote	278	Export config	157
Settings		External	95
Displayed	53	FM (Offline)	97
File name	52	Free Run	95
Restoring files	53	Frequency Config	110
Storage location	52	I/Q Power	96
Settings files		IF Power	96
Deleting	53	Import	157
Loading	53	Input Source Config	55
Predefined	345	IQ Export	157
Saving	53	IQ Import	157
Setup files		Line Config	147
External generator	40, 74, 75	Lower Level Hysteresis	127
Shift x		Marker Config	135, 137
Limit lines	153	Marker to Trace	137
Shift y		Meas Time	103, 105
Limit lines	153	MeasTime Auto	127
Short-circuit reflection measurement		MeasTime Manual	127
Calibration, external generator	79	Min	141
Signal ID		Next Min	142
External Mixer (B21, remote control)	186	Next Peak	141
External Mixer (B21)	63	Norm/Delta	136
Signal source		Outputs Config	121
Remote	184	Overview	53
Signal-to-noise ratio	28	Peak	141
Signal-to-noise-and-distortion		PM (Offline)	97
see SINAD	23	Power Sensor	98
SINAD	23	Power Sensor Config	81
Querying (remote)	295	Preamp	89
Troubleshooting	169	Ref Level	86, 91
Single sweep		Ref Level Offset	87, 91
Softkey	104	Refresh	105
Single zoom	153	Res BW	103
Slope		RF (Offline)	97
Power sensor trigger	85	RF Atten Auto	88
Trigger	99, 250	RF Atten Manual	88
Trigger (Power sensor)	85	RF Power	98
Softkey		Scale Config	117
Calibrate Reflection Open (remote control)	226	Search Config	139
Calibrate Reflection Short (remote control)	226	Select Marker	141
Calibrate Transmission (remote control)	226	Single Sweep	104
Normalize (remote control)	227	Span Manual	112
Softkeys		Sweep count	106
AF Auto Scale	119, 128	Time	97
AF Center	111	Trace 1/2/3/4	132
AF Filter Config	113	Trace Config	129
AF Full Span	112	Trigger Offset	99
AF Span Manual	111	Upper Level Hysteresis	127
AF Start	111	Sort mode	
AF Stop	111	Peak list	146
All Functions Off	145	Source offset	
AM (Offline)	97	External generator	76
Amplitude Config	85	Source power	
Auto All	126	External generator	76
Auto Freq	126	Span	112
Auto Level	87, 92, 127	Displayed	14
BB Power	96	Manual (Softkey)	112
Capture Offset	103	Specifics for	
Center	93, 112	Configuration	55
Continue Single Sweep	105	Spectrum	
Continuous Sweep	104	Demodulation	110
Demod BW	102, 113	Squelch	
Demod Config	107	AF	108
DiglConf	70	Level	108
Digital I/Q	97	Remote control	256
Display Config	106	State	108

- Standards
 - Predefined 345
 - Presetting 52
 - see Digital standards 51
- Statistics
 - Programming example 332, 333
- Status bar
 - Error messages, external generator 46
- Status registers
 - STAT:QUES:POW 182
- Step size
 - Markers 138
 - Markers (remote control) 306
- Storage location
 - Secure user mode 52
 - Settings 52
- Suffixes
 - Common 175
 - Remote commands 172
- Sweep
 - Aborting 104, 105
 - Count 106
 - Points 106
 - Settings 103
- Sweep points
 - Displayed 14
- Sweeps
 - Performing (remote) 277
 - Reverse, external generator 45
- T**
- TCP/IP
 - Address, External generator 75
 - External generator 74
- THD 23
 - Querying (remote) 295
 - Troubleshooting 169
 - Unit 121
- Threshold
 - Limit lines 151
- Time domain zoom 32, 109
 - Length 109
 - Start 109
 - State 109
 - Time per division 109
- Time per division
 - Displayed 14
 - Softkey 109
- Time trigger
 - Softkey 97
- Total harmonic distortion
 - see THD 23
- Traces
 - Average mode 131
 - Averaging (remote control) 275
 - Configuration (softkey) 129
 - Configuring (remote control) 270
 - Detector 131
 - Detector (remote control) 275
 - Export format 134
 - Exporting 133, 134, 157
 - Hold 131
 - Mode 130
 - Mode (remote) 270
 - Remote control 289
 - Retrieving results (remote) 289
 - Settings (remote control) 270
 - Settings, predefined 132
 - Softkeys 132
- Traces to be Checked
 - Limit lines 149
- Tracking
 - see External generator 76
- Transducers
 - Calibration with external generator 42, 80
- Transmission measurement
 - Calibration, external generator 79
 - External generator 37
- Trigger
 - Drop-out time 99
 - Drop-out time (Power sensor) 85
 - External (remote) 250
 - External power 84
 - Holdoff 99
 - Holdoff (Power sensor) 85
 - Hysteresis 99
 - Hysteresis (Power sensor) 85
 - Level 98
 - Level (Power sensor) 84
 - Offset (softkey) 99
 - Offset, value range 29
 - Output 100, 122
 - Power sensor 84
 - Remote control 244
 - Settings 94
 - Slope 99, 250
 - Slope (Power sensor) 85
- Trigger level
 - External trigger (remote) 247
 - I/Q Power (remote) 248
 - IF Power (remote) 247
 - RF Power (remote) 248
- Trigger source 95
 - AF 31
 - AM (Offline) 97
 - BB Power 96
 - Digital I/Q 97
 - External 95
 - FM (Offline) 97
 - Free Run 95
 - I/Q Power 96
 - IF Power 96
 - PM (Offline) 97
 - Power Sensor 98
 - RF (Offline) 97
 - RF Power 98
 - Settings 95
 - Time 97
- Troubleshooting 169
 - Demodulation bandwidth 169
 - Input overload 182
 - Overload, external generator 47
 - RF Spectrum 169
 - SINAD 169
 - THD 169
- TTL handshake
 - see TTL synchronization 75
- TTL synchronization
 - AUX control, external generator 37
 - External generator 37, 45, 75

U

Units	120
Power sensor	83
Reference level	86, 87, 91
Updating	
Result display	105
Result display (remote)	279
Upper Level Hysteresis	
Softkey	127
User manuals	8

V

View filter	
Limit lines	149
Visible	
Limit lines	149

W

Weighting filter	
AF filters	115
Window title bar information	14
Windows	
Adding (remote)	284
Closing (remote)	286, 288
Configuring	55
Layout (remote)	286
Maximizing (remote)	283
Querying (remote)	285
Replacing (remote)	286
Splitting (remote)	283
Types (remote)	284

X

X-axis	
Limit lines	152
X-Offset	
Limit lines	149
X-value	
Marker	136

Y

Y-axis	
Limit lines	152
Scaling	120
Y-Offset	
Limit lines	149
YIG-preselector	
Activating/Deactivating	57
Activating/Deactivating (remote)	183

Z

Zero Phase	
Reference Position	110
Reference Position (remote)	255
Zeroing	
Power sensor	82
Zooming	
Activating (remote)	335
Area (Multiple mode, remote)	335
Area (remote)	334
Deactivating	154

Multiple mode	153
Multiple mode (remote)	335, 336
Remote	334
Restoring original display	154
Single mode	153
Single mode (remote)	334
Time domain	32, 109