R&S® FSV
Signal and Spectrum Analyzer
Operating Manual

Test & Measurement

Operating Manual

ROHDE&SCHWARZ

This manual describes the following R&S®FSV models with firmware version 1.50:

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

In addition to the base unit, the following options are described:

- analyzer-B9/10 (1310.9545.02/1310.9551.02)
- analyzer-B17 (1310.9568.02)
- analyzer-B21 (1310.9597.02)
- analyzer-B22 (1310.9600.02)
- analyzer-B24 (1310.9616.13)
- analyzer-K9 (1310.8203.02)
- analyzer-K14 (1310.8255.02)

The firmware of the instrument makes use of several valuable open source software packages. The most important of them are listed below together with their corresponding open source license. The verbatim license texts are provided on the user documentation CD-ROM (included in delivery).

Package	Link	License
OpenSSL	http://www.openssl.org	OpenSSL/SSLeavy
Xitami	http://www.xitami.com	2.5b6
PHP	http://www.php.net	PHP v.3
DOJO-AJAX	http://www.dojotoolkit.org	Academic Free License (BSD)
ResizableLib	http://www.geocities.com/ppescher	Artistic License
BOOST Library	http://www.boost.org	Boost Software v.1
ONC/RPC	http://www.plt.rwth-aachen.de/ index.php?id=258	SUN

The product Open SSL includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com).

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

The following abbreviations are used throughout this manual: R&S®FSV is abbreviated as R&S FSV. R&S®EX-I/Q-Box is abbreviated as R&S EX-I/Q-Box.

Contents

1 Preface

1.1 Documentation Overview

The user documentation for the analyzer is divided as follows:

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

Quick Start Guide

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

Chapters 1-3	Introduction, General information
Chapter 4	Front and Rear Panel
Chapter 5	Preparing for Use
Chapter 6	Firmware Update and Installation of Firmware Options
Chapter 7	Basic Operations
Chapter 8	Basic Measurement Examples
Chapter 9	Brief Introduction to Remote Control
Appendix 1	Printer Interface
Appendix 2	LAN Interface

Operating Manuals

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

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

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

The following Operating Manuals are available for the analyzer:

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

These manuals are available in PDF format on the CD delivered with the instrument. The printed manual can be ordered from Rohde & Schwarz GmbH & Co. KG.

Service Manual

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

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

Online Help

The online help contains context-specific help on operating the analyzer and all available options. It describes both manual and remote operation. The online help is installed on the analyzer by default, and is also available as an executable .chm file on the CD delivered with the instrument.

Release Notes

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

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touch screen 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 device 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 device or on a keyboard.

1.3 How to Use the Help System

Calling context-sensitive and general help

► To display the general help dialog box, press the HELP key on the front panel.

  The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.

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

► If the help is already displayed, press the softkey for which you want to display help.

  A topic containing information about the softkey and its function is displayed.

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

Contents of the help dialog box

The help dialog box contains four tabs:

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

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

Navigating in the table of contents

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

Navigating in the help topics

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

Searching for a topic

1. Change to the "Index" tab.

2. Enter the first characters of the topic you are interested in. The entries starting with these characters are displayed.

3. Change the focus by pressing the ENTER key.

4. Select the suitable keyword by using the UP ARROW or DOWN ARROW keys or the rotary knob.

5. Press the ENTER key to display the help topic.

   The "View" tab with the corresponding help topic is displayed.

Changing the zoom

1. Change to the "Zoom" tab.

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

Closing the help window

► Press the ESC key or a function key on the front panel.

2 Advanced Measurement Examples

This chapter explains how to operate the analyzer using typical measurements as examples. Additional background information on the settings is given. For more detailed information on all available softkeys and the corresponding instrument functions, see chapter 3, "Instrument Functions", on page 53.

Examples of more basic character are provided in the Quick Start Guide, chapter 5, as an introduction. The following topics are included in the Quick Start Guide:

1. Measuring a Sinusoidal Signal

   ● Measuring the Level and Frequency Using Markers
   ● Measuring the Signal Frequency Using the Frequency Counter

2. Measuring Harmonics of Sinusoidal Signals

   ● Measuring the Suppression of the First and Second Harmonic of an Input Signal

3. Measuring Signal Spectra with Multiple Signals

   ● Separating Signals by Selecting the Resolution Bandwidth
   ● Measuring the Modulation Depth of an AM-Modulated Carrier (Span > 0)
   ● Measuring of AM-Modulated Signals

4. Measurements with Zero Span

   ● Measuring the Power Characteristic of Burst Signals
   ● Measuring the Signal-to-Noise Ratio of Burst Signals
   ● Measurement of FM-Modulated Signals

5. Storing and Loading Instrument Settings

   ● Storing an Instrument Configuration (without Traces)
   ● Storing Traces
   ● Loading an Instrument Configuration (with Traces)
   ● Configuring Automatic Loading

2.1 Test Setup

All of the following examples are based on the standard settings of the analyzer. These are set with the PRESET key. A complete listing of the standard settings can be found in chapter "Instrument Functions", section "Initializing the Configuration – PRESET Key".

In the following examples, a signal generator is used as a signal source. The RF output of the signal generator is connected to the RF input of analyzer.

If a 64 MHz signal is required for the test setup, as an alternative to the signal generator, the internal 64 MHz reference generator can be used:

1. Switch on the internal reference generator.

   a) Press the SETUP key.

   b) Press the "More" key.
   c) Press the "Service" softkey.
   d) Press the "Input RF/Cal" softkey, until "Cal" is highlighted.
      The internal 64 MHz reference generator is now on. The analyzer's RF input is switched off.

2. Switch on the RF input again for normal operation of the analyzer. Two ways are possible:

   a) Press the PRESET key.
      or:
   b) Press the SETUP key.
   c) Press the "Service" softkey.
   d) Press the "Input RF/Cal" softkey, until "RF" is highlighted.

   The internal signal path of the analyzer is switched back to the RF input in order to resume normal operation.

2.2 Measurement of Harmonics

Measuring the harmonics of a signal is a frequent problem which can be solved best by means of a signal analyzer. In general, every signal contains harmonics which are larger than others. Harmonics are particularly critical regarding high-power transmitters such as transceivers because large harmonics can interfere with other radio services.

Harmonics are generated by nonlinear characteristics. They can often be reduced by low pass filters. Since the signal analyzer has a nonlinear characteristic, e.g. in its first mixer, measures must be taken to ensure that harmonics produced in the signal analyzer do not cause spurious results. If necessary, the fundamental wave must be selectively attenuated with respect to the other harmonics with a high pass filter.

When harmonics are being measured, the obtainable dynamic range depends on the second harmonic intercept of the signal analyzer. The second harmonic intercept is the virtual input level at the RF input mixer at which the level of the 2nd harmonic becomes equal to the level of the fundamental wave. In practice, however, applying a level of this magnitude would damage the mixer. Nevertheless the available dynamic range for measuring the harmonic distance of a DUT can be calculated relatively easily using the second harmonic intercept.

As shown in figure 2-1, the level of the 2nd harmonic drops by 20 dB if the level of the fundamental wave is reduced by 10 dB.
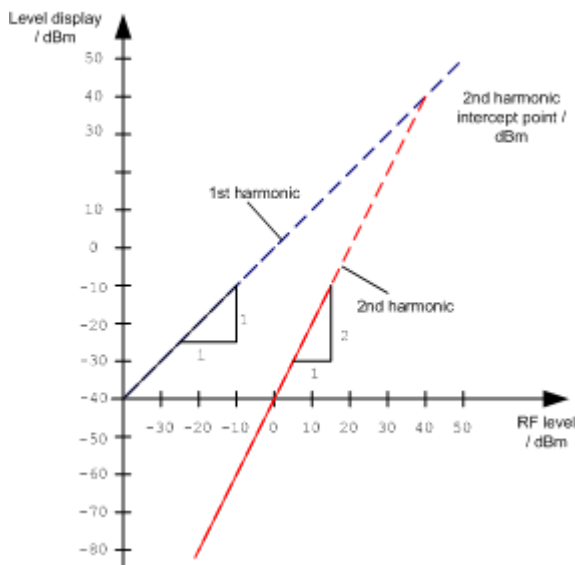
Fig. 2-1: Extrapolation of the 1st and 2nd harmonics to the 2nd harmonic intercept at 40 dBm

The following formula for the obtainable harmonic distortion d_2 in dB is derived from the straight-line equations and the given intercept point:

$d_2 = S.H.I – P_I$ (1)

where:

d2	=	harmonic distortion
P_I	=	mixer level/dBm
S.H.I.	=	second harmonic intercept

The mixer level is the RF level applied to the RF input minus the set RF attenuation.

The formula for the internally generated level P_1 at the 2nd harmonic in dBm is:

$P_1 = 2 * P_I – S.H.I.$ (2)

The lower measurement limit for the harmonic is the noise floor of the signal analyzer. The harmonic of the measured DUT should – if sufficiently averaged by means of a video filter – be at least 4 dB above the noise floor so that the measurement error due to the input noise is less than 1 dB.

The following rules for measuring high harmonic ratios can be derived:

● Select the smallest possible IF bandwidth for a minimal noise floor.

● Select an RF attenuation which is high enough to just measure the harmonic ratio.

The maximum harmonic distortion is obtained if the level of the harmonic equals the intrinsic noise level of the receiver. The level applied to the mixer, according to (2), is:

$$P_I = \frac{P_{noise} / dBm + IP2}{2}$$

At a resolution bandwidth of 10 Hz (noise level -143 dBm, S.H.I. = 40 dBm), the optimum mixer level is – 51.5 dBm. According to (1) a maximum measurable harmonic distortion of 91.5 dB minus a minimum S/N ratio of 4 dB is obtained.

> If the harmonic emerges from noise sufficiently (approx. >15 dB), it is easy to check (by changing the RF attenuation) whether the harmonics originate from the DUT or are generated internally by the signal analyzer. If a harmonic originates from the DUT, its level remains constant if the RF attenuation is increased by 10 dB. Only the displayed noise is increased by 10 dB due to the additional attenuation. If the harmonic is exclusively generated by the signal analyzer, the level of the harmonic is reduced by 20 dB or is lost in noise. If both – the DUT and the signal analyzer – contribute to the harmonic, the reduction in the harmonic level is correspondingly smaller.

High-Sensitivity Harmonics Measurements

If harmonics have very small levels, the resolution bandwidth required to measure them must be reduced considerably. The sweep time is, therefore, also increased considerably. In this case, the measurement of individual harmonics is carried out with the analyzer set to a small span. Only the frequency range around the harmonics will then be measured with a small resolution bandwidth.

Signal generator settings (e.g. analyzer SMU):

Frequency:	128 MHz
Level:	- 25 dBm

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is set to its default state.

2. Set the center frequency to 128 MHz and the span to 100 kHz:

   a) Press the FREQ key.
      The "Frequency" menu is displayed.
   b) In the dialog box, enter "128" using the numeric keypad and confirm with the MHz key.
   c) Press the SPAN key.
   d) In the dialog box, enter "100" using the numeric keypad and confirm with the kHz key.

   The analyzer displays the reference signal with a span of 100 kHz and resolution bandwidth of 1 kHz.

3. Switching on the marker by pressing the MKR key.
   The marker is positioned on the trace maximum.

4. Set the measured signal frequency and the measured level as reference values

   a) Press the MKR FUNC key

   b) Press the "Phase Noise" softkey.
      The position of the marker becomes the reference point. The reference point level is indicated by a horizontal line, the reference point frequency with a vertical line. At the same time, the delta marker 2 is switched on.

   c) Press the "Ref Fixed" softkey.
      The mode changes from phase noise measurement to reference fixed, the marker readout changes from dB/Hz to dB.
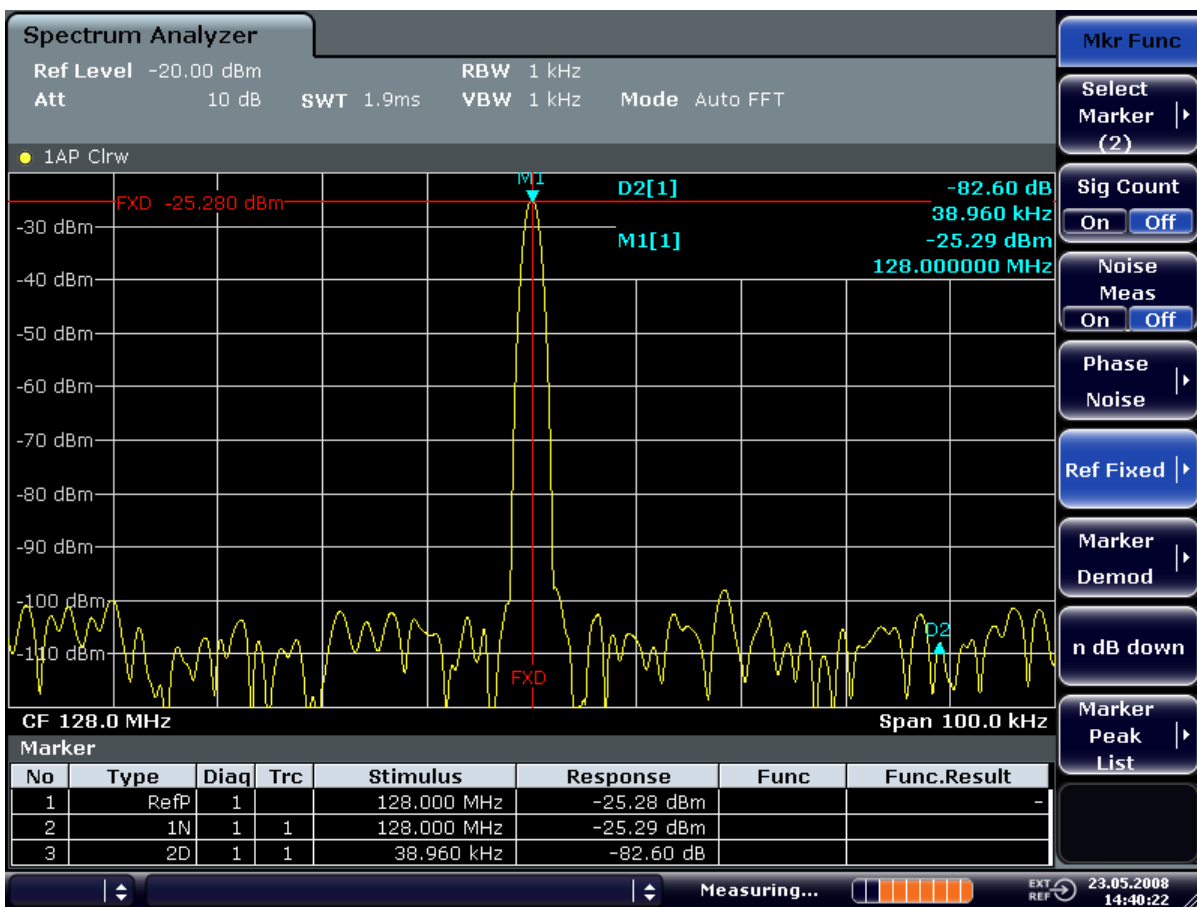

Fig. 2-2: Fundamental wave and the frequency and level reference point

5. Make the step size for the center frequency equal to the signal frequency

   a) Press the FREQ key.
      The "Frequency" menu is displayed.

   b) Press the "CF-Stepsize" softkey and press the "= Marker" softkey in the submenu.

   The step size for the center frequency is now equal to the marker frequency.

6. Set the center frequency to the 2nd harmonic of the signal

   a) Press the FREQ key.
      The "Frequency" menu is displayed.

　　　　b) Press the "UPARROW" key once.

　　　　　The center frequency is set to the 2nd harmonic.

7. Place the delta marker on the 2nd harmonic.

　　　　a) Press the MKR ->key.

　　　　b) Press the "Peak" softkey.

The delta marker moves to the maximum of the 2nd harmonic. The displayed level result is relative to the reference point level (= fundamental wave level).
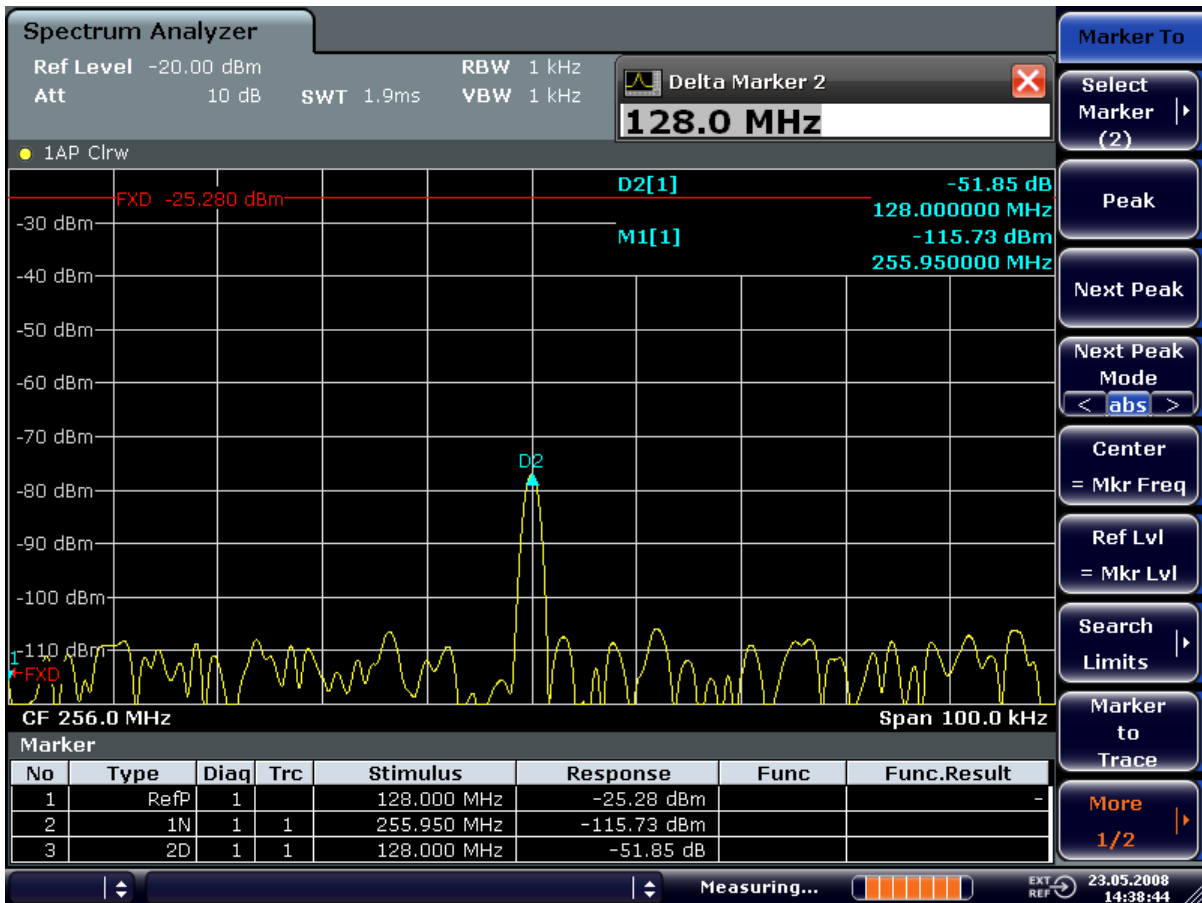

Fig. 2-3: Measuring the level difference between the fundamental wave (= reference point level) and the 2nd harmonic

The other harmonics are measured with steps 5 and 6, the center frequency being incremented or decremented in steps of 128 MHz using the "UPARROW" or "DNARROW" key.

2.3 Measuring the Spectra of Complex Signals

2.3.1 Separating Signals by Selecting an Appropriate Resolution Bandwidth

A basic feature of a signal analyzer is being able to separate the spectral components of a mixture of signals. The resolution at which the individual components can be separated is determined by the resolution bandwidth. Selecting a resolution bandwidth that is too large may make it impossible to distinguish between spectral components, i.e. they are displayed as a single component.

An RF sinusoidal signal is displayed by means of the passband characteristic of the resolution filter (RBW) that has been set. Its specified bandwidth is the 3 dB bandwidth of the filter.

Two signals with the same amplitude can be resolved if the resolution bandwidth is smaller than or equal to the frequency spacing of the signal. If the resolution bandwidth is equal to the frequency spacing, the spectrum display screen shows a level drop of 3 dB precisely in the center of the two signals. Decreasing the resolution bandwidth makes the level drop larger, which thus makes the individual signals clearer.

If there are large level differences between signals, the resolution is determined by selectivity as well as by the resolution bandwidth that has been selected. The measure of selectivity used for signal analyzers is the ratio of the 60 dB bandwidth to the 3 dB bandwidth (= shape factor).

For the analyzer, the shape factor for bandwidths is < 5, i.e. the 60 dB bandwidth of the 30 kHz filter is <150 kHz.

The higher spectral resolution with smaller bandwidths is won by longer sweep times for the same span. The sweep time has to allow the resolution filters to settle during a sweep at all signal levels and frequencies to be displayed.

2.3.2 Intermodulation Measurements

If several signals are applied to a transmission two-port device with nonlinear characteristic, intermodulation products appear at its output by the sums and differences of the signals. The nonlinear characteristic produces harmonics of the useful signals which intermodulate at the characteristic. The intermodulation products of lower order have a special effect since their level is largest and they are near the useful signals. The intermodulation product of third order causes the highest interference. It is the intermodulation product generated from one of the useful signals and the 2nd harmonic of the second useful signal in case of two-tone modulation.

The frequencies of the intermodulation products are above and below the useful signals. The figure 2-4 shows intermodulation products P_{I1} and P^{I2} generated by the two useful signals P_{U1} and P_{U2}.
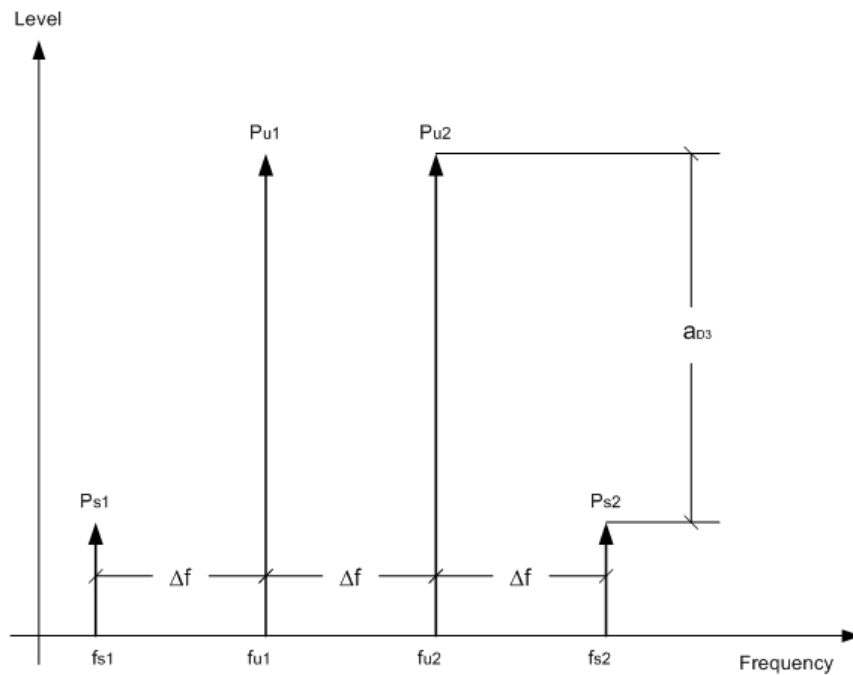
Fig. 2-4: Intermodulation products PU1 and PU2

The intermodulation product at f_{I2} is generated by mixing the 2nd harmonic of useful signal P_{U2} and signal P_{U1}, the intermodulation product at f_{I1} by mixing the 2nd harmonic of useful signal P_{U1} and signal P_{U2}.

$f_{i1} = 2 \times f_{u1} - f_{u2}$ (6)

$f_{i2} = 2 \times f_{u2} - f_{u1}$ (7)

The level of the intermodulation products depends on the level of the useful signals. If the two useful signals are increased by 1 dB, the level of the intermodulation products increases by 3 dB, which means that spacing a_{D3} between intermodulation signals and useful signals are reduced by 2 dB. This is illustrated in .
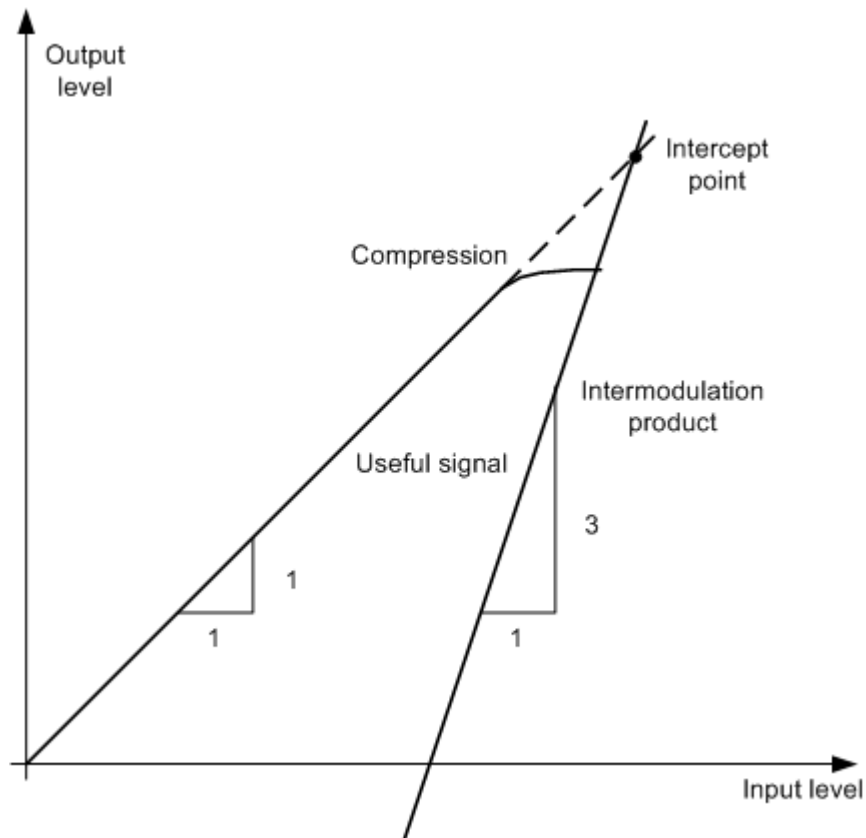
Fig. 2-5: Dependence of intermodulation level on useful signal level

The useful signals at the two-port output increase proportionally with the input level as long as the two-port is in the linear range. A level change of 1 dB at the input causes a level change of 1 dB at the output. Beyond a certain input level, the two-port goes into compression and the output level stops increasing. The intermodulation products of the third order increase three times as much as the useful signals. The intercept point is the fictitious level where the two lines intersect. It cannot be measured directly since the useful level is previously limited by the maximum two-port output power.

It can be calculated from the known line slopes and the measured spacing a_{D3} at a given level according to the following formula.
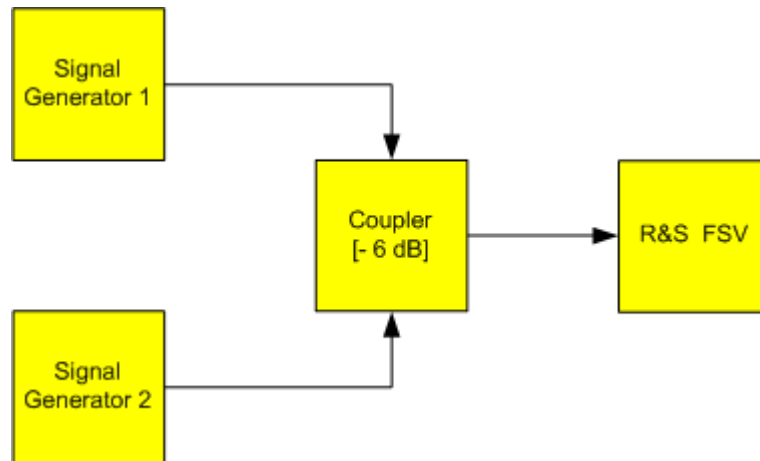
$$IP3 = \frac{a_{D3}}{2} + P_N$$

The 3rd order intercept point (TOI), for example, is calculated for an intermodulation of 60 dB and an input level P_U of -20 dBm according to the following formula:

$$IP3 = \frac{60}{2} + (-20dBm) = 10dBm$$

2.3.2.1   Measurement Example – Measuring the analyzer's Intrinsic Intermodulation

Test setup:

Signal generator settings (e.g. analyzer SMU):

	Level	Frequency
Signal generator 1	-4 dBm	999.7 MHz
Signal generator 2	-4 dBm	1000.3 MHz

Procedure:

1. Set the analyzer to its default settings by pressing the PRESET key.
   The analyzer is in its default state.

2. Set center frequency to 1 GHz and the frequency span to 3 MHz.

   a) Press the FREQ key and enter "1 GHz".
   b) Press the SPAN key and enter "3 MHz".

3. Set the reference level to -10 dBm and RF attenuation to 0 dB.

   a) Press the AMPT key and enter "-10 dBm".
   b) Press the "RF Atten Manual" softkey and enter "0 dB".

4. Set the resolution bandwidth to 10 kHz.

   a) Press the BW key.
   b) Press the "Res BW Manual" softkey and enter "10 kHz".
      The noise is reduced, the trace is smoothed further and the intermodulation prod-
      ucts can be clearly seen.
   c) Press the "Video BW Manual" softkey and enter "1 kHz".

5. Measuring intermodulation by means of the 3rd order intercept measurement function

   a) Press the MEAS key.

b) Press the "TOI" softkey.

The analyzer activates four markers for measuring the intermodulation distance. Two markers are positioned on the useful signals and two on the intermodulation products. The 3rd order intercept is calculated from the level difference between the useful signals and the intermodulation products. It is then displayed on the screen:
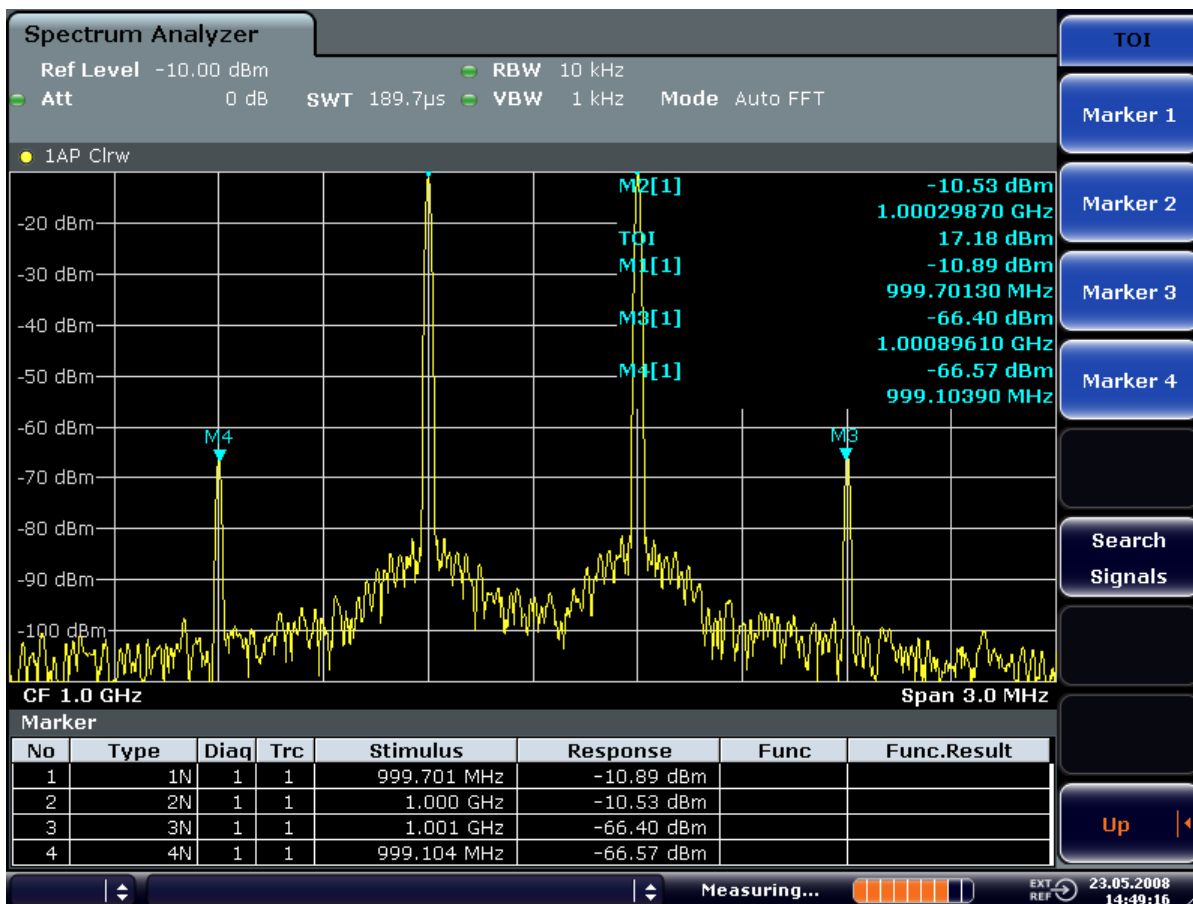

Fig. 2-6: Result of intrinsic intermodulation measurement on the analyzer. The 3rd order intercept (TOI) is displayed at the top right corner of the grid.

The level of a signal analyzer's intrinsic intermodulation products depends on the RF level of the useful signals at the input mixer. When the RF attenuation is added, the mixer level is reduced and the intermodulation distance is increased. With an additional RF attenuation of 10 dB, the levels of the intermodulation products are reduced by 20 dB. The noise level is, however, increased by 10 dB.

6. Increasing RF attenuation to 20 dB to reduce intermodulation products.

a) Press the AMPT key.

b) Press the "RF Atten Manual" softkey and enter "20 dB".

The analyzer's intrinsic intermodulation products disappear below the noise floor.
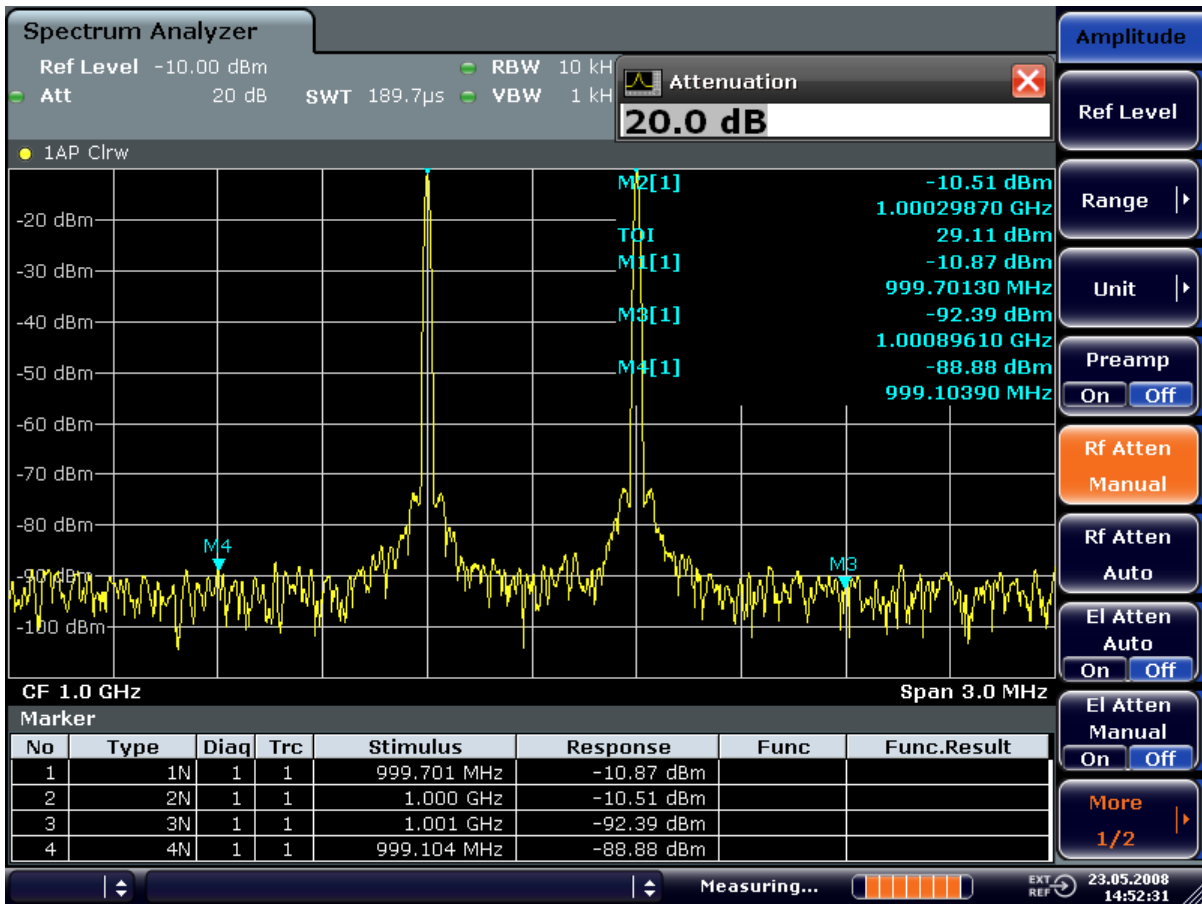
Fig. 2-7: If the RF attenuation is increased, the analyzer's intrinsic intermodulation products disappear below the noise floor.

Calculation method:

The method used by the analyzer to calculate the intercept point takes the average useful signal level P_u in dBm and calculates the intermodulation d_3 in dB as a function of the average value of the levels of the two intermodulation products. The third order intercept (TOI) is then calculated as follows:

TOI/dBm = ½ d_3 + P_u

Intermodulation- free dynamic range

The "Intermodulation-free dynamic range", i.e. the level range in which no internal inter-modulation products are generated if two-tone signals are measured, is determined by the 3rd order intercept point, the phase noise and the thermal noise of the signal analyzer. At high signal levels, the range is determined by intermodulation products. At low signal levels, intermodulation products disappear below the noise floor, i.e. the noise floor and the phase noise of the signal analyzer determine the range. The noise floor and the phase noise depend on the resolution bandwidth that has been selected. At the smallest reso-lution bandwidth, the noise floor and phase noise are at a minimum and so the maximum range is obtained. However, a large increase in sweep time is required for small resolution bandwidths. It is, therefore, best to select the largest resolution bandwidth possible to obtain the range that is required. Since phase noise decreases as the carrier-offset

increases, its influence decreases with increasing frequency offset from the useful signals.

The following diagrams illustrate the intermodulation-free dynamic range as a function of the selected bandwidth and of the level at the input mixer (= signal level – set RF attenuation) at different useful signal offsets.
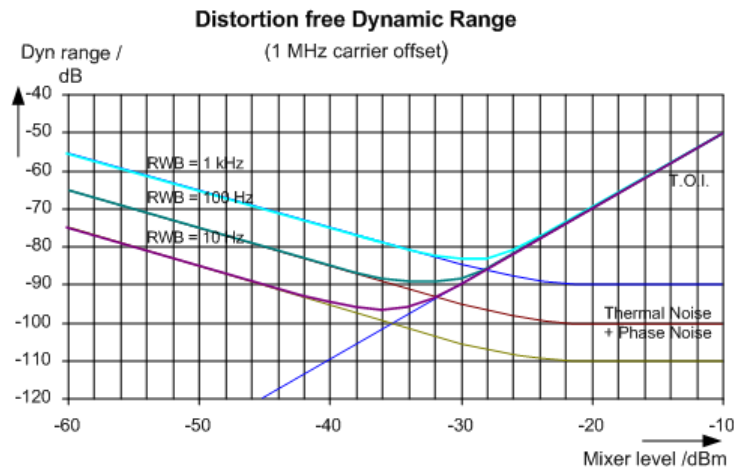

Fig. 2-8: *Intermodulation-free range of the analyzer as a function of level at the input mixer and the set resolution bandwidth*

(Useful signal offset = 1 MHz, DANL = -145 dBm/Hz, TOI = 15 dBm; typical values at 2 GHz)

The optimum mixer level, i.e. the level at which the intermodulation distance is at its maximum, depends on the bandwidth. At a resolution bandwidth of 10 Hz, it is approx. -35 dBm and at 1 kHz increases to approx. -30 dBm.

Phase noise has a considerable influence on the intermodulation-free range at carrier offsets between 10 and 100 kHz (figure 2-9). At greater bandwidths, the influence of the phase noise is greater than it would be with small bandwidths. The optimum mixer level at the bandwidths under consideration becomes almost independent of bandwidth and is approx. -40 dBm.
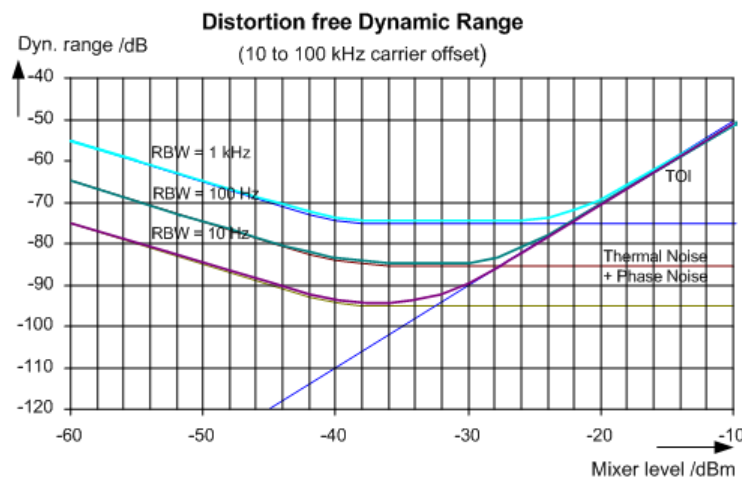

Fig. 2-9: *Intermodulation-free dynamic range of the analyzer as a function of level at the input mixer and of the selected resolution bandwidth*

(Useful signal offset = 10 to 100 kHz, DANL = -145 dBm/Hz, TOI = 15 dBm; typical values at 2 GHz).

> If the intermodulation products of a DUT with a very high dynamic range are to be measured and the resolution bandwidth to be used is therefore very small, it is best to measure the levels of the useful signals and those of the intermodulation products separately using a small span. The measurement time will be reduced- in particular if the offset of the useful signals is large. To find signals reliably when frequency span is small, it is best to synchronize the signal sources and the analyzer.

2.4 Measuring Signals in the Vicinity of Noise

The minimum signal level a signal analyzer can measure is limited by its intrinsic noise. Small signals can be swamped by noise and therefore cannot be measured. For signals that are just above the intrinsic noise, the accuracy of the level measurement is influenced by the intrinsic noise of the signal analyzer.

The displayed noise level of a signal analyzer depends on its noise figure, the selected RF attenuation, the selected reference level, the selected resolution and video bandwidth and the detector. The effect of the different parameters is explained in the following.

Impact of the RF attenuation setting

The sensitivity of a signal analyzer is directly influenced by the selected RF attenuation. The highest sensitivity is obtained at a RF attenuation of 0 dB. The attenuation can be set in 10 dB steps up to 70 dB. Each additional 10 dB step reduces the sensitivity by 10 dB, i.e. the displayed noise is increased by 10 dB.

Impact of the resolution bandwidth

The sensitivity of a signal analyzer also directly depends on the selected bandwidth. The highest sensitivity is obtained at the smallest bandwidth (1 Hz). If the bandwidth is increased, the reduction in sensitivity is proportional to the change in bandwidth. The analyzer has bandwidth settings in 1, 2, 3, 5 sequence. Increasing the bandwidth by a factor of 3 increases the displayed noise by approx. 5 dB (4.77 dB precisely). If the bandwidth is increased by a factor of 10, the displayed noise increases by a factor of 10, i.e. 10 dB.

Impact of the video bandwidth

The displayed noise of a signal analyzer is also influenced by the selected video bandwidth. If the video bandwidth is considerably smaller than the resolution bandwidth, noise spikes are suppressed, i.e. the trace becomes much smoother. The level of a sine wave signal is not influenced by the video bandwidth. A sine wave signal can therefore be freed from noise by using a video bandwidth that is small compared with the resolution bandwidth, and thus be measured more accurately.

Impact of the detector

Noise is evaluated differently by the different detectors. The noise display is therefore influenced by the choice of detector. Sine wave signals are weighted in the same way by all detectors, i.e. the level display for a sine wave RF signal does not depend on the selected detector, provided that the signal-to-noise ratio is high enough. The measurement accuracy for signals in the vicinity of intrinsic signal analyzer noise is also influenced by the detector which has been selected. For details on the detectors of the analyzer refer to chapter "Instrument Functions", section "Detector overview" or the Online Help.

2.4.1 Measurement Example – Measuring Level at Low S/N Ratios

The example shows the different factors influencing the S/N ratio.

Signal generator settings (e.g. analyzer SMU):

Frequency:	128 MHz
Level:	- 90 dBm

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Set the center frequency to 128 MHz and the frequency span to 100 MHz:

   a) Press the FREQ key and enter "128 MHz".

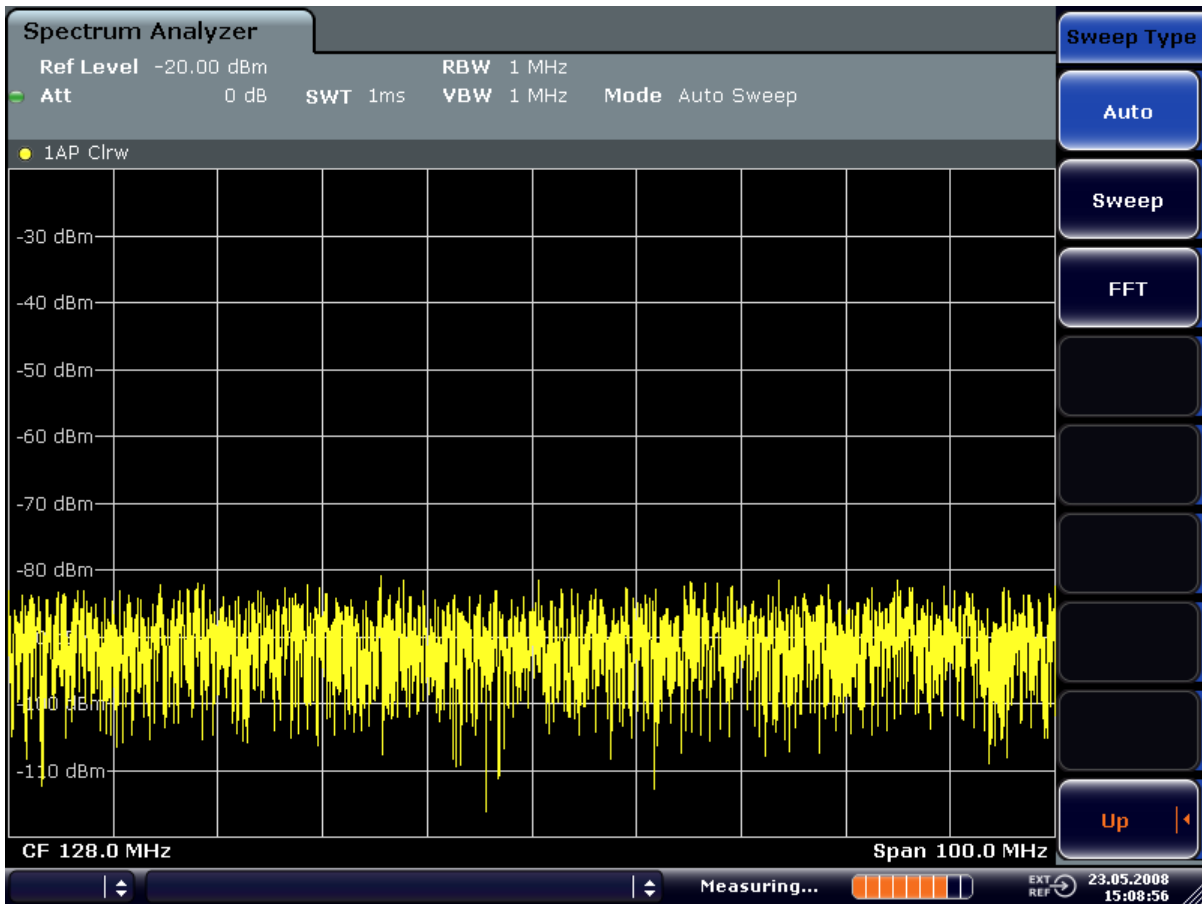b) Press the SPAN key and enter "100 MHz".

Fig. 2-10: Sine wave signal with low S/N ratio. The signal is measured with the auto peak detector and is completely hidden in the intrinsic noise of the analyzer.

3. To suppress noise spikes the trace can be averaged.

a) Press the TRACE key.
b) Press the "Trace Wizard" softkey.
The Trace Wizard dialog box opens.

c) Select "Average" in the "Trace Mode" drop-down menu of the selected trace.
    The traces of consecutive sweeps are averaged. To perform averaging, the ana-
    lyzer automatically switches on the sample detector. The RF signal, therefore,
    can be more clearly distinguished from noise.
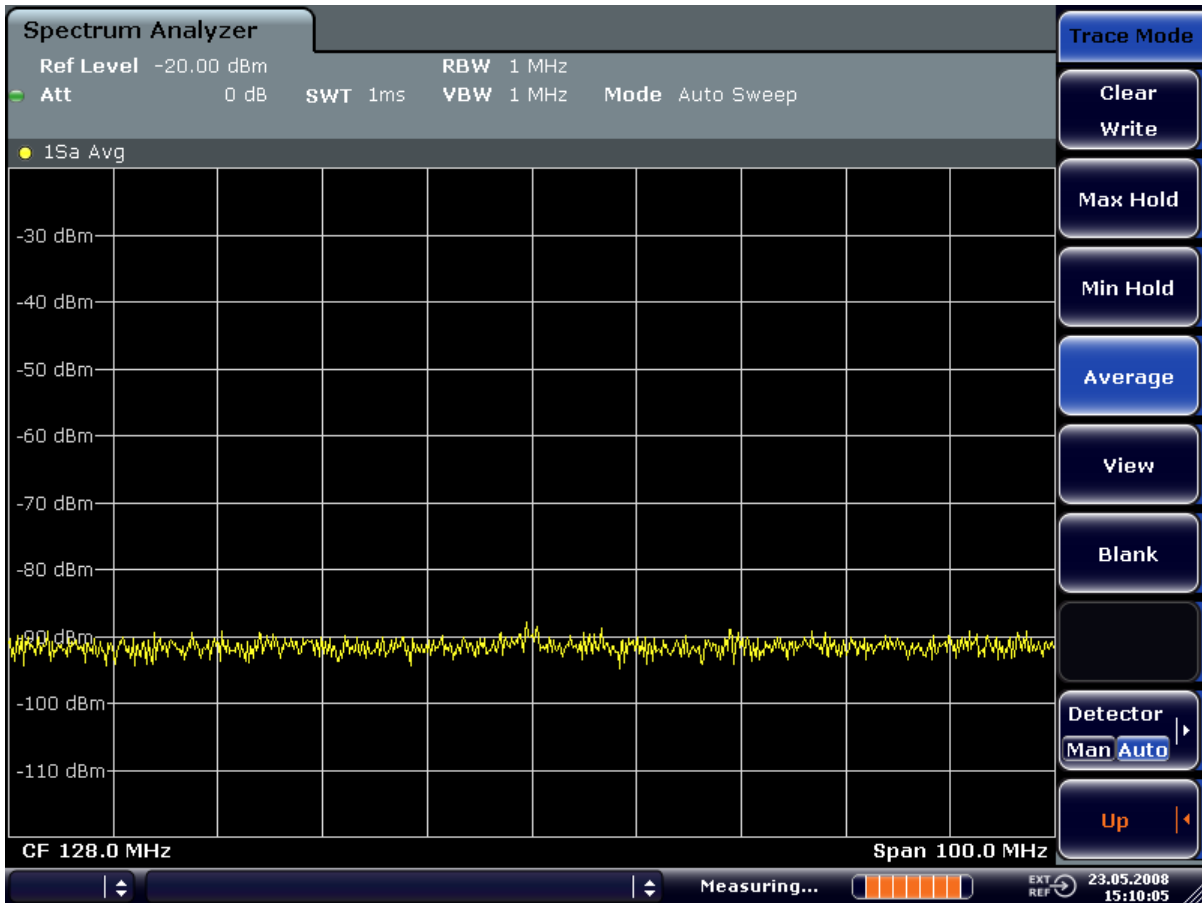
Fig. 2-11: RF sine wave signal with low S/N ratio if the trace is averaged.

4. Instead of trace averaging, a video filter that is narrower than the resolution bandwidth
    can be selected:

a) Press the TRACE key.
b) Press the "Trace Wizard" softkey.
    The Trace Wizard dialog box opens.
c) Select "Clear Write" in the "Trace Mode" drop-down menu of the selected trace.
d) Press the BW key.

e) Press the "Video BW Manual" softkey and enter "10 kHz".
The RF signal can be more clearly distinguished from noise.
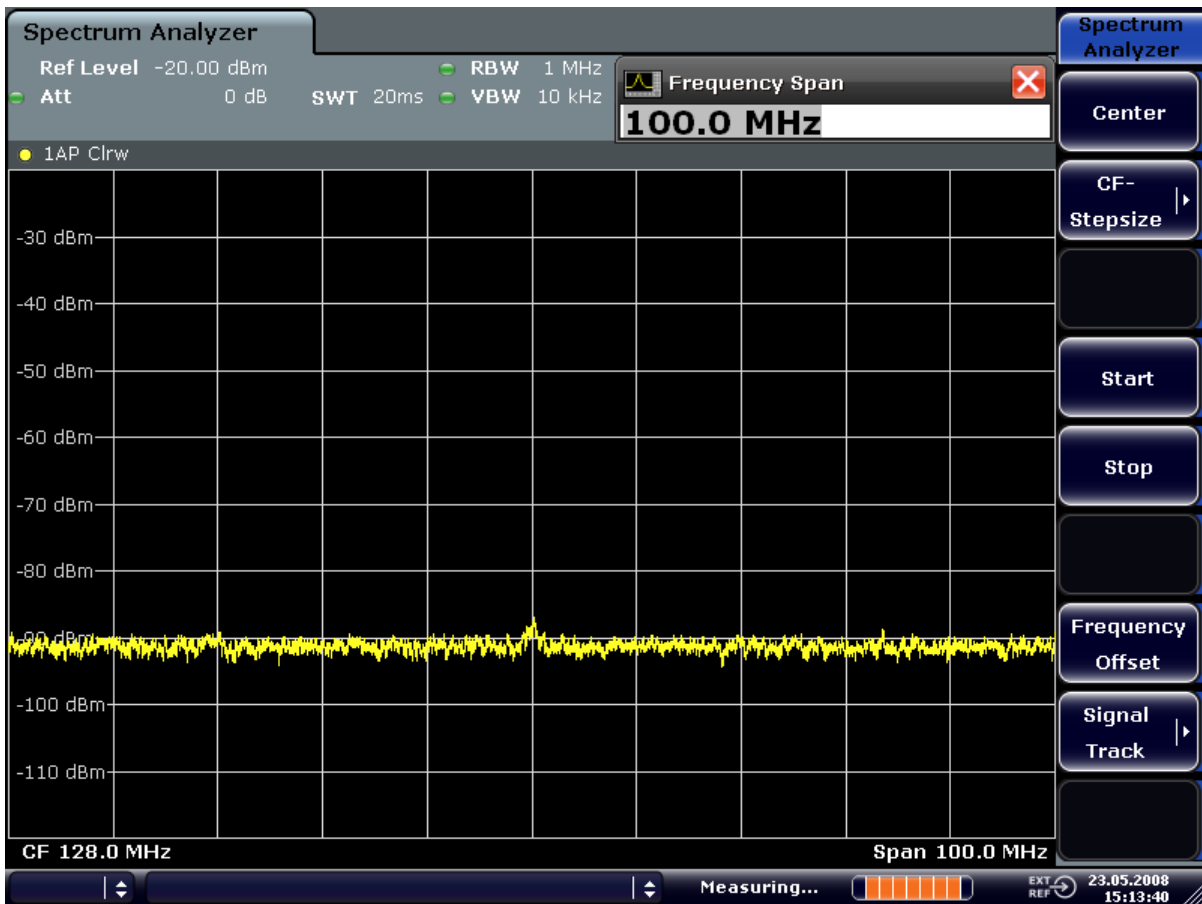
Fig. 2-12: RF sine wave signal with low S/N ratio if a smaller video bandwidth is selected.

5. By reducing the resolution bandwidth by a factor of 10, the noise is reduced by 10 dB:

a) In the "Bandwidth" menu press the "Res BW Manual" softkey and enter "100 kHz".
   The displayed noise is reduced by approx. 10 dB. The signal, therefore, emerges from noise by about 10 dB. Compared to the previous setting, the video bandwidth has remained the same, i.e. it has increased relative to the smaller resolution bandwidth. The averaging effect of the video bandwidth is therefore reduced. The trace will be noisier.
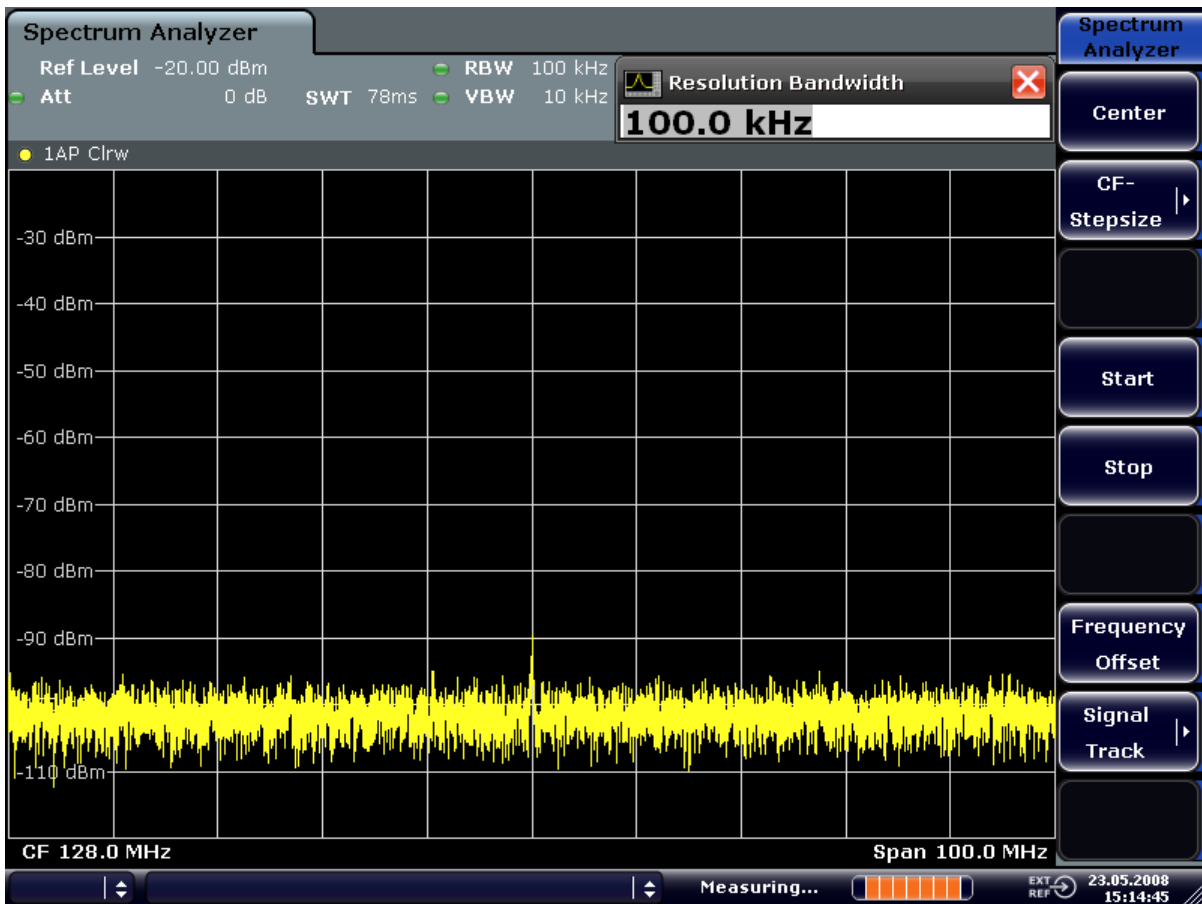

Fig. 2-13: Reference signal at a smaller resolution bandwidth

2.5 Noise Measurements

Noise measurements play an important role in signal analysis. Noise e.g. affects the sensitivity of radio communication systems and their components.

Noise power is specified either as the total power in the transmission channel or as the power referred to a bandwidth of 1 Hz. The sources of noise are, for example, amplifier noise or noise generated by oscillators used for the frequency conversion of useful signals in receivers or transmitters. The noise at the output of an amplifier is determined by its noise figure and gain.

The noise of an oscillator is determined by phase noise near the oscillator frequency and by thermal noise of the active elements far from the oscillator frequency. Phase noise can mask weak signals near the oscillator frequency and make them impossible to detect.

2.5.1 Measuring Noise Power Density

To measure noise power referred to a bandwidth of 1 Hz at a certain frequency, the analyzer provides marker function. This marker function calculates the noise power density from the measured marker level.

2.5.1.1 Measurement Example – Measuring the Intrinsic Noise Power Density of the analyzer at 1 GHz and Calculating the analyzer's Noise Figure

Test setup:

► Connect no signal to the RF input; terminate RF input with 50 Ω.

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Set the center frequency to 1.234 GHz and the span to 1 MHz.
   a) Press the FREQ key and enter "1.234 GHz".
   b) Press the SPAN key and enter "1 MHz".

3. Switch on the marker and set the marker frequency to 1.234 GHz by pressing the MKR key and entering "1.234 GHz".

4. Switch on the noise marker function by switching on the "Noise Meas" softkey.
   a) Press the MKR FUNC key.
   b) Switch the "Noise Meas" softkey to "On"
      The analyzer displays the noise power at 1 GHz in dBm (1Hz).

   Note: Since noise is random, a sufficiently long measurement time has to be selected to obtain stable measurement results. This can be achieved by averaging the trace or by selecting a very small video bandwidth relative to the resolution bandwidth.

5. The measurement result is stabilized by averaging the trace.
   a) Press the TRACE key.
   b) Press the "Trace Wizard" softkey.
      The Trace Wizard dialog box opens.
   c) Select "Average" in the "Trace Mode" drop-down menu of the selected trace.

   The analyzer performs sliding averaging over 10 traces from consecutive sweeps. The measurement result becomes more stable.

Conversion to other reference bandwidths

The result of the noise measurement can be referred to other bandwidths by simple conversion. This is done by adding 10 × log (BW) to the measurement result, BW being the new reference bandwidth.

Example:

A noise power of -150 dBm (1 Hz) is to be referred to a bandwidth of 1 kHz.

$P_{[1kHz]}$ = -150 + 10 × log (1000) = -150 +30 = -120 dBm (1 kHz)

Calculation method for noise power

If the noise marker is switched on, the analyzer automatically activates the sample detector. The video bandwidth is set to 1/10 of the selected resolution bandwidth (RBW).

To calculate the noise, the analyzer takes an average over 17 adjacent pixels (the pixel on which the marker is positioned and 8 pixels to the left, 8 pixels to the right of the marker). The measurement result is stabilized by video filtering and averaging over 17 pixels.

Since both video filtering and averaging over 17 trace points is performed in the log display mode, the result would be 2.51 dB too low (difference between logarithmic noise average and noise power). The analyzer, therefore, corrects the noise figure by 2.51 dB.

To standardize the measurement result to a bandwidth of 1 Hz, the result is also corrected by -10 × log (RBW_{noise}), with RBW_{noise} being the power bandwidth of the selected resolution filter (RBW).

Detector selection

The noise power density is measured in the default setting with the sample detector and using averaging. Other detectors that can be used to perform a measurement giving true results are the average detector or the RMS detector. If the average detector is used, the linear video voltage is averaged and displayed as a pixel. If the RMS detector is used, the squared video voltage is averaged and displayed as a pixel. The averaging time depends on the selected sweep time (=SWT/501). An increase in the sweep time gives a longer averaging time per pixel and thus stabilizes the measurement result. The analyzer automatically corrects the measurement result of the noise marker display depending on the selected detector (+1.05 dB for the average detector, 0 dB for the RMS detector). It is assumed that the video bandwidth is set to at least three times the resolution bandwidth. While the average or RMS detector is being switched on, the analyzer sets the video bandwidth to a suitable value.

The Pos Peak, Neg Peak, Auto Peak and Quasi Peak detectors are not suitable for measuring noise power density.

Determining the noise figure

The noise figure of amplifiers or of the analyzer alone can be obtained from the noise power display. Based on the known thermal noise power of a 50 Ω resistor at room temperature (-174 dBm (1Hz)) and the measured noise power P_{noise} the noise figure (NF) is obtained as follows:

$$NF = P_{noise} + 174 - g,$$

where g = gain of DUT in dB

Example:

The measured internal noise power of the analyzer at an attenuation of 0 dB is found to be -143 dBm/1 Hz. The noise figure of the analyzer is obtained as follows

$$NF = -143 + 174 = 31 \text{ dB}$$

If noise power is measured at the output of an amplifier, for example, the sum of the internal noise power and the noise power at the output of the DUT is measured. The noise power of the DUT can be obtained by subtracting the internal noise power from the total power (subtraction of linear noise powers). By means of the following diagram, the noise level of the DUT can be estimated from the level difference between the total and the internal noise level.
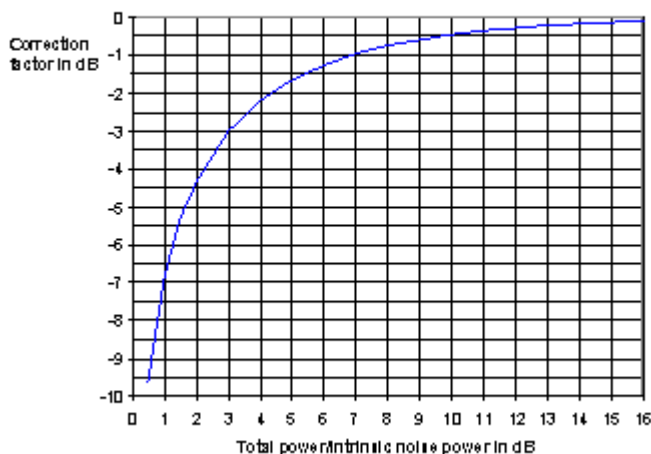
Fig. 2-14: Correction factor for measured noise power as a function of the ratio of total power to the intrinsic noise power of the signal analyzer

2.5.2 Measurement of Noise Power within a Transmission Channel

Noise in any bandwidth can be measured with the channel power measurement functions. Thus the noise power in a communication channel can be determined, for example. If the noise spectrum within the channel bandwidth is flat, the noise marker from the previous example can be used to determine the noise power in the channel by considering the channel bandwidth. If, however, phase noise and noise that normally increases towards the carrier is dominant in the channel to be measured, or if there are discrete spurious signals in the channel, the channel power measurement method must be used to obtain correct measurement results.

2.5.2.1 Measurement Example – Measuring the Intrinsic Noise of the analyzer at 1 GHz in a 1.23 MHz Channel Bandwidth with the Channel Power Function

Test setup:

► Leave the RF input of the analyzer open-circuited or terminate it with 50 Ω.

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Set the center frequency to 1 GHz and the span to 1 MHz.

   a) Press the FREQ key and enter "1 GHz".
   b) Press the SPAN key and enter "2 MHz".

3. To obtain maximum sensitivity, set RF attenuation on the analyzer to 0 dB.

   a) Press the AMPT key.
   b) Press the "RF Atten Manual" softkey and enter "0 dB".

4. Set the "Sweep Type" to sweep.

   a) Press the AUTO SET key.
   b) Press the "Sweep Type" softkey.
   c) Press the SWEEP softkey.

5. Switch on and configure the channel power measurement.

   a) Press the MEAS key.
   b) Press the "Ch Power/ACLR" softkey.
      The analyzer activates the channel or adjacent channel power measurement according to the currently set configuration.
   c) Press the "CP/ACLR Settings" softkey.
      The submenu for configuring the channel is displayed.
   d) Press the "Channel Settings" softkey.
      The submenu for channel settings is displayed.
   e) Press the "Channel Bandwidth" softkey and enter "1.23 MHz".
      The analyzer displays the 1.23 MHz channel as two vertical lines which are symmetrical to the center frequency.

f)   Press the "Adjust Settings" softkey.

The settings for the frequency span, the bandwidth (RBW and VBW) and the detector are automatically set to the optimum values required for the measurement.
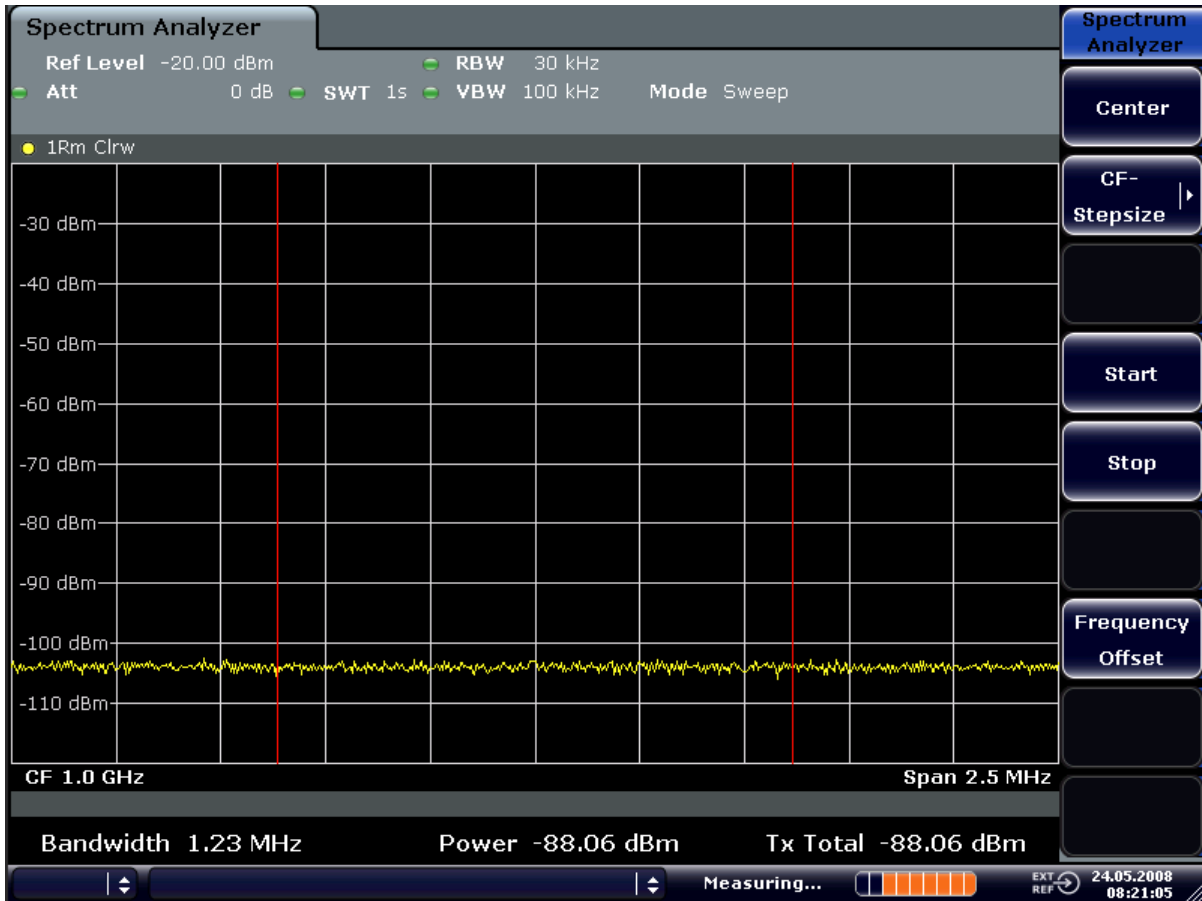
Fig. 2-15: Measurement of the analyzer's intrinsic noise power in a 1.23 MHz channel bandwidth.

6.   Stabilizing the measurement result by increasing the sweep time

a)   Press the "UP" key twice.

The main menu for channel and adjacent channel power measurement is displayed.

b)   Press the "Sweep Time" softkey and enter "1 s".

The trace becomes much smoother because of the RMS detector and the channel power measurement display is much more stable.

Method of calculating the channel power

When measuring the channel power, the analyzer integrates the linear power which corresponds to the levels of the pixels within the selected channel. The signal analyzer uses a resolution bandwidth which is far smaller than the channel bandwidth. When sweeping over the channel, the channel filter is formed by the passband characteristics of the resolution bandwidth (see figure 2-16).

Fig. 2-16: Approximating the channel filter by sweeping with a small resolution bandwidth

The following steps are performed:

1. The linear power of all the trace pixels within the channel is calculated.

    $P_i = 10^{(L_i/10)}$

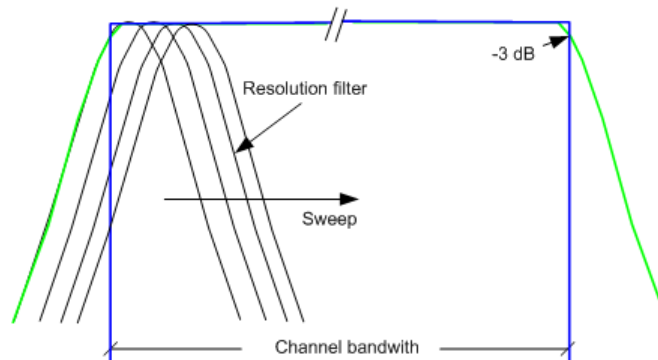   where P_i = power of the trace pixel i

    L_i = displayed level of trace point i

2. The powers of all trace pixels within the channel are summed up and the sum is divided by the number of trace pixels in the channel.

3. The result is multiplied by the quotient of the selected channel bandwidth and the noise bandwidth of the resolution filter (RBW).

Since the power calculation is performed by integrating the trace within the channel bandwidth, this method is also called the IBW method (**I**ntegration **B**and**w**idth method).

Parameter settings

For selection of the sweep time, see next section. For details on the parameter settings refer to chapter "Instrument Functions", section "Settings of the CP/ACLR test parameters" or the Online Help.

Sweep time selection

The number of A/D converter values, N, used to calculate the power, is defined by the sweep time. The time per trace pixel for power measurements is directly proportional to the selected sweep time.

If the sample detector is used, it is best to select the smallest sweep time possible for a given span and resolution bandwidth. The minimum time is obtained if the setting is coupled. This means that the time per measurement is minimal. Extending the measurement time does not have any advantages as the number of samples for calculating the power is defined by the number of trace pixels in the channel.

If the RMS detector is used, the repeatability of the measurement results can be influenced by the selection of sweep times. Repeatability is increased at longer sweep times.

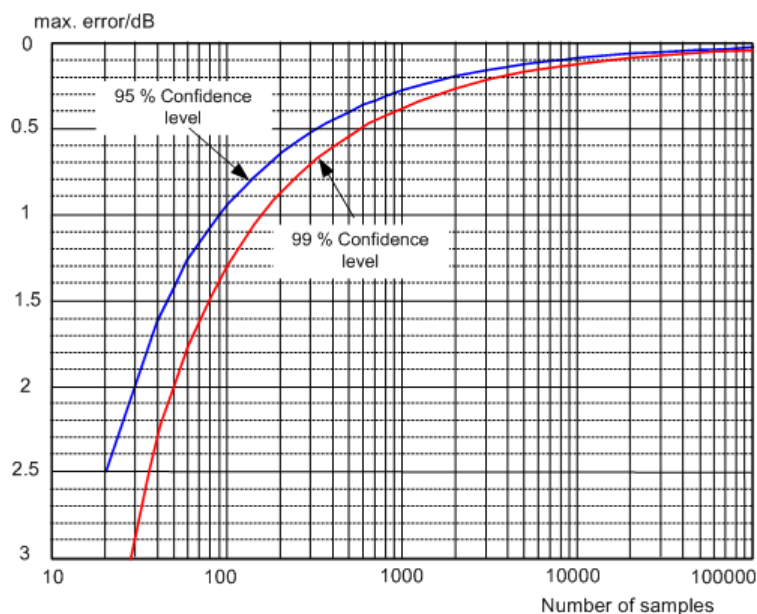Repeatability can be estimated from the following diagram:

Fig. 2-17: Repeatability of channel power measurements as a function of the number of samples used for power calculation

The curves in Repeatability of channel power measurements as a function of the number of samples used for power calculation indicate the repeatability obtained with a probability of 95 % and 99 % depending on the number of samples used.

The repeatability with 600 samples is Â± 0.5 dB. This means that – if the sample detector and a channel bandwidth over the whole diagram (channel bandwidth = span) is used – the measured value lies within Â± 0.5 dB of the true value with a confidence level of 99 %.

If the RMS detector is used, the number of samples can be estimated as follows:

Since only uncorrelated samples contribute to the RMS value, the number of samples can be calculated from the sweep time and the resolution bandwidth.

Samples can be assumed to be uncorrelated if sampling is performed at intervals of 1/ RBW. The number of uncorrelated samples is calculated as follows:

N_{decorr} = SWT · RBW (N_{decorr} means uncorrelated samples)

The number of uncorrelated samples per trace pixel is obtained by dividing N_{decorr} by 691 (= pixels per trace).

Example

At a resolution bandwidth of 30 kHz and a sweep time of 100 ms, 3000 uncorrelated samples are obtained. If the channel bandwidth is equal to the frequency display range, i.e. all trace pixels are used for the channel power measurement, a repeatability of 0.2 dB with a probability of 99 % is the estimate that can be derived from Repeatability of channel power measurements as a function of the number of samples used for power calculation.

2.5.3   Measuring Phase Noise

The analyzer has an easy-to-use marker function for phase noise measurements. This marker function indicates the phase noise of an RF oscillator at any carrier in dBc in a bandwidth of 1 Hz.

2.5.3.1   Measurement Example – Measuring the Phase Noise of a Signal Generator at a Carrier Offset of 10 kHz

Test setup:
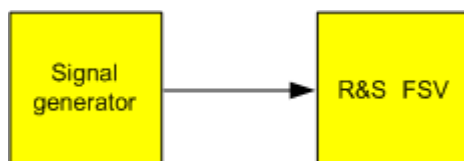
Signal generator settings (e.g. analyzer SMU):

Frequency:	100 MHz
Level:	0 dBm

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   analyzer is in its default state.

2. Set the center frequency to 100 MHz and the span to 50 kHz.

   a) Press the FREQ key and enter "100 MHz".
   b) Press the SPAN key and enter "50 kHz".

3. Set the analyzer's reference level to 0 dBm (=signal generator level) by pressing the AMPT key and enter "0 dBm".

4. Enable phase noise measurement.

   a) Press the MKR FUNC key.
   b) Press the "Phase Noise" softkey.
       The analyzer activates phase noise measurement. Marker 1 (=main marker) and marker 2 (= delta marker) are positioned on the signal maximum. The position of the marker is the reference (level and frequency) for the phase noise measurement. A horizontal line represents the level of the reference point and a vertical line the frequency of the reference point. The dialog box for the delta marker is displayed so that the frequency offset at which the phase noise is to be measured can be entered directly.

5. Set the frequency offset to 10 kHz for determining phase noise by entering "10 kHz".

The analyzer displays the phase noise at a frequency offset of 10 kHz. The magnitude of the phase noise in dBc/Hz is displayed in the delta marker output field at the top right of the screen (Phn2).

6. Stabilize the measurement result by activating trace averaging.
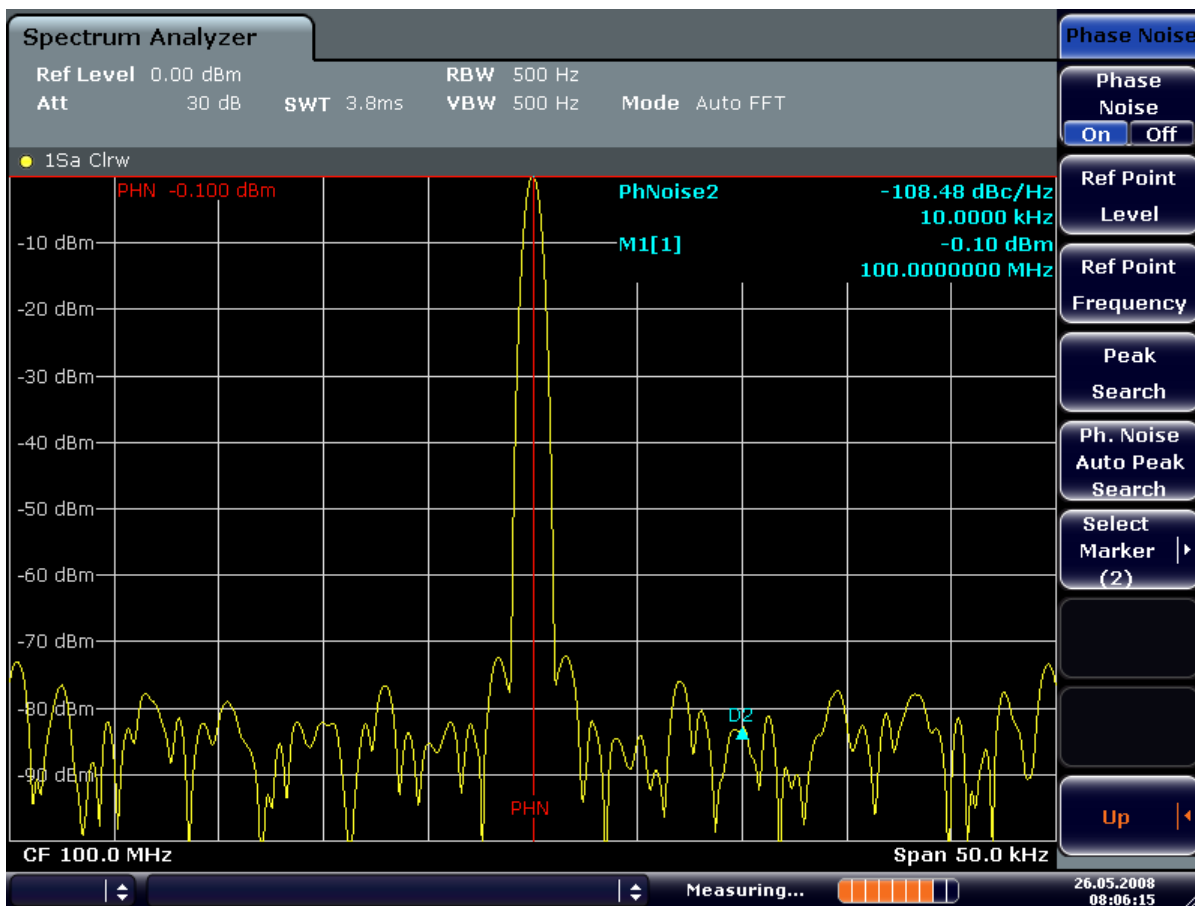
Fig. 2-18: Measuring phase noise with the phase-noise marker function

The frequency offset can be varied by moving the marker with the rotary knob or by entering a new frequency offset as a number.

2.6 Measurements on Modulated Signals

For measurements on AM and FM signals refer to the Quick Start Guide, chapter 5, "Basic Measurements Examples".

2.6.1 Measuring Channel Power and Adjacent Channel Power

Measuring channel power and adjacent channel power is one of the most important tasks in the field of digital transmission for a signal analyzer with the necessary test routines. While, theoretically, channel power could be measured at highest accuracy with a power

meter, its low selectivity means that it is not suitable for measuring adjacent channel power as an absolute value or relative to the transmit channel power. The power in the adjacent channels can only be measured with a selective power meter.

A signal analyzer cannot be classified as a true power meter, because it displays the IF envelope voltage. However, it is calibrated such as to correctly display the power of a pure sine wave signal irrespective of the selected detector. This calibration cannot be applied for non-sinusoidal signals. Assuming that the digitally modulated signal has a Gaussian amplitude distribution, the signal power within the selected resolution bandwidth can be obtained using correction factors. These correction factors are normally used by the signal analyzer's internal power measurement routines in order to determine the signal power from IF envelope measurements. These factors apply if and only if the assumption of a Gaussian amplitude distribution is correct.

Apart from this common method, the analyzer also has a true power detector, i.e. an RMS detector. It correctly displays the power of the test signal within the selected resolution bandwidth irrespective of the amplitude distribution, without additional correction factors being required. The absolute measurement uncertainty of the FSV is < 1.5 dB and a relative measurement uncertainty of < 0.5 dB (each with a confidence level of 95 %).

There are two possible methods for measuring channel and adjacent channel power with a signal analyzer:

1. IBW method (**I**ntegration **B**andwidth **M**ethod)
   The signal analyzer measures with a resolution bandwidth that is less than the channel bandwidth and integrates the level values of the trace versus the channel bandwidth. This method is described in chapter 2.5.2.1, "Measurement Example – Measuring the Intrinsic Noise of the analyzer at 1 GHz in a 1.23 MHz Channel Bandwidth with the Channel Power Function", on page 33.

2. Using a channel filter
   For a detailed description, refer to the following section.

Measurements using a channel filter

In this case, the signal analyzer makes zero span measurements using an IF filter that corresponds to the channel bandwidth. The power is measured at the output of the IF filter. Until now, this method has not been used for signal analyzers, because channel filters were not available and the resolution bandwidths, optimized for the sweep, did not have a sufficient selectivity. The method was reserved for special receivers optimized for a particular transmission method.

The analyzer has test routines for simple channel and adjacent channel power measurements. These routines give quick results without any complex or tedious setting procedures.

2.6.1.1 Measurement Example 1 – ACPR Measurement on an CDMA2000 Signal

Test setup:

Signal generator settings (e.g. analyzer SMU):

Frequency:	850 MHz
Level:	0 dBm
Modulation:	CDMA2000

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Press the FREQ key and enter "850 MHz" as the center frequency.

3. Press the SPAN key and enter "4 MHz".

4. Set the reference level to +10 dBm by pressing the AMPT key and enter "10 dBm".

5. Configure the adjacent channel power for the CDMA2000 standard (more precisely: CDMA2000 1X).

   a) Press the MEAS key.
   b) Press the "Ch Power ACLR" softkey.
   c) Press the "CP/ACLR Standard" softkey.
   d) In the standards list, mark *CDMA2000*.

   The analyzer sets the channel configuration according to the 2000 standard with 2 adjacent channels above and 2 below the transmit channel. The spectrum is displayed in the upper part of the screen, the numeric values of the results and the channel configuration in the lower part of the screen. The various channels are represented by vertical lines on the graph.
   The frequency span, resolution bandwidth, video bandwidth and detector are selected automatically to give correct results. To obtain stable results – especially in the adjacent channels (30 kHz bandwidth) which are narrow in comparison with the transmission channel bandwidth (1.23 MHz) – the RMS detector is used.

6. Set the optimal reference level and RF attenuation for the applied signal level by pressing the "Adjust Ref Level" softkey.

7. Activate "Fast ACP" mode to increase the repeatability of results by pressing the "Fast ACP" softkey (for details see below).

The analyzer sets the optimal RF attenuation and the reference level based on the transmission channel power to obtain the maximum dynamic range. The figure 2-19 shows the result of the measurement.
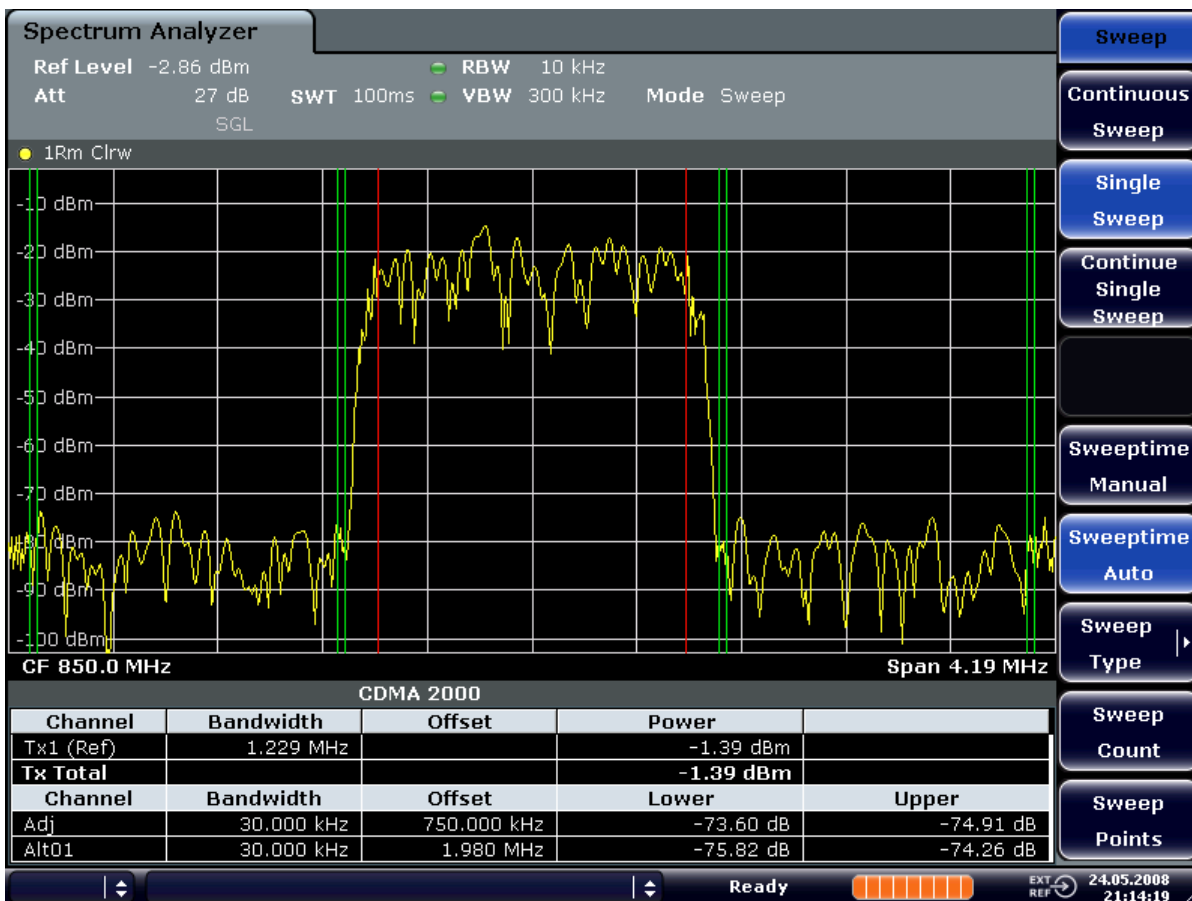
Fig. 2-19: Adjacent channel power measurement on a CDMA2000 1x signal

Repeatability of results

The repeatability of the results, especially in the narrow adjacent channels, strongly depends on the measurement time for a given resolution bandwidth. A longer sweep time may increase the probability that the measured value converges to the true value of the adjacent channel power, but obviously increases measurement time.

The integrated bandwidth method (IBW) calculates channel power and ACLR from the trace data obtained during a continuous sweep over the selected span. Most parts of this sweep are neither part of the channel itself nor the defined adjacent channels. Therefore, most of the samples taken during the sweeptime cannot be used for channel power or ACLR calculation.

To obtain a high repeatability with short measurement times, the analyzer offers a "Fast ACLR" mode. In the Fast ACLR mode, the analyzer measures the power of each channel at the defined channel bandwidth, while being tuned to the center frequency of the chan-

nel in question. The digital implementation of the resolution bandwidths makes it possible to select filter characteristics that are precisely tailored to the signal. In case of CDMA2000, the power in the useful channel is measured with a bandwidth of 1.23 MHz and that of the adjacent channels with a bandwidth of 30 kHz. Therefore the analyzer changes from one channel to the other and measures the power at a bandwidth of 1.23 MHz or 30 kHz using the RMS detector. The power of the frequency range between the channels of interest is not measured in Fast ACLR mode, because it is not required for channel power or ACLR calculation. The measurement time per channel is set with the sweep time. It is equal to the selected measurement time divided by the selected number of channels.
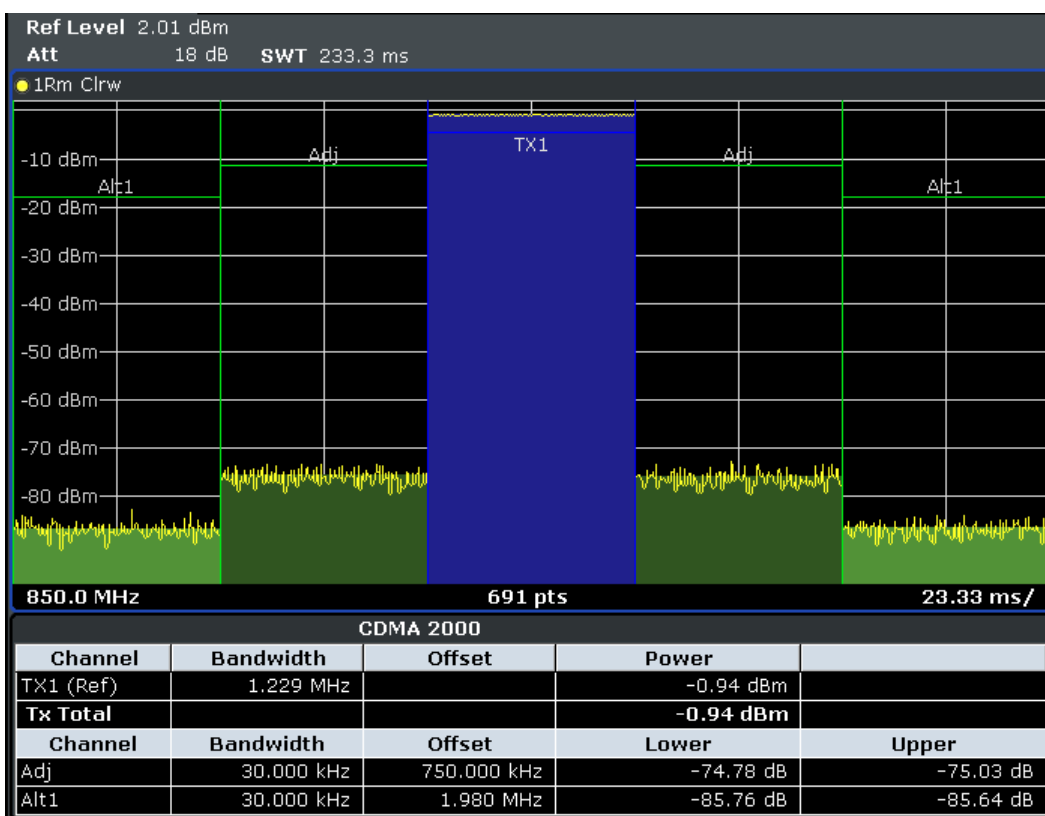

Ref Level	2.01 dBm			
Att	18 dB	SWT 233.3 ms		
1Rm Clrw				

| 850.0 MHz | | 691 pts | | 23.33 ms/ |

CDMA 2000				
Channel	Bandwidth	Offset	Power	
TX1 (Ref)	1.229 MHz		−0.94 dBm	
Tx Total			**−0.94 dBm**	
Channel	Bandwidth	Offset	Lower	Upper
Adj	30.000 kHz	750.000 kHz	−74.78 dB	−75.03 dB
Alt1	30.000 kHz	1.980 MHz	−85.76 dB	−85.64 dB

Fig. 2-20: Measuring the channel power and adjacent channel power ratio for CDMA2000 1X signals with zero span (Fast ACP)

The five channels from the above example (1 channel plus 2 lower and 2 upper adjacent channels) and the sweep time of 100 ms yield a measurement time per channel of 20 ms. The number of effective samples taken into account for power calculation in one channel is the product of sweeptime in channel times the selected resolution bandwidth.

Assuming a sweeptime of 100 ms, there are (30 kHz / 4.19 MHz) * 100 ms * 10 kHz ≈ 7 samples. Whereas in Fast ACLR mode, there are (100 ms / 5) * 30 kHz ≈ 600 samples. Comparing these numbers explains the increase of repeatability with a 95% confidence level (2δ) from ± 2.8 dB to ± 0.34 dB for a sweeptime of 100 ms (as shown in).

For the same repeatability, the sweep time would have to be set to 8.5 s with the integration method. The shows the standard deviation of the results as a function of the sweep time.
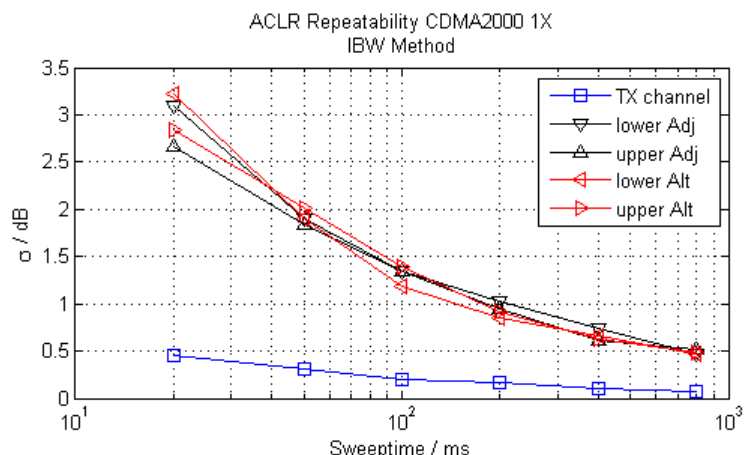
Fig. 2-21: Repeatability of adjacent channel power measurement on CDMA2000 standard signals if the integration bandwidth method is used

The figure 2-22 shows the repeatability of power measurements in the transmit channel and of relative power measurements in the adjacent channels as a function of sweep time. The standard deviation of measurement results is calculated from 100 consecutive measurements. Take scaling into account if comparing power values.

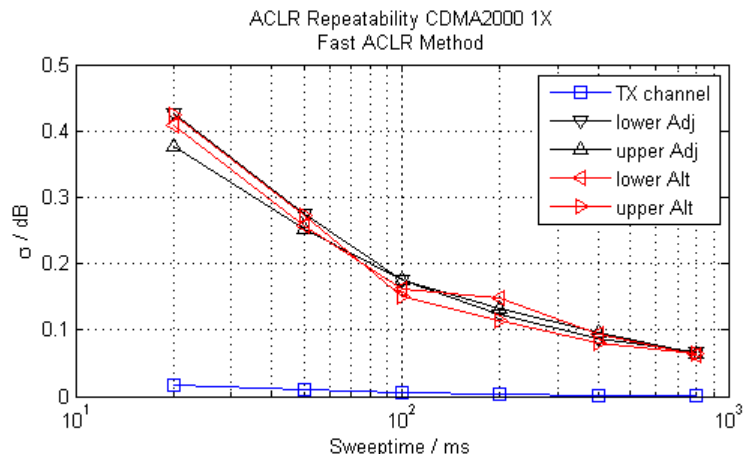*Fig. 2-22: Repeatability of adjacent channel power measurements on CDMA2000 signals in the fast ACP mode*

2.6.1.2 Measurement Example 2 – Measuring Adjacent Channel Power of a W-CDMA Uplink Signal

Test setup:

Signal generator settings (e.g. analyzer SMU):

Frequency:	1950 MHz
Level:	4 dBm
Modulation:	3 GPP W-CDMA Reverse Link

Procedure:

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Set the center frequency to 1950 MHz by pressing the FREQ key and entering "1950 MHz".

3. Switch on the ACLR measurement for W-CDMA.

   a) Press the MEAS key.
   b) Press the "Ch Power ACLR" softkey.
   c) Press the "CP/ACLR Standard" softkey.
   d) In the standards list, select *W-CDMA 3GPP REV*.
      The analyzer sets the channel configuration to the 3GPP W-CDMA standard for mobiles with two adjacent channels above and below the transmit channel. The frequency span, the resolution and video bandwidth and the detector are automatically set to the correct values. The spectrum is displayed in the upper part of the screen and the channel power, the level ratios of the adjacent channel powers and the channel configuration in the lower part of the screen. The individual channels are displayed as vertical lines on the graph.

4. Set the optimum reference level and the RF attenuation for the applied signal level.

a) Press the "Adjust Ref Level" softkey.
    The analyzer sets the optimum RF attenuation and the reference level for the
    power in the transmission channel to obtain the maximum dynamic range. The
    following figure shows the result of the measurement.

Channel	Bandwidth	Offset	Power	
TX1 (Ref)	3.840 MHz		3.13 dBm	
Tx Total			**3.13 dBm**	

Channel	Bandwidth	Offset	Lower	Upper
Adj	3.840 MHz	5.000 MHz	-66.17 dB	-65.36 dB
Alt1	3.840 MHz	10.000 MHz	-70.70 dB	-70.31 dB
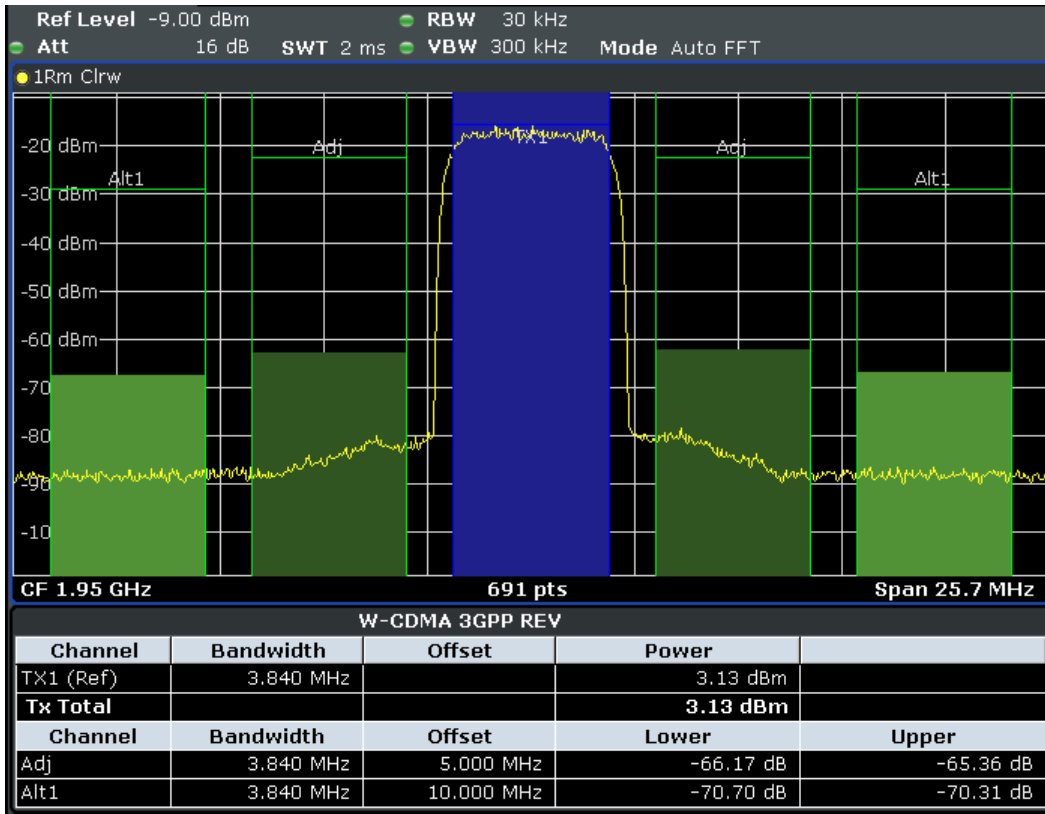
Fig. 2-23: Measuring the relative adjacent channel power on a W-CDMA uplink signal

5. Set up the adjacent channel power measurement with the fast ACLR mode.

    a) Set "Fast ACLR" softkey to "On".
    b) Press the "Adjust Ref Level" softkey.
        The analyzer measures the power of the individual channels with zero span. A
        root raised cosine filter with the parameters α = 0.22 and chip rate 3.84 Mcps (=
        receive filter for 3GPP W-CDMA) is used as channel filter.

Ref Level -6.00 dBm
Att   11 dB   SWT 101 ms

W-CDMA 3GPP FWD				
Channel	Bandwidth	Offset	Power	
TX1 (Ref)	3.840 MHz		-2.86 dBm	
Tx Total			**-2.86 dBm**	
Channel	Bandwidth	Offset	Lower	Upper
Adj	3.840 MHz	5.000 MHz	-68.36 dB	-67.69 dB
Alt1	3.840 MHz	10.000 MHz	-71.84 dB	-70.78 dB
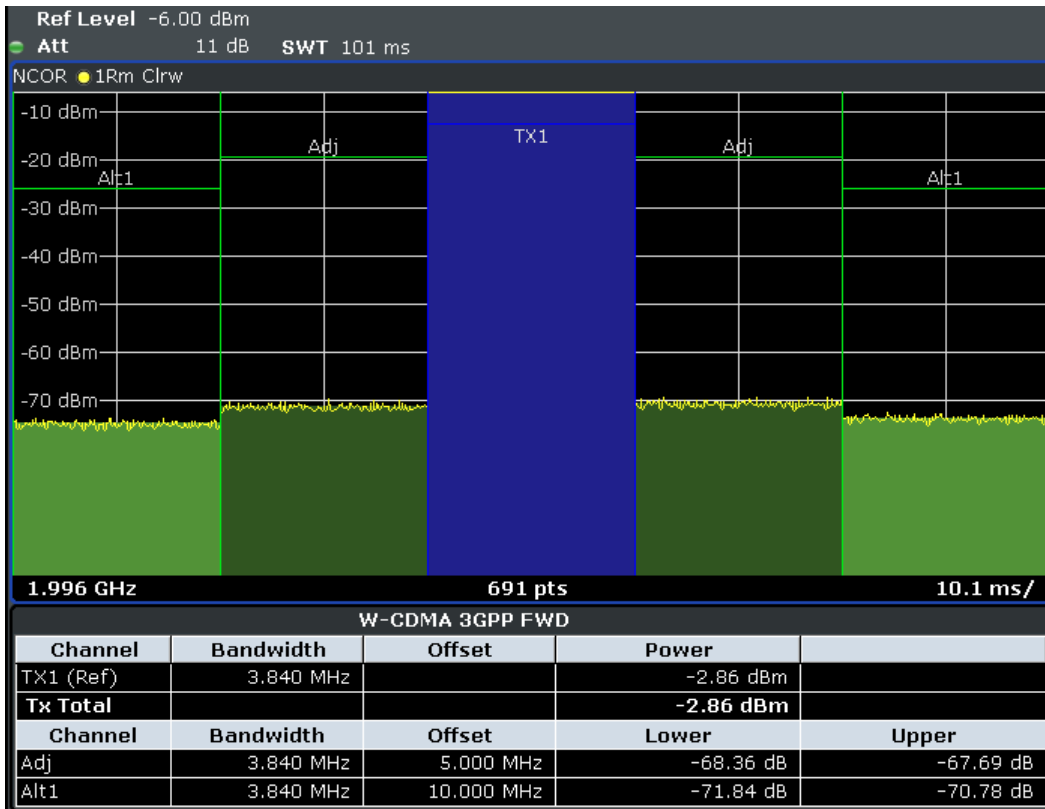
Fig. 2-24: Measuring the adjacent channel power of a W-CDMA signal with the fast ACLR mode

Optimum Level Setting for ACP Measurements on W-CDMA Signals

The dynamic range for ACPR measurements is limited by the thermal noise floor, the phase noise and the intermodulation (spectral regrowth) of the signal analyzer. The power values produced by the analyzer due to these factors accumulate linearly. They depend on the applied level at the input mixer. The three factors are shown in the figure below for the adjacent channel (5 MHz carrier offset).

***Fig. 2-25: The analyzer's dynamic range for adjacent channel power measurements on W-CDMA uplink
signals is a function of the mixer level.***

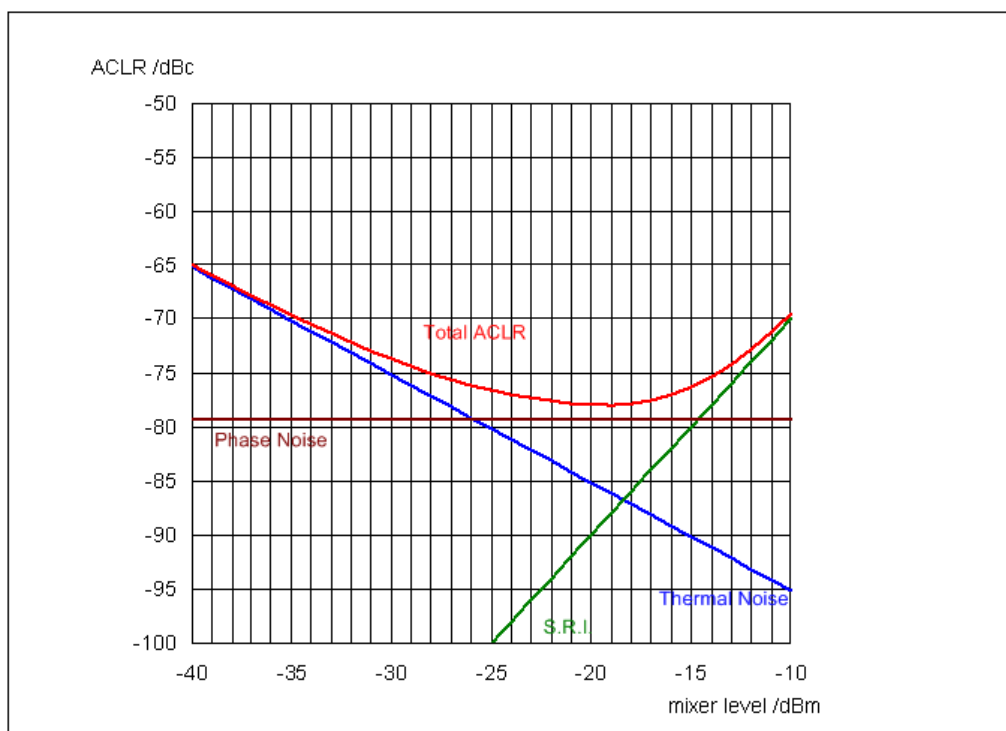The level of the W-CDMA signal at the input mixer is shown on the horizontal axis, i.e.
the measured signal level minus the selected RF attenuation. The individual components
which contribute to the power in the adjacent channel and the resulting relative level (total
ACPR) in the adjacent channel are displayed on the vertical axis. The optimum mixer
level is -18 dBm. The relative adjacent channel power (ACPR) at an optimum mixer level
is -77 dBc. Since, at a given signal level, the mixer level is set in 5 dB steps with the 5
dB RF attenuator, the optimum 10 dB range spreads from -17 dBm to -22 dBm. In this
range, the obtainable dynamic range with noise correction is 77 dB.

To set the attenuation parameter manually, the following method is recommended:

► Set the RF attenuation so that the mixer level (= measured channel power – RF
attenuation) is between -16 dBm and -22 dBm.

This method is automated with the "Adjust Ref Level" function. Especially in remote con-
trol mode, e.g. in production environments, it is best to correctly set the attenuation
parameters prior to the measurement, as the time required for automatic setting can be
saved.

To measure the analyzer's intrinsic dynamic range for W-CDMA adjacent channel power
measurements, a filter which suppresses the adjacent channel power is required at the
output of the transmitter. A SAW filter with a bandwidth of 4 MHz, for example, can be
used.

2.6.2   Amplitude Distribution Measurements

If modulation types are used that do not have a constant zero span envelope, the transmitter has to handle peak amplitudes that are greater than the average power. This includes all modulation types that involve amplitude modulation –QPSK for example. CDMA transmission modes in particular may have power peaks that are large compared to the average power.

For signals of this kind, the transmitter must provide large reserves for the peak power to prevent signal compression and thus an increase of the bit error rate at the receiver.

The peak power or the crest factor of a signal is therefore an important transmitter design criterion. The crest factor is defined as the peak power/mean power ratio or, logarithmically, as the peak level minus the average level of the signal.

To reduce power consumption and cut costs, transmitters are not designed for the largest power that could ever occur, but for a power that has a specified probability of being exceeded (e.g. 0.01 %).

To measure the amplitude distribution, the analyzer has simple measurement functions to determine both the APD = Amplitude Probability Distribution and CCDF = Complementary Cumulative Distribution Function.

In the APD display mode, the probability of occurrence of a certain level is plotted against the level.

In the CCDF display mode, the probability that the mean signal power will be exceeded is shown in percent.

2.6.2.1   Measurement Example – Measuring the APD and CCDF of White Noise Generated by the analyzer

1. Set the analyzer to its default state by pressing the PRESET key.
   The analyzer is in its default state.

2. Configure the analyzer for APD measurement

   a) Press the AMPT key and enter "-60 dBm".
      The analyzer's intrinsic noise is displayed at the top of the screen.
   b) Press the MEAS key.
   c) Press the "More" softkey.
   d) Press the "APD" softkey.
      The analyzer sets the frequency span to 0 Hz and measures the amplitude probability distribution (APD). The number of uncorrelated level measurements used for the measurement is 100000. The mean power and the peak power are displayed in dBm. The crest factor (peak power – mean power) is output as well.
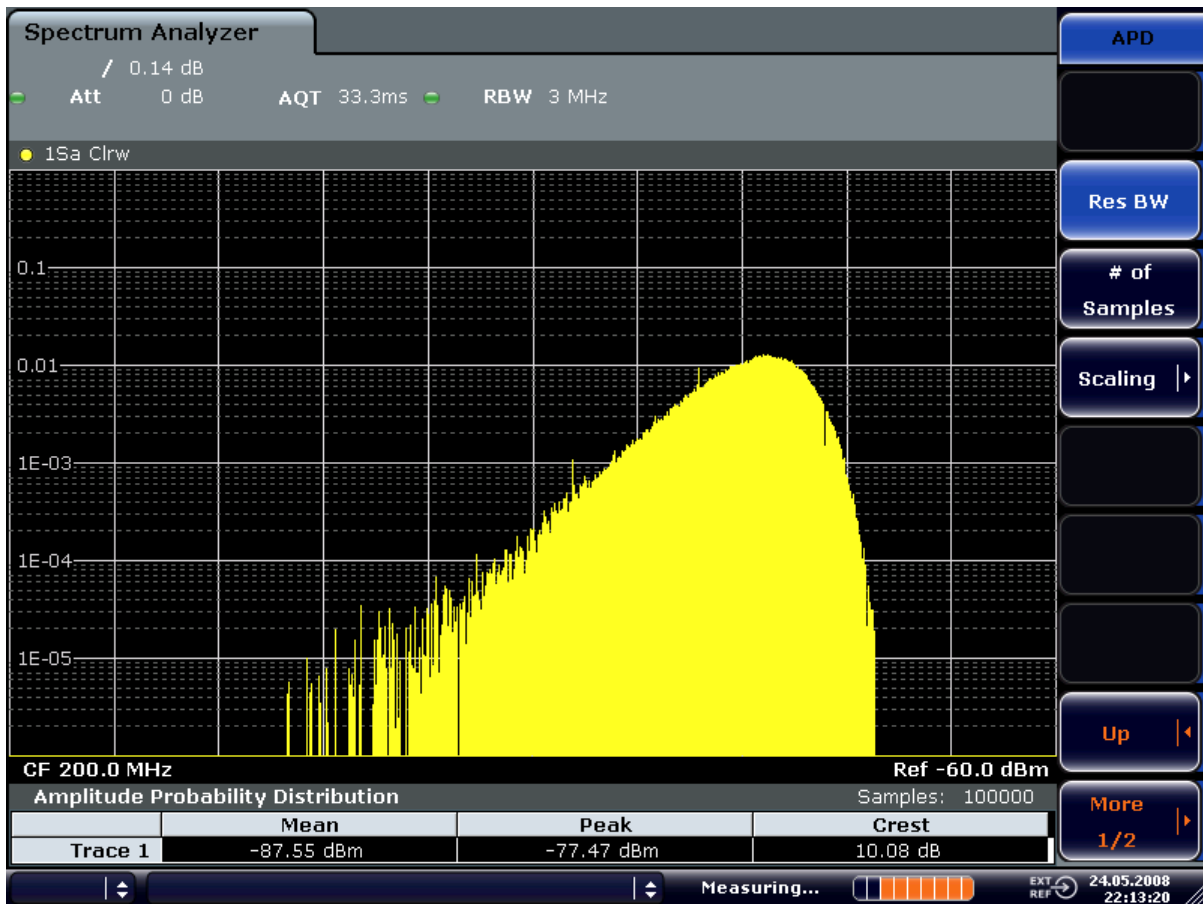
Fig. 2-26: Amplitude probability distribution of white noise

3. Switch to the CCDF display mode.

    a) Press the "UP" key.

    b) Press the "CCDF" softkey.
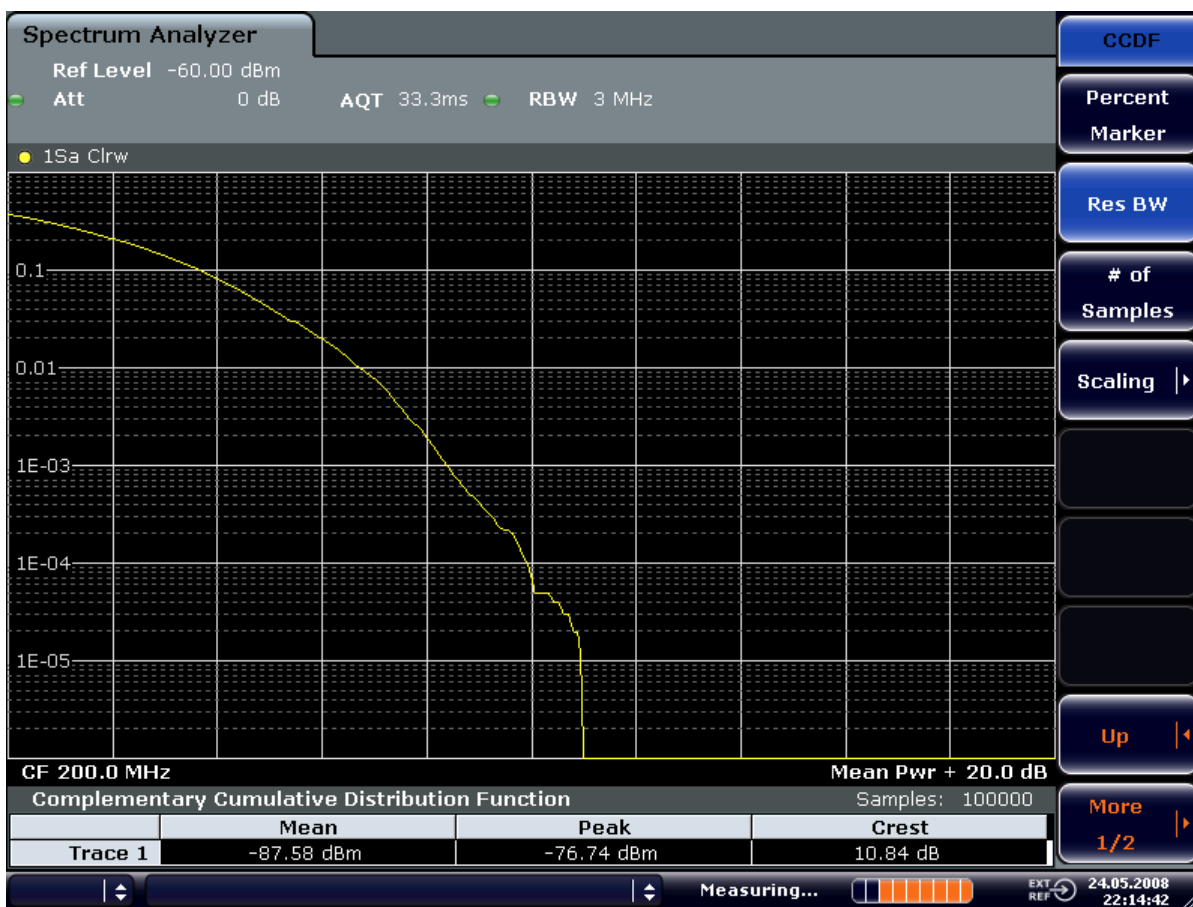   The CCDF display mode is switched on.

Fig. 2-27: CCDF of white noise

The CCDF trace indicates the probability that a level will exceed the mean power. The level above the mean power is plotted along the x-axis of the graph. The origin of the axis corresponds to the mean power level. The probability that a level will be exceeded is plotted along the y-axis.

Bandwidth selection

When the amplitude distribution is measured, the resolution bandwidth must be set so that the complete spectrum of the signal to be measured falls within the bandwidth. This is the only way of ensuring that all the amplitudes will pass through the IF filter without being distorted. If the resolution bandwidth which is selected is too small for a digitally modulated signal, the amplitude distribution at the output of the IF filter becomes a Gaussian distribution according to the central limit theorem and so corresponds to a white noise signal. The true amplitude distribution of the signal therefore cannot be determined.

Selecting the number of samples

For statistics measurements with the analyzer, the number of samples NSamples is entered for statistical evaluation instead of the sweep time. Since only statistically independent samples contribute to statistics, the measurement or sweep time is calculated automatically and displayed. The samples are statistically independent if the time difference is at least 1/RBW. The sweep time SWT is, therefore, expressed as follows:

$$SWT = N_{Samples}/RBW$$

3 Instrument Functions

This chapter describes the analyzer functions and all basic settings functions of the analyzer in detail.

For each key the available softkey menus and commands are described. The commands for the optional remote control (if any) are indicated for each softkey. The description is divided into the following topics:

A brief introduction on handling the instrument is given in "Basic Operations" in the Quick Start Guide. This also includes the description of the keys for basic operations like switching the instrument on and off or starting a measurement.

The front and the rear view of the instrument together with a table of all available keys and a short description are provided in the analyzer Quick Start Guide. "Preparing for Use" informs how to start working with the instrument for the first time.

3.1 General Settings, Printout and Instrument Settings

After putting the instrument into operation and becoming familiar with the handling of the instrument (for details see Quick Start Guide) the preparations for measurements can start. In this section the general settings of the instrument, the data management and the processing of measurement results are described. This includes the following topics and keys:

3.1.1 Instrument Setup and Interface Configuration – SETUP Key

The SETUP key is used to set or display the default settings of the instrument: reference frequency, noise source, level correction values, date, time, LAN interface, firmware update and enabling of options, information about instrument configuration and service support functions. For further details refer also to the Quick Start Guide, chapter 2 "Preparing for Use".

To open the Setup menu

► Press the SETUP key.

The "Setup" menu is displayed.

Menu and softkey description

●

Further information

●

Tasks

- chapter 3.1.1.2, "Activating or Deactivating the LXI Class C Functionality", on page 78

3.1.1.1 Softkeys of the Setup Menu

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

Reference Int/Ext

Switches between the internal and external reference signal source. The default setting is internal reference. It is important that the external reference signal is deactivated when switching from external to internal reference to avoid interactions.

If the reference signal is missing when switching to external reference, the message "EXREF" is displayed to indicate that no synchronization is performed.

The analyzer can use the internal reference source or an external reference source as frequency standard from which all internal oscillators are derived. A 10 MHz crystal oscillator is used as internal reference source. In the external reference setting, all internal oscillators of the analyzer are synchronized to the external reference frequency, which can be set from 1–20 MHz in 100 kHz steps. For details on connectors refer to the Quick Start Guide, chapter 1 "Front and Rear Panel".

SCPI command:

[SENSe:]ROSCillator:SOURce on page 733

SOURce:EXTernal<1|2>:ROSCillator: EXTernal:FREQuency on page 733

Handle missing Ext. Ref

If an external reference is selected but none is available, there are different ways the instrument can react. This command opens a submenu to select the preferred method of handling a missing external reference. By default, an error flag is displayed in the status bar of the display.

The submenu contains the following commands:

- "Show Error Flag" on page 59
- "Auto select Reference" on page 59

Show Error Flag ← Handle missing Ext. Ref

If this option is selected, an error flag is displayed in the status bar of the display when an external reference is selected but none is available.

SCPI command:

[SENSe:]ROSCillator:SOURce on page 733

Auto select Reference ← Handle missing Ext. Ref

If this option is selected, the instrument automatically switches back to the internal reference if no external reference is available. Note that you must re-activate the external reference if it becomes available again at a later time.

SCPI command:

[SENSe:]ROSCillator:SOURce on page 733

Transducer

Opens the "Select Transducer" dialog box and a submenu to activate or deactivate defined transducer factors, to generate new transducer factors or to edit existing ones.

In the "Select Transducer" dialog box, a transducer factor can be edited, deleted or copied, if selected, using the corresponding softkeys. The default directory in which the transducer factors are saved is displayed (`C:\R_S\INSTR\TRD`; the extension of transducer factor files is *.TDF). Subdirectories can be added or deleted via the file manager. They are displayed or hidden using the arrow keys or the Show Directory softkey / "Hide Directory" button.

Two different directory views are possible: If the "Show all" option is activated, all transducer factors in the directory are displayed. If the "Show compatible" option is activated, only the compatible transducer factors in the directory are displayed.

For details on transducer factors refer to chapter 2, "Advanced Measurement Examples", on page 11.

The submenu contains the following commands:

- "Active (On/Off)" on page 60
- "Edit" on page 60 >
- "New" on page 62
- "Copy to" on page 62
- "Delete" on page 62
- "Ref Level Adjust (Man/Auto)" on page 62
- "Show Directory" on page 63

SCPI command:

[SENSe:]CORRection:TRANsducer:SELect on page 732

Active (On/Off) ← Transducer

Activates or deactivates the selected transducer factor. A maximum of 8 transducer factors can be activated at the same time. Each time an additional transducer factor is activated, its unit compatibility is checked. If one factor has a different unit than dB, all the other activated factors must have the unit dB.

SCPI command:

[SENSe:]CORRection:TRANsducer:SELect on page 732

[SENSe:]CORRection:TRANsducer[:STATe] on page 730

Edit ← Transducer

Opens the "Edit Transducer" dialog box with the data of the selected factor, as well as a submenu. During editing, a transducer factor remains stored in the background until the factor is saved using the Save Factor softkey.

A transducer factor can contain up to 625 values. By defining up to 8 adjacent factors, a transducer system with up to 5000 values can be implemented.

The submenu contains the following commands:

- "Edit Name" on page 61
- "Edit Unit" on page 61
- "Edit Value" on page 61
- "Insert Value" on page 61
- "Delete Value" on page 61

- "Interpolation Lin/Log" on page 61
- "Save Factor" on page 61

SCPI command:

[SENSe:]CORRection:TRANsducer:COMMent on page 731

Edit Name ← Edit ← Transducer
Sets the focus on the "Name" field to enter a file name. The extension is added automatically.

SCPI command:

[SENSe:]CORRection:TRANsducer:SELect on page 732

Edit Unit ← Edit ← Transducer
Sets the focus on the "Unit" field to select the unit.

Note: If one factor has a different unit than "dB", all the other activated factors must have the unit "dB".

SCPI command:

[SENSe:]CORRection:TRANsducer:UNIT on page 732

Edit Value ← Edit ← Transducer
Sets the focus to enter positions and values as frequency/level pairs. The entered data is also displayed graphically. Using the "Shift x" or "Shift y" button, all entered values can be shifted in x or y direction.

The valid transducer value range is: -200 dB < value < 200 dB

SCPI command:

[SENSe:]CORRection:TRANsducer:DATA on page 731

Insert Value ← Edit ← Transducer
Inserts an empty line above the selected reference value to enter a new reference value. When entering a new reference value in the line, the ascending order of frequencies must be taken into consideration, however.

Each transducer factor may contain a maximum of 625 values. The valid transducer value range is: -200 dB < value < 200 dB

Delete Value ← Edit ← Transducer
Deletes the selected reference value (complete line). The reference values that follow move one line up.

Interpolation Lin/Log ← Edit ← Transducer
Sets the scaling of the x-axis to linear or logarithmic.

SCPI command:

[SENSe:]CORRection:TRANsducer:SCALing on page 732

Save Factor ← Edit ← Transducer
Saves the changed factor to a file on the internal flash disk. If a transducer factor with the same name already exists, a confirmation query is displayed. If the new factor is active, the new values are immediately applied.

In remote control, the save operation is performed automatically after the definition of the reference values.

New ← Transducer

Opens the "Edit Transducer" dialog box to enter data for a new factor.

This dialog box contains the same contents as the Edit softkey.

The submenu contains the following commands:

- "Edit Name" on page 61
- "Edit Unit" on page 61
- "Edit Value" on page 61
- "Insert Value" on page 61
- "Delete Value" on page 61
- "Interpolation Lin/Log" on page 61
- "Save Factor" on page 61

Copy to ← Transducer

Opens the "Edit Transducer" dialog box to copy the selected factor.

This dialog box contains the same contents as the "Edit" on page 60 softkey.

The submenu contains the following commands:

- "Edit Name" on page 61
- "Edit Unit" on page 61
- "Edit Value" on page 61
- "Insert Value" on page 61
- "Delete Value" on page 61
- "Interpolation Lin/Log" on page 61
- "Save Factor" on page 61

Delete ← Transducer

Deletes the selected factor after confirmation.

SCPI command:

[SENSe:]CORRection:TRANsducer:DELete on page 731

Ref Level Adjust (Man/Auto) ← Transducer

Activates or deactivates the automatic adjustment of the reference level to the selected transducer factor.

If a transducer factor is used (active), the trace is moved by a calculated shift. However, an upward shift reduces the dynamic range for the displayed values.

"Auto"   Activates the automatic adjustment. The original dynamic range is restored by also shifting the reference level by the maximum value of the transducer factor.

"Man"   Deactivates the automatic adjustment. Adjust the reference level via the "Amplitude" menu.

SCPI command:

[SENSe:]CORRection:TRANsducer:ADJust:RLEVel[:STATe] on page 730

Show Directory ← Transducer

Displays the subdirectory of the selected directory.

Alignment

Opens a submenu with the available functions for recording, displaying and activating the data for self alignment.

The correction data and characteristics required for the alignment are determined by comparison of the results at different settings with the known characteristics of the high-precision calibration signal source at 65.83 MHz. The correction data are stored as a file on flash disk and can be displayed using the "Show Align Results" on page 63 softkey.

The submenu contains the following commands:

● "Self Alignment" on page 63
● "Show Align Results" on page 63
● "Touch Screen Alignment" on page 63

Self Alignment ← Alignment

Starts the recording of correction data of the instrument. If the correction data acquisition has failed or if the correction values are deactivated, a corresponding message is displayed in the status field.

As long as the self alignment data is collected the procedure can be cancelled using the "Abort" button.

SCPI command:
*CAL on page 415

Show Align Results ← Alignment

Opens a dialog box that displays the correction data of the alignment:

● date and time of last correction data record
● overall results of correction data record
● list of found correction values according to function/module

The results are classified as follows:

PASSED	calibration successful without any restrictions
CHECK	deviation of correction value larger than expected, correction could however be performed
FAILED	deviations of correction value too large, no correction was possible. The found correction data are not applicable.

SCPI command:
CALibration:RESult on page 698

Touch Screen Alignment ← Alignment

Displays a touch screen alignment dialog.

When the device is delivered, the touch screen is initially aligned. However, it may become necessary to adjust the alignment later, e.g. after an image update or after exchanging a hard disk. If you notice that touching a specific point on the screen does not achieve the correct response, you may try adjusting the alignment, as well. .

Using a finger or any other pointing device, press the 4 markers on the screen.

The touch screen is aligned according to the executed pointing operations.

General Setup
Opens a submenu for all general settings such as IP address and LAN settings, date and time, remote control (optional) and measurement display.

Configure Network ← General Setup
Opens the "Network Connections" dialog box to change the LAN settings. For details refer to the Quick Start Guide, chapter 2 "Preparing for Use" and appendix B "LAN Interface".

Network Address ← General Setup
Opens a submenu to configure the internet protocol properties and the computer name.

Computer Name ← Network Address ← General Setup
Opens an edit dialog box to enter the computer name via the keypad. The naming conventions of Windows apply. If too many characters and/or numbers are entered, in the status line, an according message is displayed. For step-by-step instructions refer to the Quick Start Guide, appendix B "LAN Interface".

IP Address ← Network Address ← General Setup
Opens an edit dialog box to enter the IP address via the keypad. The TCP/IP protocol is preinstalled with the IP address 10.0.0.10. If the DHCP server is available ("DHCP On"), the dialog box entry is read-only.

The IP address consists of four number blocks separated by dots. Each block contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a block (as an example see the preinstalled address). For step-by-step instructions refer to the Quick Start Guide, chapter 2 "Preparing for Use".

Subnet Mask ← Network Address ← General Setup
Opens an edit dialog box to enter the subnet mask via the keypad. The TCP/IP protocol is preinstalled with the subnet mask 255.255.255.0. If the DHCP server is available ("DHCP On"), the dialog box entry is read-only.

The subnet mask consists of four number blocks separated by dots. Each block contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a block (as an example see the preinstalled address). For step-by-step instructions refer to the Quick Start Guide, chapter 2 "Preparing for Use".

DHCP (On/Off) ← Network Address ← General Setup
Switches between DHCP server available (On) or not available (Off). If a DHCP server is available in the network, the IP address and subnet mask of the instrument are obtained automatically from the DHCP server. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

LXI ← General Setup
Opens the LXI submenu containing the following softkeys:

- "Info" on page 65
- "Password" on page 65
- "Description" on page 65

- "LAN Reset" on page 65

As of firmware version 1.50, LXI functionality is available only for user accounts with administrator rights.

Info ← LXI ← General Setup

Shows the current parameters of LXI class C, including the current version, class and various computer parameters like the computer name or IP address.

While active, the dialog is not updated.

As of firmware version 1.50, LXI functionality is available only for user accounts with administrator rights.

SCPI command:
SYSTem:LXI:INFo on page 746

Password ← LXI ← General Setup

Shows the currently set password. You can also change the current password using this softkey.

The password is required to change settings via the web browser (e.g. IP parameter). An empty password is not valid, i.e. you must enter a password.

By default, the password is *LxiWebIfc*.

As of firmware version 1.50, LXI functionality is available only for user accounts with administrator rights.

SCPI command:
SYSTem:LXI:PASSword on page 747

Description ← LXI ← General Setup

Opens a dialog box to view or change the LXI instrument description. This description is used on some of the LXI web sites.

By default, the description is "Signal Analyzer".

As of firmware version 1.50, LXI functionality is available only for user accounts with administrator rights.

SCPI command:
SYSTem:LXI:MDEScription on page 747

LAN Reset ← LXI ← General Setup

Resets the LAN configuration to a state required by the LXI standard. For example, the TCP/IP mode is set to DHCP and Dynamic DNS and ICMP Ping are enabled. In addition, the analyzer sets the password and the instrument description to their initial states (see "Password" on page 65 and "Description" on page 65 softkeys).

As of firmware version 1.50, only user accounts with administrator rights can reset the LAN configuration.

SCPI command:
SYSTem:LXI:LANReset on page 746

GPIB ← General Setup

Opens a submenu to set the parameters of the remote control interface.

GPIB Address ← **GPIB** ← **General Setup**

Opens an edit dialog box to enter the GPIB address. Values from 0 to 30 are allowed. The default address is 20.

SCPI command:

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess on page 740

ID String Factory ← **GPIB** ← **General Setup**

Selects the default response to the *IDN? query.

SCPI command:

SYSTem:IDENtify:FACTory on page 744

ID String User ← **GPIB** ← **General Setup**

Opens an edit dialog box to enter a user-defined response to the *IDN? query. Max. 36 characters are allowed.

SCPI command:

SYSTem:IDENtify[:STRing] on page 745

Compatibility Mode ← **GPIB** ← **General Setup**

Sets the analyzer in a state compatible to previous R&S devices, enabling the usage of existing external control applications. In particular, the number of measurement points and available bandwidths are adjusted to those of other devices.

Furthermore, some special GPIB settings are available in order to emulate HP models (see chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E", on page 750):

- "GPIB Language" on page 67
- "IF Gain (Norm/Puls)" on page 67
- "Sweep Repeat (On/Off)" on page 68
- "Coupling (FSx/HP)" on page 68

"Default"   Standard analyzer operation, see "Mode Default" on page 66

"R&S FSP"   Compatible to R&S FSP, see "Mode R&S FSP" on page 66

"R&S FSU"   Compatible to R&S FSU, see "Mode R&S FSU" on page 67

SCPI command:

SYSTem:COMPatible on page 741

Mode Default ← **Compatibility Mode** ← **GPIB** ← **General Setup**

Resets the number of measurement points and available bandwidths to default analyzer values.

SCPI command:

SYST:COMP DEF, see SYSTem:COMPatible on page 741

Mode R&S FSP ← **Compatibility Mode** ← **GPIB** ← **General Setup**

Sets the number of measurement points and available bandwidths as in R&S FSP devices.

SCPI command:

SYST:COMP FSP, see SYSTem:COMPatible on page 741

Mode R&S FSU ← Compatibility Mode ← GPIB ← General Setup

Sets the number of measurement points and available bandwidths as in R&S FSU devices.

SCPI command:

`SYST:COMP FSU`, see `SYSTem:COMPatible` on page 741

GPIB Language ← Compatibility Mode ← GPIB ← General Setup

Opens a list of selectable remote-control languages:

Language	Comment
SCPI	
71100C	Compatible to 8566A/B
71200C	Compatible to 8566A/B
71209A	Compatible to 8566A/B
8560E	
8561E	
8562E	
8563E	
8564E	
8565E	
8566A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8566B	
8568A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568A_DC	Uses DC input coupling by default if supported by the instrument
8568B	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568B_DC	Uses DC input coupling by default if supported by the instrument
8591E	Compatible to 8594E
8594E	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.

For details on the GPIB languages, see chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E", on page 750.

SCPI command:

`SYSTem:LANGuage` on page 746

IF Gain (Norm/Puls) ← Compatibility Mode ← GPIB ← General Setup

Configures the internal IF gain settings in HP emulation mode due to the application needs. This setting is only taken into account for resolution bandwidth < 300 kHz.

NORM	Optimized for high dynamic range, overload limit is close to reference level.
PULS	Optimized for pulsed signals, overload limit up to 10 dB above reference level.

This softkey is only available if a HP language is selected via the "GPIB Language" soft-
key (see "GPIB Language" on page 67).

SCPI command:
SYSTem:IFGain:MODE on page 745

Sweep Repeat (On/Off) ← **Compatibility Mode** ← **GPIB** ← **General Setup**
Controls a repeated sweep of the E1 and MKPK HI HP model commands (for details on
the commands refer to "GPIB Language" on page 67). If the repeated sweep is OFF, the
marker is set without sweeping before.

Note: In single sweep mode, switch off this softkey before you set the marker via the E1
and MKPK HI commands in order to avoid sweeping again.

This softkey is only available if a HP language is selected via the "GPIB Language" soft-
key (see "GPIB Language" on page 67).

SCPI command:
SYSTem:RSW on page 749

Coupling (FSx/HP) ← **Compatibility Mode** ← **GPIB** ← **General Setup**
Controls the default coupling ratios in the HP emulation mode for:

● span and resolution bandwidth (Span/RBW) and
● resolution bandwidth and video bandwidth (RBW/VBW)

For FSP(=FSV), the standard parameter coupling of the instrument is used. As a result,
in most cases a shorter sweeptime is used than in case of HP.

This softkey is only available if a HP language is selected via the "GPIB Language" soft-
key (see "GPIB Language" on page 67).

SCPI command:
SYSTem:HPCoupling on page 744

REV String Factory ← **Compatibility Mode** ← **GPIB** ← **General Setup**
Selects the default response to the REV? query for the revision number (HP emulation
only, see chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and
8594E", on page 750).

SCPI command:
SYSTem:REVision:FACTory on page 748

REV String User ← **Compatibility Mode** ← **GPIB** ← **General Setup**
Opens an edit dialog box to enter a user-defined revision number in response to the
REV? query (HP emulation only, see chapter 4.2.5, "GPIB Commands of HP Models
856xE, 8566A/B, 8568A/B and 8594E", on page 750). Max. 36 characters are allowed.

SCPI command:
SYSTem:REVision[:STRing] on page 748

Display Update (On/Off) ← GPIB ← General Setup

Defines whether the instrument display is switched off when changing from manual operation to remote control. In remote control mode, this softkey is displayed in the local menu.

SCPI command:
SYSTem:DISPlay:UPDate on page 742

GPIB Terminator LFEOI/EOI ← GPIB ← General Setup

Changes the GPIB receive terminator.

According to the standard, the terminator in ASCII is <LF> and/or <EOI>. For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by changing the receive terminator to EOI.

SCPI command:
SYSTem:COMMunicate:GPIB[:SELF]:RTERminator on page 740

*IDN Format Leg./New ← GPIB ← General Setup

Defines the response format to the *IDN? remote command (see *IDN on page 416). This function is intended for re-use of existing control programs together with the analyzer.

"Leg"   Legacy format, compatible to the R&S FSP/FSU/FSQ family

"New"   analyzer format

SCPI command:
SYSTem:FORMat:IDENt on page 744

I/O Logging (On/Off) ← GPIB ← General Setup

Activates or deactivates the SCPI error log function. All remote control commands received by the analyzer are recorded in the following log file:

C:\R_S\instr\ScpiLogging\ScpiLog.txt

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs.

Time+Date ← General Setup

Opens an edit dialog box to enter time and date for the internal real time clock. For details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

SCPI command:
SYSTem:TIME on page 749
SYSTem:DATE on page 742

Configure Monitor ← General Setup

Determines and displays the configuration of a connected external monitor, if available. In the configuration dialog box, you can switch from the internal monitor (laptop icon) to the external monitor (monitor icon), or both (double monitor icon). For external, the analyzer display is disabled (turns dark). The screen content formerly displayed on the analyzer is displayed on the external screen.

For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

Soft Frontpanel ← General Setup

Activates or deactivates the display of the instrument emulation.

deactivated	Only the measurement screen is displayed. This is the setting for working at the analyzer.
activated	In addition to the measurement screen, the whole front panel is displayed, i.e. the hardkeys and other hardware controls of the device are simulated on the screen. This is the setting for working at a computer with XP Remote Desktop or at an external monitor.
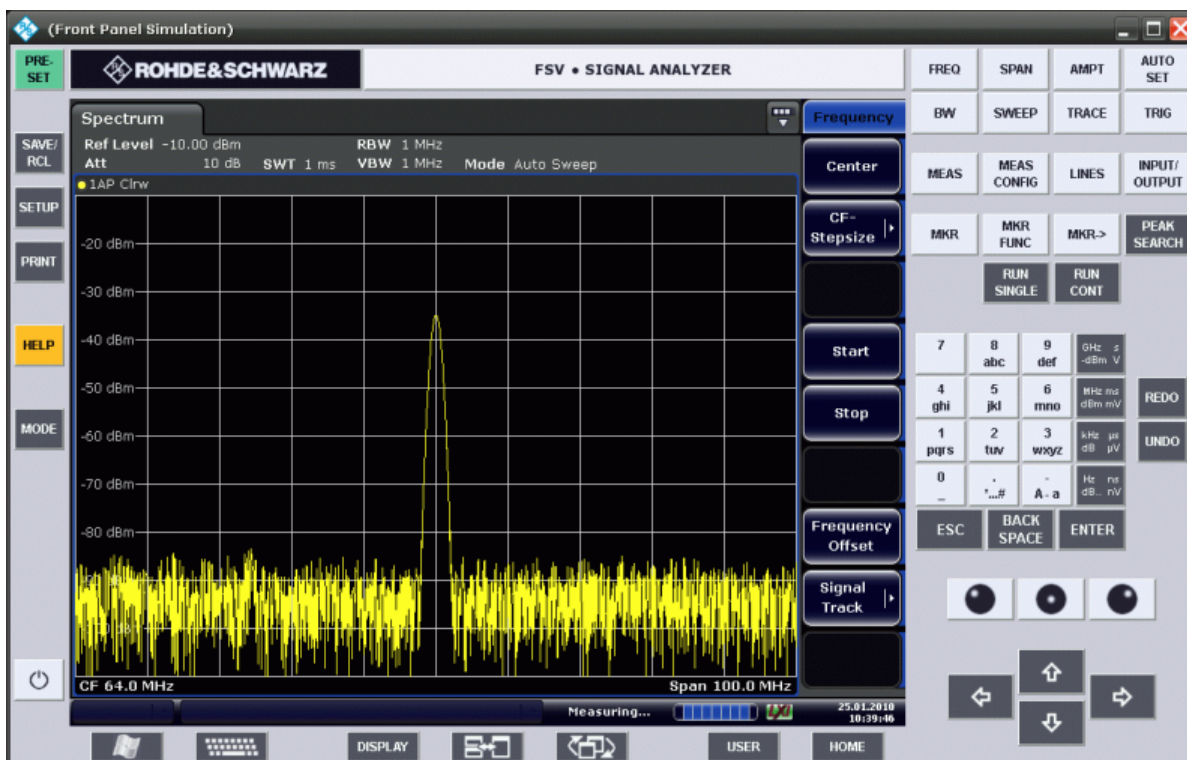
Fig. 3-1: Soft Frontpanel

Alternatively to this softkey, you can use the F6 key.

SCPI command:

SYSTem:DISPlay:FPANel on page 742

Display Setup

Opens a submenu to define the display settings.

The following display settings are available:

- "Tool Bar State (On/Off)" on page 71
- "Screen Title (On/Off)" on page 71
- "Time+Date (On/Off)" on page 71
- "Time+Date Format (US/DE)" on page 71
- "Print Logo (On/Off)" on page 71
- "Annotation (On/Off)" on page 71
- "Theme Selection" on page 71
- "Screen Colors" on page 71

- "Print Colors" on page 73
- "Display Pwr Save (On/Off)" on page 74

Tool Bar State (On/Off) ← Display Setup

Displays or removes the tool bar above the diagram for standard file functions.

SCPI command:

DISPlay:TBAR[STATe] on page 707

Screen Title (On/Off) ← Display Setup

Activates/deactivates the display of a diagram title (if available) and opens an edit dialog box to enter a new title for the active diagram. Max. 20 characters are allowed.

SCPI command:

DISPlay[:WINDow<n>]:TEXT[:DATA] on page 708

DISPlay[:WINDow<n>]:TEXT:STATe on page 708

Time+Date (On/Off) ← Display Setup

Activates/deactivates the display of date and time beneath the diagram.

SCPI command:

DISPlay[:WINDow<n>]:TIME on page 708

Time+Date Format (US/DE) ← Display Setup

Switches the time and date display on the screen between US and German (DE).

SCPI command:

DISPlay[:WINDow<n>]:TIME:FORMat on page 708

Print Logo (On/Off) ← Display Setup

Activates/deactivates the display of the Rohde & Schwarz company logo in the upper left corner.

SCPI command:

DISPlay:LOGO on page 705

Annotation (On/Off) ← Display Setup

Activates/deactivates the display of the frequency information in the diagram footer. For example to protect confidential data it can be useful to hide the frequency information.

SCPI command:

DISPlay:ANNotation:FREQuency on page 704

Theme Selection ← Display Setup

Opens a selection list of available themes for the screen display. The theme defines the colors used for keys and screen elements, for example. The default theme is "BlueO-cean".

SCPI command:

DISPlay:THEMe:SELect on page 707

Screen Colors ← Display Setup

Opens a submenu to configure the screen colors. For details on screen colors refer to the Quick Start Guide, chapter 2 "Preparing for Use".

The submenu contains the following commands:

- "Select Screen Color Set" on page 72
- "Color (On/Off)" on page 72
- "Select Object" on page 72
- "Predefined Colors" on page 72
- "User Defined Colors" on page 73
- "Set to Default" on page 73

SCPI command:

DISPlay:CMAP<m>:HSL on page 704

Select Screen Color Set ← Screen Colors ← Display Setup
Opens the "Select Screen Color Set" dialog box to select default or user defined color settings.

If one of the default settings is selected ("Default Colors 1"/"2"), the default settings for brightness, color tint and color saturation for all display screen elements are restored. The default color schemes provide optimum visibility of all picture elements at an angle of vision from above or below. Default setting is "Default Colors 1".

If "User Defined Colors" is selected, a user-defined color set can be defined. For step-by-step instruction refer to the Quick Start Guide, chapter 2 "Preparing for Use".

SCPI command:

DISPlay:CMAP<m>:DEFault on page 704

Color (On/Off) ← Screen Colors ← Display Setup
Switches from color display to black-and-white display and back. The default setting is color display.

Select Object ← Screen Colors ← Display Setup
Opens the "Color Setup" dialog box to select the color settings for a selected object.

The "Selected Object" list is displayed to select the object. For setting the color the pre-defined colors are displayed.

SCPI command:

DISPlay:CMAP<m>:HSL on page 704

HCOPy:CMAP<m>:HSL on page 712

Predefined Colors ← Screen Colors ← Display Setup
In the "Color Setup" dialog box, displays the "Predefined Colors" (alternatively to the "Predefined Colors" button). This softkey is only available if, in the "Select Color Set" dialog box, the "User Defined Colors" option is selected or the "Color Setup" dialog box is displayed. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

SCPI command:

DISPlay:CMAP<m>:PDEFined on page 705

HCOPy:CMAP<m>:PDEFined on page 713

User Defined Colors ← Screen Colors ← Display Setup

In the "Color Setup" dialog box, displays the "User Defined Colors" (alternatively to the "User Defined Colors" button). This softkey is only available if, in the "Select Color Set" dialog box, the "User Defined Colors" option is selected or the "Color Setup" dialog box is displayed. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

SCPI command:

DISPlay:CMAP<m>:HSL on page 704

HCOPy:CMAP<m>:HSL on page 712

Set to Default ← Screen Colors ← Display Setup

Opens the "Set to Default" dialog box to select one of the factory default color settings.

SCPI command:

DISPlay:CMAP<m>:DEFault on page 704

HCOPy:CMAP<m>:DEFault on page 711

Print Colors ← Display Setup

Opens a submenu to select the colors for the printout. To facilitate color selection, the selected color combination is displayed when the menu is entered. The previous colors are restored when the menu is exited. For details on screen colors refer to the Quick Start Guide, chapter 2 "Preparing for Use".

The submenu contains the following commands:

- "Select Print Color Set" on page 73
- "Color (On/Off)" on page 74
- "Select Object" on page 91
- "Predefined Colors" on page 91
- "User Defined Colors" on page 91
- "Set to Default" on page 91

SCPI command:

HCOPy:CMAP<m>:HSL on page 712

Select Print Color Set ← Print Colors ← Display Setup

Opens the "Select Print Color Set" dialog box to select the color settings for printout.

Screen Colors (Print)	Selects the current screen colors for the printout. The background is always printed in white and the grid in black.
Screen Colors (Hardcopy)	Selects the current screen colors without any changes for a hardcopy. The output format is set via the "Device Setup" on page 90 softkey in the "Print" menu.
Optimized Colors	Selects an optimized color setting for the printout to improve the visibility of the colors (default setting). Trace 1 is blue, trace 2 black, trace 3 green, and the markers are turquoise. The background is always printed in white and the grid in black.
User Defined Colors	Enables the softkeys to define colors for the printout.

SCPI command:

HCOPy:CMAP<m>:DEFault on page 711

Color (On/Off) ← Print Colors ← Display Setup

Switches from color printout to black-and-white printout and back. All colored areas are printed in white and all colored lines in black. This improves the contrast. The default setting is color printout, provided that the selected printer can produce color printouts.

SCPI command:

HCOPy:DEVice:COLor on page 714

Display Pwr Save (On/Off) ← Display Setup

Switches the power-save mode for the display (On/Off) and opens an edit dialog box to enter the time for the power-save function to respond. After the elapse of this time the display is completely switched off, i.e. including backlighting. This mode is recommended when the instrument is exclusively operated in remote control.

For details on the power-save mode for the display refer to the Quick Start Guide, chapter 2 "Preparing for Use".

SCPI command:

DISPlay:PSAVe[:STATe] on page 706

DISPlay:PSAVe:HOLDoff on page 706

System Info

Opens a submenu to display detailed information on module data, device statistics and system messages.

The submenu contains the following commands:

- "Hardware Info" on page 74
- "Versions+Options" on page 74
- "System Messages" on page 75
- "Clear All Messages" on page 75

Hardware Info ← System Info

Opens a dialog box that displays hardware information, e.g. on the frontend and motherboard. Every listed component is described by its serial number, order number, model information, hardware code, and hardware revision.

SCPI command:

DIAGnostic<n>:SERVice:HWINfo on page 699

Versions+Options ← System Info

Opens a dialog box that displays a list of hardware and firmware information, including:

Label	Description
Device ID	Unique ID of the device
Instrument Firmware	Installed firmware version
BIOS	Installed BIOS version
CPLD	CPLD version
MB-FPGA	Motherboard FPGA version

Label	Description
Data Sheet Version	Data sheet version of the basic device
<option>	Installed hardware and firmware options

For details on options refer to the Quick Start Guide, chapter 2 "Checking the Supplied Items".

SCPI command:

*IDN on page 416

*OPT on page 417

SYSTem:DEVice:ID?/SYSTem:DID on page 742

SYSTem:DEVice:ID?/SYSTem:DID on page 742

System Messages ← System Info
Opens the "System Messages" dialog box that displays the generated system messages in the order of their occurrence. The most recent messages are placed at the top of the list. Messages that have occurred since the last display of system messages menu are marked with an asterisk '*'. The following information is available:

No	device-specific error code
Message	brief description of the message
Component	hardware messages: name of the affected module
	software messages: name of the affected software
Date/Time	date and time of the occurrence of the message

If the number of error messages exceeds the capacity of the error buffer, "Message buffer overflow" is displayed. To delete messages see "Clear All Messages" on page 75 soft-key.

SCPI command:

SYSTem:ERRor:LIST on page 743

Clear All Messages ← System Info
Deletes all system messages. The softkey is only available if the "System Messages" dialog box is displayed.

SCPI command:

SYSTem:ERRor:CLEar:ALL on page 743

Firmware Update
Opens the "Firmware Update" dialog box.

Enter the name of or browse for the firmware installation file and press the "Execute" button. For details on installation refer to the Quick Start Guide, chapter 3 "Firmware Update and Installation of Firmware Options".

As of firmware version 1.50, only user accounts with administrator rights can perform a firmware update.

SCPI command:

SYSTem:FIRMware:UPDate on page 743

Option Licenses

Opens a submenu to install options. For details on options refer to the Quick Start Guide, chapter 3 "Firmware Update and Installation of Firmware Options".

The submenu contains the following commands:

- "Install Option" on page 76
- "Install Option by XML" on page 76

As of firmware version 1.50, only user accounts with administrator rights are able to install options.

Install Option ← Option Licenses

Opens an edit dialog box to enter the license key for the option that you want to install.

If an option is about to expire, a message box is displayed to inform you. You can then use this softkey to enter a new license key.

If an option has already expired, a message box appears for you to confirm. In this case, all instrument functions are unavailable (including remote control) until the analyzer is rebooted. You must then use the "Install Option" softkey to enter the new license key.

For more information about the option in question refer to the System Info softkey in the "Setup" menu.

As of firmware version 1.50, only user accounts with administrator rights are able to install options.

Install Option by XML ← Option Licenses

Opens an edit dialog to install an additional option to the analyzer using an XML file. Enter or browse for the name of an XML file on the instrument that contains the option key and press "Select".

As of firmware version 1.50, only user accounts with administrator rights are able to install options.

Application Setup Recovery

Controls instrument behavior when switching between measurement applications, e.g. from "Spectrum" to "Analog Demod" and back.

If this softkey is activated, the current instrument settings are stored when you switch to a different application. When you switch back to the previous application, the corresponding instrument settings are restored. Thus, the settings of the individual applications are independant of each other.

If the softkey is deactivated (default), only a few parameters of the current instrument setting are passed between applications (e.g. center frequency, level settings).

SCPI command:

SYSTem:APPLication:SRECovery[:STATe] on page 739

Service

Opens a submenu that contains additional functions for maintenance and/or trouble-shooting.

NOTICE! . The service functions are not necessary for normal measurement operation. However, incorrect use can affect correct operation and/or data integrity of the analyzer. Therefore, many of the functions can only be used after entering a password. They are described in the instrument service manual.

The submenu contains the following commands:

- "Input Source" on page 77
- "Reset Password" on page 77
- "Selftest" on page 78
- "Selftest Results" on page 78
- "Password" on page 78
- "Service Function" on page 78

As of firmware version 1.50, only user accounts with administrator rights are able to use functions.

Input Source ← Service

Opens a submenu to select the input source for measurement.

The submenu contains the following options:

- "RF" on page 77
- "Calibration Frequency RF" on page 77
- "Calibration Frequency MW" on page 77

RF ← Input Source ← Service

Switches the input of the analyzer to the RF input connector (normal position). This is the default setting.

SCPI command:

DIAGnostic<n>:SERVice:INPut[:SELect] on page 699

Calibration Frequency RF ← Input Source ← Service

Opens an edit dialog box to set the generator frequency for the internal calibration.

SCPI command:

DIAGnostic<n>:SERVice:INPut:PULSed:CFRequency on page 700

Calibration Frequency MW ← Input Source ← Service

Opens an edit dialog box to set the calibration frequency for frequencies greater than 7 GHz (for analyzer 13 and 30 only).

SCPI command:

DIAGnostic<n>:SERVice:INPut:PULSed:MCFRequency on page 700

Reset Password ← Service

Deactivates all set passwords.

SCPI command:

SYSTem:PASSword:RESet on page 747

Selftest ← Service

Initiates the self test of the instrument modules to identify a defective module in case of failure. All modules are checked consecutively and the test result is displayed.

SCPI command:

*TST on page 419

Selftest Results ← Service

Opens the "Selftest Result" dialog box that contains the test results. In case of failure a short description of the failed test, the defective module, the associated value range and the corresponding test results are indicated.

SCPI command:

DIAGnostic<n>:SERVice:STESt:RESult on page 702

Password ← Service

Opens an edit dialog box to enter the password. This ensures that the service functions are only used by authorized personnel.

SCPI command:

SYSTem:PASSword[:CENable] on page 747

Service Function ← Service

Opens the "Service Function" dialog box to start special service functions. For further information refer to the service manual.

SCPI command:

DIAGnostic<n>:SERVice:SFUNction on page 701

3.1.1.2 Activating or Deactivating the LXI Class C Functionality

As of firmware version 1.50, only user accounts with administrator rights are able to use LXI functionality.

1. In the Windows XP "Start" menu, select the "LXI" entry and press the ENTER key. An LXI configuration dialog box is displayed.
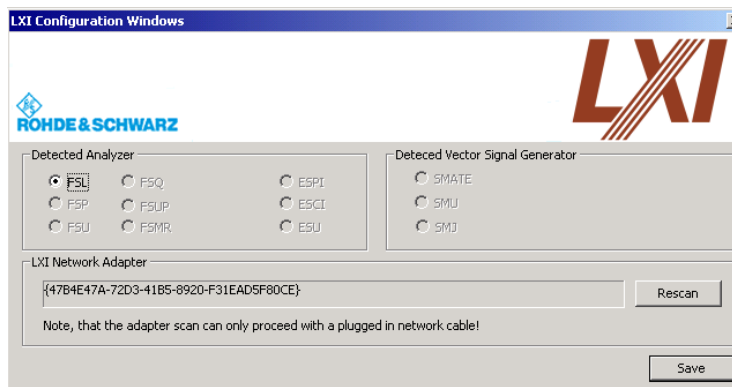
2. Press the "Rescan" button.

3. Press the "Save" button.

The instrument reboots and after the reboot LXI is active.

4. To deactivate the LXI Class C functionality perform step 1 and 2 again.
An LXI configuration dialog box is displayed.
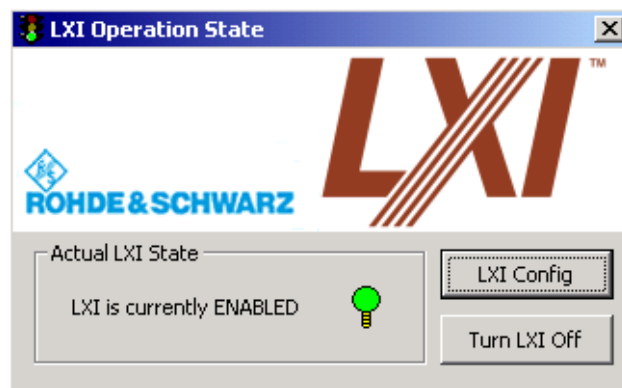
5. Press the "Turn LXI Off" button.

3.1.1.3 LXI Class C Functionality

If the LXI Class C functionality is installed and enabled (default state is off; see chapter 3.1.1.1, "Softkeys of the Setup Menu", on page 57), the instrument can be accessed via any web browser (e.g. the Microsoft Internet Explorer) to perform the following tasks:

● modifying network configurations

● modifying device configurations

● monitoring connections from the device to other devices

To change settings, in the web browser, open the "http://<instrument-hostname>" or "http://<instrument-ip-address>" page. The password to change LAN configurations is *LxiWeb*.

As of firmware version 1.50, only user accounts with administrator rights are able to use LXI functionality.

3.1.2 Saving and Recalling Settings Files – SAVE/RCL Key

The SAVE/RCL key is used to store and load instrument settings and to manage stored files.

The "Save/Recall" menu includes functions for storing ("Save" on page 81 softkey) instrument settings such as instrument configurations (measurement/display settings, etc) and measurement results on permanent storage media, or to load ("Recall" on page 83 softkey) stored data back onto the instrument.

Functions for management of storage media ("File Manager" on page 85 softkey) include among others functions for listing, copying, and deleting/renaming files.

The analyzer is capable of internally storing complete instrument settings with instrument configurations and measurement data in the form of settings files. The respective data

are stored on the internal flash disk or, if selected, on a memory stick or network drive. The mass media are assigned to the volume names as follows:

Drive	Designation	Comment
C	operating system, firmware and stored instrument settings	for customer data
A	USB floppy drive	if connected
D	USB memory stick or USB CD-ROM	if connected
E …Z	additional USB mass storage devices or mounted LAN volumes	if connected

To open the Save/Recall menu

► Press the SAVE/RCL key.

The "Save/Recall" menu is displayed.

Menu and softkey description

● chapter 3.1.2.1, "Softkeys of the SAVE/RCL Menu", on page 80

Further information

● chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87
● chapter 3.1.2.3, "Navigation in the File Manager", on page 88

3.1.2.1 Softkeys of the SAVE/RCL Menu

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

Save

Opens the "Save" dialog box to define and store the settings file. To navigate in the dialog box and define/enter data, use the corresponding softkeys. For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87.

Path	Directory in which the settings file is stored. The default path for user settings files is C:\r_s\instr\user
Files	List of settings files already stored
File Name	Name of settings file
Comment	Comment regarding the settings file
[Items]	Selection of items to be saved in the settings file

The submenu contains the following commands:

- "Save File / Recall File" on page 82
- "Select Path" on page 82
- "Select File" on page 82
- "Edit File Name" on page 82
- "Edit Comment" on page 82
- "Select Items" on page 82 >
- "Delete File" on page 83

Save File / Recall File ← Save

Saves the settings file with the defined file name ("Save" dialog box), or recalls the selected settings file ("Recall" dialog box). If the file name already exists, upon saving, a message is displayed. Selecting "Yes" overwrites the existing file, selecting "No" aborts the saving process.

For details on the file name conventions refer to the "Edit File Name" on page 82 softkey description.

You can assign stored settings files to user-definable softkeys in the "User" menu for easy access, see chapter 3.1.5, "User-Defined Menu – USER key", on page 92 .

SCPI command:

MMEMory:STORe<n>:STATe on page 728

MMEMory:STORe<n>:STATe:NEXT on page 728

MMEMory:LOAD:STATe 1, on page 723

Select Path ← Save

Opens the directory list to select the drive and folder for the settings file to be stored or loaded. The default path is "C:\r_s\instr\user". For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87.

Select File ← Save

Sets the focus on the "Files" list. For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87 .

SCPI command:

MMEMory:CATalog on page 718

Edit File Name ← Save

Sets the focus on the "File Name" field.

In the "Save" dialog box, the field already contains a suggestion for a new name: the file name used in the last saving process is counted up to the next unused name. For example, if the name last used was "test_004", the new name "test_005" is suggested, but only if this name is not in use. If the name "test_005" is already in use, the next free name is suggested, e.g. "test_006". You can change the suggested name to any name conform to the following naming conventions.

The name of a settings file consists of a base name followed by an underscore and three numbers, e.g. limit_lines_005. In the example, the base name is "limit_lines". The base name can contain characters, numbers and underscores. The file extension is added automatically.

Edit Comment ← Save

Sets the focus on the "Comment" field to enter a comment for the settings file. Max. 60 characters are allowed. For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87 .

Select Items ← Save

Displays the softkey submenu for selecting the items to be stored or loaded.

The submenu contains the following commands:

● "Select Items" on page 83

- "Enable all Items" on page 83
- "Disable all Items" on page 83

Select Items ← Select Items ← Save
Sets the focus on the items list. For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87 .

In the "Save" dialog box, all items that can be saved are displayed. The number of displayed items depends on the installed options, as for some options additional items can be stored.

In the "Recall" dialog box, the items saved in the selected file are displayed.

SCPI command:
MMEMory:SELect[:ITEM]:HWSettings on page 726
MMEMory:SELect[:ITEM]:LINes:ALL on page 727
MMEMory:SELect[:ITEM]:TRACe[:ACTive] on page 728
MMEMory:SELect[:ITEM]:TRANsducer:ALL on page 728

Enable all Items ← Select Items ← Save
Selects all items for saving or loading.

SCPI command:
MMEMory:SELect[:ITEM]:ALL on page 726

Disable all Items ← Select Items ← Save
Selects none of the items for saving or loading.

SCPI command:
MMEMory:SELect[:ITEM]:NONE on page 727

Delete File ← Save
Deletes the selected settings file.

SCPI command:
MMEMory:CLEar:STATe 1, on page 720

Recall
Opens the "Recall" dialog box to load a settings file. To navigate in the dialog box, use the corresponding softkeys. For details see also chapter 3.1.2.2, "Navigation in the Dialog Boxes for Saving and Loading Settings Files", on page 87 .

Path	Directory from which the settings file is loaded. The default path for user settings files is C:\r_s\instr\user
Files	List of stored settings files
File Name	Name of settings file
Comment	Comment of the settings file
[Items]	Items saved in the settings file

Note: After you use the "Recall" function, the history of previous actions is deleted, i.e. any actions performed previously cannot be undone or redone using the "UNDO/REDO" keys.

The submenu contains the following commands:

- "Save File / Recall File" on page 82
- "Select Path" on page 82
- "Select File" on page 82
- "Edit File Name" on page 82
- "Edit Comment" on page 82
- "Select Items" on page 83 >
- "Delete File" on page 83

SCPI command:

MMEMory:LOAD:STATe 1, on page 723

Startup Recall

Opens a submenu to activate or deactivate and set up the startup recall function.

The submenu contains the following commands:

- "Startup Recall (On/Off)" on page 84
- "Select Dataset" on page 84

Startup Recall (On/Off) ← Startup Recall

Activates or deactivates the startup recall function. If activated, the settings stored in the file selected via the "Select Dataset" on page 84 softkey are loaded when booting or for preset. If deactivated, the default settings are loaded.

SCPI command:

MMEMory:LOAD:AUTO on page 722

Select Dataset ← Startup Recall

Opens the "Startup Recall" dialog box to select the settings file for the startup recall function (see also "Startup Recall (On/Off)" on page 84 softkey).

ScreenShot

Saves the current measurement screen as a file (screenshot). This function can also be performed via the "Screenshot" icon in the toolbar, if available.

SCPI command:

Remote: HCOPHCOPy[:IMMediate<1|2>]

Export

Opens a submenu to configure exports of trace data. For details see chapter 3.2.8.7, "ASCII File Export Format", on page 144.

ASCII Trace Export ← Export

Opens the "ASCII Trace Export Name" dialog box and saves the active trace in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the trace data. For details on an ASCII file see chapter 3.2.8.7, "ASCII File Export Format", on page 144.

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "Decim Sep" softkey (see "Decim Sep" on page 85).

SCPI command:

FORMat:DEXPort:DSEParator on page 558

MMEMory:STORe<n>:TRACe on page 572

Decim Sep ← Export
Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

Import
This function is currently not available.

File Manager
Opens the "File Manager" dialog box and a submenu to manage mass storage media and files. In the upper left corner, the current drive is displayed. Below the folders and subfolders of the current directory are displayed. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88 .

The following tasks can be performed:

● copying files from flash disk to other media
● copying files into another directory
● renaming and deleting files

The submenu contains the following commands:

● "Edit Path" on page 85
● "New Folder" on page 86
● "Copy" on page 86
● "Rename" on page 86
● "Cut" on page 86
● "Paste" on page 86
● "Delete" on page 86
● "Sort Mode" on page 86 >
● "File Lists (1/2)" on page 87
● "Current File List (1/2)" on page 87
● "Network Drive" on page 87 >

Edit Path ← File Manager
For details see "Select Path" on page 82 softkey.

SCPI command:
MMEMory:MSIS on page 724

MMEMory:CDIRectory on page 719

New Folder ← File Manager

Creates a new folder and opens an edit dialog box to enter name and path (absolute or relative to the current directory) of the new folder.

SCPI command:

MMEMory:MDIRectory on page 723

Copy ← File Manager

Copies the selected item to the clipboard. The item can be copied later using the "Paste" on page 86 softkey. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88 .

SCPI command:

MMEMory:COPY on page 721

Rename ← File Manager

Opens an edit dialog box to enter a new file or folder name:. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88 .

SCPI command:

MMEMory:MOVE on page 723

Cut ← File Manager

Copies the selected file to the clipboard. If the file is later copied to a different directory using the "Paste" on page 86 softkey, it is deleted in the current directory. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88.

Paste ← File Manager

Copies a file from the clipboard to the currently selected directory. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88 .

Delete ← File Manager

Deletes the selected item after confirmation. For details on navigation see also chapter 3.1.2.3, "Navigation in the File Manager", on page 88 .

SCPI command:

MMEMory:DELete on page 722

MMEMory:RDIRectory on page 726

Sort Mode ← File Manager

Opens a submenu to select the sorting mode for the displayed files. The entry for the next higher directory level ("..") and the folders are always located at the top of the list.

The submenu contains the following commands:

- "Name" on page 86
- "Date" on page 87
- "Extension" on page 87
- "Size" on page 87

Name ← Sort Mode ← File Manager

Sorts the displayed files in alphabetical order of the file names.

Date ← Sort Mode ← File Manager

Sorts the displayed files in respect to the date.

Extension ← Sort Mode ← File Manager

Sorts the displayed files in respect to the extension.

Size ← Sort Mode ← File Manager

Sorts the displayed files in respect to the size.

File Lists (1/2) ← File Manager

Splits the screen to copy files from one directory to the other. The focus between the two panes is switched using the "FIELD RIGHT" and "FIELD LEFT" keys.

Current File List (1/2) ← File Manager

Changes the focus to the selected file list.

Network Drive ← File Manager

Opens the "Map Network Drive" dialog box and submenu.

For further information refer to the Quick Start Guide.

The submenu contains the following commands:

Map Network Drive ← Network Drive ← File Manager

Sets the focus on the "Drive" list.

For further information refer to the Quick Start Guide.

SCPI command:

Disconnect Network Drive ← Network Drive ← File Manager

Opens the "Disconnect Network Drive" dialog box. In the "Drive" list, select the drive you want to disconnect and confirm with "OK".

SCPI command:

3.1.2.2 Navigation in the Dialog Boxes for Saving and Loading Settings Files

The "Save" and "Recall" dialog boxes are used to save and recall settings files. For both dialog boxes, the same navigation principle applies. Press the "Save" on page 81 or "Recall" on page 83 softkey to open the corresponding dialog box.

● "Path" field
  To change the directory, press the "Select Path" on page 82 softkey.
  To select a folder, use the rotary knob or the "UPARROW" and "DNARROW" keys.
  To open a subfolder, press the "RIGHTARROW" key. To close subfolders, press the

"LEFTARROW" key. To confirm the selection, press the rotary knob or the ENTER key.

- "Files" list
  If the "Recall" or "Startup Recall" dialog box is opened, the focus is on the "Files" list. To set the focus on the "Files" list, press the "Select File" on page 82 softkey. To select a folder, use the rotary knob or the "UPARROW" and "DNARROW" keys. To open a subfolder, press the ENTER key. To select a file, use the rotary knob or the "UPARROW" and "DNARROW" keys. To load the selected file, press the rotary knob or the ENTER key. To delete the selected file, press the softkey.

- "File Name" field
  If the "Save" dialog box is opened, the focus is on the "File Name" field. To set the focus on "File Name" field, press the "Edit File Name" on page 82 softkey. Enter the name in the "File Name" field. The extension of the data name is ignored. For details on entering the name, refer to the Quick Start Guide, chapter 4 "Basic Operations".

- "Comment" field
  To enter a comment, press the "Edit Comment" on page 82 softkey.

- Items saved in the settings file
  To select a special item, set the focus on the entry using the arrow keys or the rotary knob. To confirm the selection, press the ENTER key. To deselect the item, press the ENTER key again.

3.1.2.3 Navigation in the File Manager

- To change from one subfolder to another, use the ENTER key.
- To change to the next higher directory, select the dots "..".
- To change into a subfolder, use the "RIGHTARROW" and "LEFTARROW" keys.
- To select a file or a folder, use the "UPARROW" and "DNARROW" keys.
- To confirm the selection of a file or folder, press the ENTER key.

3.1.3 Manual Operation – Local Menu

When switched on, the instrument is always in the manual measurement mode and can be operated via the front panel. As soon as the instrument receives a remote command, it is switched to the remote control mode.

In remote control mode, all keys of the instrument except the PRESET key are disabled, see chapter 3.1.1, "Instrument Setup and Interface Configuration – SETUP Key", on page 56. The "LOCAL" softkey and the Display Update (On/Off) softkey are displayed. Depending on the setting of the Display Update (On/Off) softkey, the diagrams, traces and display fields are displayed or hidden. For further details on the Display Update (On/Off) softkey refer to chapter 3.1.1, "Instrument Setup and Interface Configuration – SETUP Key", on page 56.

For details on remote control refer to chapter 5 "Remote Control – Basics".

The change to manual operation consists of:

● Enabling the Front Panel Keys
  Returning to manual mode enables all inactive keys. The main softkey menu of the current mode is displayed.

● Displaying the measurement diagrams again.
  The diagrams, traces and display fields are displayed again.

● Generating the "OPERATION COMPLETE" message
  If, at the time of pressing the "LOCAL" softkey, the synchronization mechanism via *OPC, *OPC? or *WAI is active, the currently running measurement procedure is aborted and synchronization is achieved by setting the corresponding bits in the registers of the status reporting system.

● Setting Bit 6 (User Request) of the Event Status Register
  With a corresponding configuration of the status reporting system, this bit immediately causes the generation of a service request (SRQ) to inform the control software that the user wishes to return to front panel control. For example this can be used to interrupt the control program and to correct instrument settings manually. This bit is set each time the "LOCAL" softkey is pressed.

To return to manual operation

► Press the "LOCAL" softkey.

The instrument switches from remote to manual operation, but only if the local lockout function has not been activated in the remote control mode.

3.1.4 Measurement Documentation – PRINT Key

The PRINT key is used to select and configure the printer and to customize the screen printout. For detailed information on printer selection and installation refer to the Quick Start Guide.

To open the Print menu

► Press the PRINT key.

The "Print" menu is displayed.

Softkeys of the Print Menu

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

Print Screen

Starts to printout all test results displayed on the screen: diagrams, traces, markers, marker lists, limit lines etc. Comments, title, date, and time are included at the bottom margin of the printout. All displayed items belonging to the instrument software (softkeys, tables, dialog boxes) are not printed out.

The output is defined via the "Device Setup" on page 90 softkey. If the output is saved in a file, the file name used in the last saving process is counted up to the next unused name. If you use a file name that already exists, upon saving, a message is displayed. Selecting "Yes" overwrites the existing file, selecting "No" aborts the saving process. For further details on the file name and an example, refer to the "Save/ Recall" menu, "Edit File Name" on page 82 softkey.

Path	Directory in which the file is stored. The default path is C:\r_s\instr\user
Files	List of the existing files in the same format
File Name	Name of the file

SCPI command:

HCOPy:ITEM:ALL on page 715

HCOPy[:IMMediate<1|2>] on page 715

HCOPy[:IMMediate<1|2>]:NEXT on page 715

Device Setup

Opens the "Hardcopy Setup" dialog box to define the output: image file, clipboard, or the printer. The dialog box consists of two tabs which are selected via the "Device (1/2)" on page 91 softkey.

For further information refer to the Quick Start Guide.

SCPI command:

HCOPy:DEVice:LANGuage<1|2> on page 714

SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt on page 740

SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT] on page 740

SYSTem:COMMunicate:PRINter:SELect <1|2> on page 741

HCOPy:PAGE:ORIentation<1|2> on page 716

HCOPy:DESTination<1|2> on page 713

HCOPy:TDSTamp:STATe<1|2> on page 716

HCOPy:TDSTamp:STATe<1|2> on page 716

Device (1/2)

Selects the tab of the device in the "Device Setup" dialog box. The analyzer is able to manage two print settings independently of each other. For each device the print setting is displayed on the corresponding tab of the "Device Setup" dialog box ("Device Setup" on page 90 softkey).

For further information refer to the Quick Start Guide.

Colors

Opens a submenu to define the colors to be used. For details see "Print Colors" on page 73 softkey of the "Setup" menu.

The submenu contains the following commands:

- "Select Print Color Set" on page 91
- "Color (On/Off)" on page 91
- "Select Object" on page 91
- "Predefined Colors" on page 91
- "User Defined Colors" on page 91
- "Set to Default" on page 91

Select Print Color Set ← Colors

For details see "Select Print Color Set" on page 73 softkey of the "Setup" menu.

Color (On/Off) ← Colors

For details see "Color (On/Off)" on page 72 softkey of the "Setup" menu.

Select Object ← Colors

For details see "Select Object" on page 72 softkey of the "Setup" menu.

Predefined Colors ← Colors

For details see "Predefined Colors" on page 72 softkey of the "Setup" menu.

User Defined Colors ← Colors

For details see "User Defined Colors" on page 73 softkey of the "Setup" menu.

Set to Default ← Colors

For details see "Set to Default" on page 73 softkey of the "Setup" menu.

Comment

Opens dialog box to enter a comment. Max. 120 characters are allowed. 60 characters fit in one line. In the first line, at any point a manual line-feed can be forced by entering "@".

Date and time are inserted automatically. The comment is printed below the diagram area, but not displayed on the screen. If a comment should not be printed, it must be deleted.

For details on the alphanumeric entries refer to the Quick Start Guide, chapter 4 "Basic Operations".

SCPI command:

HCOPy:ITEM:WINDow<n>:TEXT on page 716

Install Printer

Opens the "Printers and Faxes" window to install a new printer. All printers that are already installed are displayed.

For further information refer to the Quick Start Guide, appendix A, "Printer Interface".

As of firmware version 1.50, only user accounts with administrator rights can install a printer.

3.1.5 User-Defined Menu – USER key

The USER key displays a user-defined menu. The softkeys displayed here can be labelled and assigned to user-defined settings files as required.

To open the user-defined menu

► Press the USER key.

The "User" menu is displayed.

Softkeys of the User menu

The "User" menu contains 8 user-definable softkeys as well as a User-Defined Menu – USER key softkey that allows you to define them. Pressing one of the user-definable softkeys has the same effect as the Save File / Recall File function for a pre-defined settings file. The definitions for these softkeys remain unchanged even after a reset function and after updating the firmware.

Remote commands are not available for the "User" menu functions.

User Pref Setup Softkey

Opens an "ApplicationManager" dialog to set up the user-defined softkeys.

	User key saveset	User key label
1		Empty
2	H:\etv\SW\user\Save2.dfl	Settings_2
3	H:\etv\SW\user\Save3.dfl	Settings_3
4	H:\etv\SW\user\Save4.dfl	Settings_4
5	H:\etv\SW\user\Save5.dfl	Settings_5
6		Empty
7	H:\etv\SW\user\Save7.dfl	Settings_7
8	H:\etv\SW\user\Save8.dfl	Settings_8
	Save	Cancel
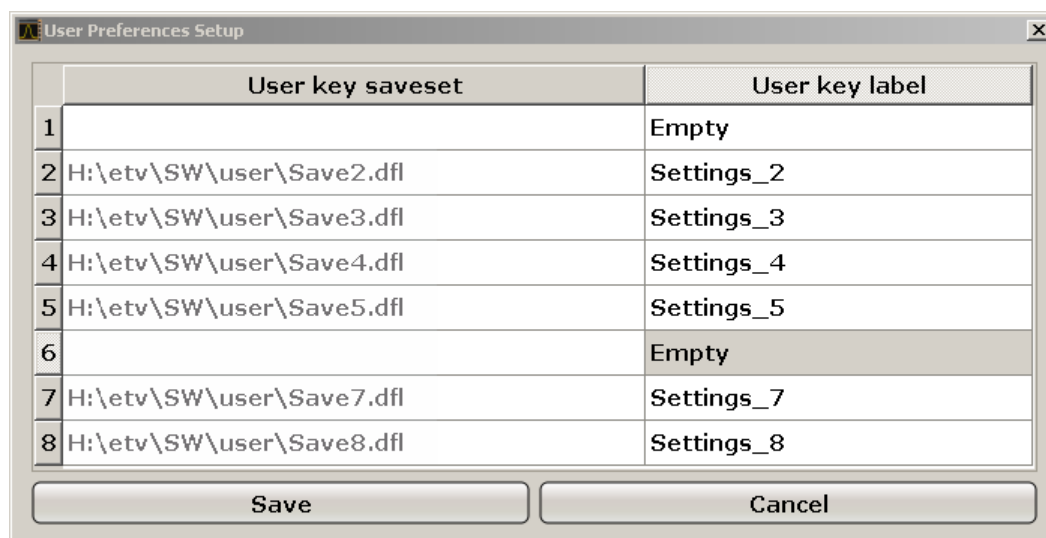
For each user-definable softkey (1–8), you can define a key label and assign a settings file that is to be loaded when the softkey is selected.

To define the key label

1. Click into the table entry for the corresponding softkey.

2. Enter a label for the softkey.

3. Press ENTER.

To assign a settings file

1. Click into the table entry for the corresponding softkey.

2. In the file selection dialog, select a stored settings file to be recalled when the softkey is selected.

3. Click "Select".
    The selected file is displayed in the "ApplicationManager" dialog.

To store the softkey settings

►   Click "Save" to store the user-defined softkey definitions.

3.2   Measurement Parameters

In this section all menus necessary for setting measurement parameters are described. For details on changing the mode refer to chapter 3.4.1, "Measurement Mode Selection – MODE Key", on page 276.

Editing measurement parameters in the information bar

The currently defined main measurement parameters are displayed in the information bar of the display. They can easily be edited by touching the setting in the display (with a finger or mouse pointer). The corresponding (edit) dialog box is displayed where you can edit the setting.

If you touch the setting in the display longer than 1 second or right-click it, a context-sensitive menu is displayed. The entries correspond to the functions available in the softkey menu for that setting.

Table 3-1: Sweep range variables

Abbrev.	Definition	analyzer3 value	analyzer7 value	analyzer13 value	analyzer30 value	analyzer40 value
f_{max}	max. frequency	3.6 GHz	7 GHz	13.6 GHz	30 GHz	40 GHz
f_{min}	min. frequency available	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz
$span_{min}$	smallest selectable span > 0 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz

3.2.1   Initializing the Configuration – PRESET Key

The PRESET key resets the instrument to the default setting and therefore provides a defined initial state as a known starting point for measurements.

> If the "local lockout" function is active in the remote control mode, the PRESET key is disabled.

Further information

Task

3.2.1.1   Presetting the Instrument

1. Define the data set for the presetting:

   a) To retrieve the originally provided settings file (see chapter 3.2.1.2, "Initial Configuration", on page 96), in the "SAVE/RCL" menu, deactivate the "Startup Recall" softkey.

b) To retrieve a customized settings file, in the "File" menu, activate the "Startup Recall" softkey, press the "Startup Recall Setup" softkey, and select the corresponding file.
For details refer to chapter 3.1.2, "Saving and Recalling Settings Files – SAVE/RCL Key", on page 79.

2. Press the PRESET key to trigger a preset.

Remote: `*RST` or `SYSTem:PRESet`

(For details refer to chapter 4.2.4.12, "SYSTem Subsystem", on page 738.)

After you use the PRESET function, the history of previous actions is deleted, i.e. any actions performed previously cannot be undone or redone using the UNDO/REDO keys.

3.2.1.2 Initial Configuration

The initial configuration is selected such that the RF input is always protected against overload, provided that the applied signal levels are in the allowed range for the instrument.

The parameter set of the initial configuration can be customized using the "Startup Recall" softkey in the "Save/Rcl" menu. For further information refer to chapter 3.1.2, "Saving and Recalling Settings Files – SAVE/RCL Key", on page 79.

Table 3-2: Initial configuration

Parameter	Setting
mode	Spectrum
sweep mode	auto
center frequency	$f_{max}/2$
center frequency step size	0.1 * span
span	analyzer3: 3.6 GHz
	analyzer7: 7 GHz
	analyzer13: 13.6 GHz
	analyzer30: 30 GHz
	analyzer40: 40 GHz
RF attenuation	0 dB
reference level	-10 dBm
level range	100 dB log
level unit	dBm
sweep time	auto
resolution bandwidth	auto (3 MHz)
video bandwidth	auto (3 MHz)

Parameter	Setting
FFT filters	off
span/RBW	100
RBW/VBW	1
sweep	cont
trigger	free run
trace 1	clr write
trace 2/3/4/5/6	blank
detector	auto peak
frequency offset	0 Hz
reference level offset	0 dB
reference level position	100 %
grid	abs
cal correction	on
noise source	off
input	RF

3.2.2 Selecting the Frequency and Span – FREQ Key

The FREQ key is used to specify the frequency axis, and to set the frequency offset and the signal track function. The frequency axis can be specified either by the start and stop frequency or by the center frequency and the span.

To open the Frequency menu

● Press the FREQ key.
The "Frequency" menu is displayed. The "Frequency Center" edit dialog box is displayed.

Menu and softkey description

● chapter 3.2.2.1, "Softkeys of the Frequency Menu", on page 98

Tasks

● chapter 3.2.2.2, "Specifying the Frequency Axis by the Start and Stop Frequency", on page 102
● chapter 3.2.2.3, "Specifying the Frequency Axis by the Center Frequency and the Span", on page 102
● chapter 3.2.2.4, "Specifying the Step Size for the Arrow Keys and the Rotary Knob", on page 102
● chapter 3.2.2.5, "Modifying the Frequency Axis by an Offset", on page 103

3.2.2.1 Softkeys of the Frequency Menu

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

Center

Opens an edit dialog box to enter the center frequency. The allowed range of values for the center frequency depends on the frequency span.

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

span = 0: $0\ Hz \leq f_{center} \leq f_{max}$

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

SCPI command:

[SENSe:]FREQuency:CENTer on page 601

CF Stepsize

Opens a submenu to set the step size of the center frequency. Apart from the =Center, =Marker and Manual softkeys, the other softkeys are displayed depending on the selected frequency span.

The step size can be coupled to the span (span > 0) or the resolution bandwidth (span = 0) or it can be manually set to a fixed value.

0.1*Span (span > 0) ← **CF Stepsize**

Sets the step size for the center frequency to 10 % of the span.

SCPI command:

`FREQ:CENT:STEP:LINK SPAN`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

`FREQ:CENT:STEP:LINK:FACT 10PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor` on page 602

0.1*RBW (zero span) ← **CF Stepsize**

Sets the step size for the center frequency to 10 % of the resolution bandwidth. This is the default setting.

SCPI command:

`FREQ:CENT:STEP:LINK RBW`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

`FREQ:CENT:STEP:LINK:FACT 10PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor` on page 602

0.5*Span (span > 0) ← **CF Stepsize**

Sets the step size for the center frequency to 50 % of the span.

SCPI command:

`FREQ:CENT:STEP:LINK SPAN`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

`FREQ:CENT:STEP:LINK:FACT 50PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor` on page 602

0.5*RBW (zero span) ← **CF Stepsize**

Sets the step size for the center frequency to 50 % of the resolution bandwidth.

SCPI command:

`FREQ:CENT:STEP:LINK RBW`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

`FREQ:CENT:STEP:LINK:FACT 50PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor` on page 602

x*Span (span > 0) ← **CF Stepsize**

Opens an edit dialog box to set the step size for the center frequency as % of the span.

SCPI command:

`FREQ:CENT:STEP:LINK SPAN`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

`FREQ:CENT:STEP:LINK:FACT 20PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

x*RBW (zero span) ← CF Stepsize
Opens an edit dialog box to set the step size for the center frequency as % of the resolution bandwidth. Values between 1 and 100 % in steps of 1 % are allowed. The default setting is 10 %.

SCPI command:
`FREQ:CENT:STEP:LINK RBW`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601
`FREQ:CENT:STEP:LINK:FACT 20PCT`, see `[SENSe:]FREQuency:CENTer:STEP:LINK` on page 601

=Center ← CF Stepsize
Sets the step size to the value of the center frequency and removes the coupling of the step size to span or resolution bandwidth. This function is especially useful during measurements of the signal harmonic content because by entering the center frequency each stroke of the arrow key selects the center frequency of another harmonic.

=Marker ← CF Stepsize
Sets the step size to the value of the current marker and removes the coupling of the step size to span or resolution bandwidth. This function is especially useful during measurements of the signal harmonic content at the marker position because by entering the center frequency each stroke of the arrow key selects the center frequency of another harmonic.

Manual ← CF Stepsize
Opens an edit dialog box to enter a fixed step size for the center frequency.

SCPI command:
`[SENSe:]FREQuency:CENTer:STEP[:VALue]` on page 601

Start
Opens an edit dialog box to define the start frequency. The following range of values is allowed:

$f_{min} \leq f_{start} \leq f_{max} - span_{min}$

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

SCPI command:
`[SENSe:]FREQuency:STARt` on page 603

Stop
Opens an edit dialog box to define the stop frequency. The following range of values for the stop frequency is allowed:

$f_{min} + span_{min} \leq f_{stop} \leq f_{max}$

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

SCPI command:
`[SENSe:]FREQuency:STOP` on page 603

Frequency Offset

Opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset. The softkey indicates the current setting. The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

SCPI command:

[SENSe:]FREQuency:OFFSet on page 603

Signal Track (span > 0)

Opens a submenu to modify the parameters for signal tracking:

● search bandwidth
● threshold value
● trace

The search bandwidth and the threshold value are shown in the diagram by two vertical lines and one horizontal line, which are labeled as "TRK". After each sweep the center frequency is set to the maximum signal found within the searched bandwidth. If no maximum signal above the set threshold value is found in the searched bandwidth, the track mechanism stops.

The submenu contains the following softkeys:

● "Track On/Off (span > 0)" on page 101
● "Track BW (span > 0)" on page 101
● "Track Threshold (span > 0)" on page 101
● "Select Trace (span > 0)" on page 101

Track On/Off (span > 0) ← Signal Track (span > 0)

Switches the signal tracking on or off.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:STRack[:STATe] on page 516

Track BW (span > 0) ← Signal Track (span > 0)

Opens an edit dialog box to set the search bandwidth for signal tracking. The frequency range is calculated as a function of the center frequency.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:STRack:BANDwidth|BWIDth on page 516

Track Threshold (span > 0) ← Signal Track (span > 0)

Opens an edit dialog box to set the threshold value for signal tracking.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:STRack:THReshold on page 516

Select Trace (span > 0) ← Signal Track (span > 0)

Opens an edit dialog box to select the trace on which the signal is tracked.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:STRack:TRACe on page 517

External Mixer

Opens the "Ext. Mixer" submenu to activate and configure an optional external mixer. This function is only available for analyzer30 and 40 instruments with the B21 option installed.

For details on the external mixer functionality, see chapter 3.8, "Instrument Functions – External Mixer (Option R&S FSV-B21)", on page 342.

3.2.2.2 Specifying the Frequency Axis by the Start and Stop Frequency

1. Press the Start softkey and enter a start frequency.

2. Press the Stop softkey and enter a stop frequency.

3.2.2.3 Specifying the Frequency Axis by the Center Frequency and the Span

1. Press the FREQ key and enter a center frequency in the "Frequency Center" edit dialog box.

2. Press the SPAN key and enter the bandwidth you want to analyze.

> Entering a value of 0 Hz will cause a change to the zero span analysis mode.

3.2.2.4 Specifying the Step Size for the Arrow Keys and the Rotary Knob

1. Press the "CF Stepsize" on page 98 softkey.

   The displayed softkeys depend on the selected frequency span (zero span or span > 0).

2. To define the step size of the center frequency:

   a) Only if span > 0: Press "0.1*Span", "0.5*Span" or "x*Span" to define the step size for the center frequency as percentage of the span (see "CF Stepsize" on page 98).

   b) Only if span = 0: Press "0.1*RBW", "0.5*RBW", or "x*RBW" to define the step size for the center frequency as percentage of the resolution bandwidth (see "CF Stepsize" on page 98).

   c) Press the =Center softkey to set the step size to the value of the center frequency and to remove the dependency of the step size to span or resolution bandwidth.

   d) Press the =Marker softkey to set the step size to the value of the marker and to remove the dependency of the step size to span or resolution bandwidth.

   e) Press the Manual softkey and enter a fixed step size for the center frequency.

The step size assigned to arrow keys corresponds to the selected value; the step size of the rotary knob is 1/10 of it.

3.2.2.5 Modifying the Frequency Axis by an Offset

●   Press the Frequency Offset softkey and enter the offset to shift the displayed frequency span.

3.2.2.6 Tracking Signals (Span > 0)

●   Press the "Signal Track (span > 0)" on page 101 softkey to display the submenu and start and stop signal tracking with specified parameters.
●   Press the "Track On/Off (span > 0)" on page 101 softkey to switch signal tracking on or off.
●   Press the "Track BW (span > 0)" on page 101 softkey and enter a bandwidth for signal tracking.
●   Press the "Track Threshold (span > 0)" on page 101 softkey and enter the threshold for signal tracking.
●   Press the "Select Trace (span > 0)" on page 101 softkey and select the trace for signal tracking.

3.2.3 Setting the Frequency Span – SPAN Key

The SPAN key is used to set the frequency span to be analyzed.

To open the Span menu

●   Press the SPAN key.
    The "Span" menu is displayed. For span > 0 an edit dialog box to enter the frequency is displayed. For zero span, an edit dialog box to enter the sweep time is displayed.

Menu and softkey description

●   chapter 3.2.3.1, "Softkeys of the Span Menu", on page 103

Task

●   chapter 3.2.3.2, "Specifying the Span (Alternatives)", on page 104

3.2.3.1 Softkeys of the Span Menu

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

Span Manual

Opens an edit dialog box to enter the frequency span. The center frequency is kept constant. The following range is allowed:

span = 0: 0 Hz

span >0: $span_{min} \leq f_{span} \leq f_{max}$

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

SCPI command:

[SENSe:]FREQuency:SPAN on page 603

Full Span

Sets the span to the full frequency range of the analyzer specified in the data sheet. This setting is useful for overview measurements.

SCPI command:

[SENSe:]FREQuency:SPAN:FULL on page 603

Zero Span

Sets the span to 0 Hz (zero span). The x-axis becomes the time axis with the grid lines corresponding to 1/10 of the current sweep time ("SWT").

SCPI command:

FREQ:SPAN 0Hz, see [SENSe:]FREQuency:SPAN on page 603

Last Span

Sets the span to the previous value. With this function e.g. a fast change between overview measurement and detailed measurement is possible.

Freq Axis (Lin/Log)

Switches the frequency axis to linear or logarithmic scaling.

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:X:SPACing on page 550

3.2.3.2 Specifying the Span (Alternatives)

1. To set the span, use the Span Manual, Full Span, Zero Span and Last Span softkeys.

2. To define a frequency range, use the Start and Stop softkeys of the "Frequency" menu.

3. For zero span, press the Sweeptime Manual softkey and enter a sweep time.

3.2.4 Setting the Level Display and Configuring the RF Input – AMPT Key

The AMPT key is used to set the reference level, the level range and unit, the scaling and the RF attenuation.

To open the amplitude menu

● Press the AMPT key.
  The "Amplitude" menu is displayed. The "Reference Level" dialog box is displayed.

Menu and softkey description

● chapter 3.2.4.1, "Softkeys of the Amplitude Menu", on page 105

Tasks

● chapter 3.2.4.2, "Specifying the Amplitude", on page 111
● chapter 3.2.4.3, "Using Electronic Attenuation (Option Electronic Attenuator, R&S FSV-B25)", on page 111

3.2.4.1 Softkeys of the Amplitude Menu

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

Ref Level

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

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel on page 551

Range

Opens a submenu to define the level display range.

Range Log 100 dB ← Range

Sets the level display range to 100 dB.

SCPI command:
DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 100DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 50 dB ← Range

Sets the level display range to 50 dB.

SCPI command:
DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 50DB
Sets the level display range to 50 dB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 10 dB ← Range

Sets the level display range to 10 dB.

SCPI command:
DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 10DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 5 dB ← Range

Sets the level display range to 5 dB.

SCPI command:

`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISP:WIND:TRAC:Y 5DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 1 dB ← Range

Sets the level display range to 1 dB.

SCPI command:

`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISP:WIND:TRAC:Y 1DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log Manual ← Range

Opens an edit dialog box to enter a value for logarithmic scaling for the level display range.

SCPI command:

`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551

Range Linear % ← Range

Selects linear scaling in % for the level display range, i.e. the horizontal grid lines are labeled in %. The grid is divided in decadal steps.

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

SCPI command:

`DISP:TRAC:Y:SPAC LIN,`see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

Range Lin. Unit ← Range

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

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

SCPI command:

`DISP:TRAC:Y:SPAC LDB,` see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

Unit

Opens the "Unit" submenu to select the unit for the level axis. The default setting is dBm. If a transducer is switched on, the softkey is not available.

In general, the signal analyzer measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. 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), conversion to other units is possible. The following units are available and directly convertible:

- dBm
- dBmV
- dBµV
- dBµA
- dBpW
- Volt
- Ampere
- Watt

SCPI command:
CALCulate<n>:UNIT:POWer on page 545

Preamp On/Off (option RF Preamplifier, B22/B24)

Switches the preamplifier on or off.

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

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

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

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:
INPut:GAIN:STATe   on page 566

RF Atten Manual/Mech Att Manual

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

The mechanical attenuation can be set in 10 dB steps.

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

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

Note: Values under 10 dB can only be entered via the numeric keypad or via remote control command in order to protect the input mixer against overload.

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

"$level_{mixer} = level_{input} - $ RF attenuation"

The maximum mixer level allowed is -10 dBm. mixer levels above this value may lead to incorrect measurement results, which are indicated by the "OVLD" status display.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog box, see "Sweep List dialog box" on page 233.

SCPI command:
INPut:ATTenuation on page 561

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

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

In Spurious Emission Measurement mode, clicking this softkey will automatically open the ""Sweep List"" dialog, see "Sweep List dialog box" on page 233.

SCPI command:
INPut:ATTenuation:AUTO on page 562

El Atten On/Off
This softkey switches the electronic attenuator on or off. This softkey is only available with option R&S FSV-B25.

When the electronic attenuator is activated, the mechanical and electronic attenuation can be defined separately. Note however, that both parts must be defined in the same mode, i.e. either both manually, or both automatically.

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

- To define the mechanical attenuation, use the RF Atten Manual/Mech Att Manual or RF Atten Auto/Mech Att Auto softkeys.
- To define the electronic attenuation, use the El Atten Mode (Auto/Man) softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, this function is available again.
When the electronic attenuator is switched off, the corresponding RF attenuation mode (auto/manual) is automatically activated.

SCPI command:
INPut:EATT:AUTO on page 565

El Atten Mode (Auto/Man)
This softkey defines whether the electronic attenuator value is to be set automatically or manually. If manual mode is selected, an edit dialog box is opened to enter the value. This softkey is only available with option R&S FSV-B25, and only if the electronic attenuator has been activated via the El Atten On/Off softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, electronic attenuation is available again. If the electronic attenuation was defined manually, it must be re-defined.

The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

To re-open the edit dialog box for manual value definition, select the "Man" mode again.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

SCPI command:

INPut:EATT:AUTO on page 565

INPut:EATT on page 565

Ref Level Offset

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 552

Ref Level Position

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

Grid Abs/Rel

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

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

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE on page 551

Input (AC/DC)

Toggles the RF input of the analyzer between AC and DC coupling.

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

SCPI command:

INPut:COUPling on page 562

Input 50 Ω/75 Ω

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

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

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

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

SCPI command:

INPut:IMPedance on page 566

3.2.4.2 Specifying the Amplitude

1. Set the reference level, offset and position using the "Ref Level", "Ref Level Offset" and "Ref Level Position" softkeys (see "Ref Level" on page 106, "Ref Level Offset" on page 110 and "Ref Level Position" on page 110).

2. Select the level range and the unit for the level axis using the "Range" and "Unit" softkeys (see "Range" on page 106 and "Unit" on page 108).

3. Set the scaling using the "Ref Level Position" and/or "Grid Abs/Rel" softkeys (see "Ref Level Position" on page 110 and "Grid Abs/Rel " on page 110).

4. Set the attenuation using the "RF Atten Manual/Mech Atten Manual" or "RF Atten Auto/Mech Att Auto", or (for option B25 only) "El Atten Mode" softkeys (see"RF Atten Manual/Mech Att Manual" on page 108, "RF Atten Auto/Mech Att Auto" on page 109, "El Atten Mode (Auto/Man)" on page 109).

5. Define the RF input coupling using the "Input (AC/DC)" softkey, or a reference impedance using the "Input (50Ω/75Ω)" softkey (see "Input (AC/DC)" on page 110, "Input 50 Ω/75 Ω " on page 110).

6. If available, activate or deactivate the RF Preamplifier (option R&S FSV-B22/B24) using the "Preamp" softkey (see "Preamp On/Off (option RF Preamplifier, B22/B24)" on page 108).

3.2.4.3 Using Electronic Attenuation (Option Electronic Attenuator, R&S FSV-B25)

Besides the mechanical attenuator at the RF input, the analyzer also offers an electronic attenuation setting (option Electronic Attenuator B25). The electronic attenuator can be set manually or automatically. The default attenuation is preset by the mechanical attenuator. The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

In automatic mode, the electronic attenuator is set to 0 dB. If a reference level outside the allowed 30 dB range is set, the mechanical attenuator performs the setting. From this new reference level to over 30dB, the electronic attenuator performs the setting again.

For stop frequencies (or center frequencies in zero span) >7 GHz, electronic attenuation cannot be defined individually. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined manually. As soon as the stop or center frequency is reduced below 7 GHz, electronic attenuation is available again. If the electronic attenuation was defined manually, it must be re-defined.

Setting electronic attenuation

1. Activate the electronic attenuation by pressing the El Atten On/Off softkey.

2. Select the required attenuator mode by pressing the El Atten Mode (Auto/Man) softkey until the required mode is highlighted.

Two new softkeys are displayed to set the mechanical attenuation. The same mode is activated for mechanical attenuation as was selected for electronic attenuation.

3. To define the attenuation manually:

   a) Press the El Atten Mode (Auto/Man) softkey again, if necessary, to display the edit dialog box.
   b) Enter the value for the electronic attenuator in the edit dialog box.
   c) If necessary, press the RF Atten Manual/Mech Att Manual softkey to open the edit dialog box for mechanical attenuation and enter the required value.

3.2.5 Defining Automatic Settings – AUTO SET Key

The "Auto Set" menu allows you define automatic settings for measurements quickly.

To open the Auto Set menu

- Press the AUTO SET key.
  The "Auto Set" menu is displayed.

Menu and softkey description

- chapter 3.2.5.1, "Softkeys of the Auto Set Menu", on page 112

3.2.5.1 Softkeys of the Auto Set Menu

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

Auto All
Performs all automatic settings.

- "Auto Freq" on page 113

- "Auto Level" on page 113

SCPI command:

[SENSe:]ADJust:ALL on page 576

Auto Freq

Defines the center frequency automatically by determining the highest frequency level in the frequency span. This function uses the signal counter; thus it is intended for use with sinusoidal signals.

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

This function is not available for 1xEV-DO MS Analysis mode (K85).

SCPI command:

[SENSe:]ADJust:FREQuency on page 576

Auto Level

Defines the optimal reference level for the current measurement automatically. The measurement time for automatic leveling can be defined using the Settings softkey.

SCPI command:

[SENSe:]ADJust:LEVel on page 576

Settings

Opens a submenu to define settings for automatic leveling.

Possible settings are:

- "Meas Time Manual" on page 113
- "Meas Time Auto" on page 113

Meas Time Manual ← Settings

Opens an edit dialog box to enter the duration of the level measurement in seconds. The level measurement is used to determine the optimal reference level automatically (see the "Auto Level" softkey, "Auto Level" on page 113). The default value is 1 ms.

SCPI command:

[SENSe:]ADJust:CONFigure:LEVel:DURation on page 577

Meas Time Auto ← Settings

The level measurement is used to determine the optimal reference level automatically (see the Auto Level softkey).

Sweep Type

Opens a submenu to define the sweep type.

This function is not available in IQ Analyzer mode or for I/Q Digital Baseband input (option R&S FSV-B17).

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- "Sweep" on page 114
- "FFT" on page 114 (not available with 5-Pole filters, channel filters or RRC filters, see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121)
- "Auto" on page 114

Sweep ← Sweep Type

Sets the Sweep Type to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

SCPI command:

SWE:TYPE SWE, see [SENSe:]SWEep:TYPE on page 648

FFT ← Sweep Type

Sets the Sweep Type to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

FFT is not available when using 5-Pole filters, Channel filters or RRC filters.

Note: Not all measurement configurations allow for FFT mode. For instance, the Quasi peak detector does not support FFT. In this case, sweep mode is used. The same applies when a tracking generator (internal or external, options R&S FSV-B9/B10) is active. FFT mode is also available for:

● sweep time
● video bandwidth
● all detectors except Quasi peak
● gated trigger measurements
● signal count

SCPI command:

SWE:TYPE FFT, see [SENSe:]SWEep:TYPE on page 648

Auto ← Sweep Type

Automatically sets the fastest available Sweep Type for the current measurement. Auto mode is set by default.

SCPI command:

SWE:TYPE AUTO, see [SENSe:]SWEep:TYPE on page 648

FFT Filter Mode ← Sweep Type

Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

Auto ← FFT Filter Mode ← Sweep Type

The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 580

Narrow ← FFT Filter Mode ← Sweep Type

For an RBW ≤ 10kHz, the FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 580

3.2.6 Setting the Bandwidths and Sweep Time – BW Key

The BW key is used to set the resolution bandwidth, video bandwidth (VBW) and sweep time (SWT). The values available for resolution bandwidth and video bandwidth depend on the selected filter type. For details on channel filters see also chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122 .

To open the bandwidth menu

● Press the BW key.
   The "Bandwidth" menu is displayed.

Menu and softkey description

● chapter 3.2.6.1, "Softkeys of the Bandwidth Menu", on page 115

Further information

● chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122
● table 3-3

Tasks

● chapter 3.2.6.2, "Specifying the Bandwidth", on page 121
● chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121

3.2.6.1 Softkeys of the Bandwidth Menu

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

> For Spurious Emission Measurements, the settings are defined in the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

Res BW Manual

Opens an edit dialog box to enter a value for the resolution bandwidth. The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DNARROW key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the resolution bandwidth is indicated by a green bullet next to the "RBW" display in the channel bar.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 580

[SENSe:]BANDwidth|BWIDth[:RESolution] on page 579

Res BW Auto

Couples the resolution bandwidth to the selected span (for span > 0). If the span is changed, the resolution bandwidth is automatically adjusted.

This setting is recommended, if a favorable setting of the resolution bandwidth in relation to the selected span is desired.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 580

Video BW Manual

Opens an edit dialog box to enter the video bandwidth. The available video bandwidths are specified in the data sheet.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DOWN key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the video bandwidth is indicated by a green bullet next to the "VBW" display in the channel bar.

Note: RMS detector and VBW.

If an RMS detector is used, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used the sweep time should be increased to get more stable trace curves. For details on detectors see chapter 3.2.8.6, "Detector Overview", on page 143.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO on page 582

[SENSe:]BANDwidth|BWIDth:VIDeo on page 582

Video BW Auto

Couples the video bandwidth to the resolution bandwidth. If the resolution bandwidth is changed, the video bandwidth is automatically adjusted.

This setting is recommended, if a minimum sweep time is required for a selected resolution bandwidth. Narrow video bandwidths require longer sweep times due to the longer settling time. Wide bandwidths reduce the signal/noise ratio.

SCPI command:

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO on page 582

Sweeptime Manual

Opens an edit dialog box to enter the sweep time.

Sweep time	
absolute max. sweep time value:	16000 s
absolute min. sweep time value:	zero span: 1 µs
	span > 0: depends on device model (refer to data sheet)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or UPARROW/DNARROW key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the analyzer displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

SWE:TIME:AUTO OFF, see [SENSe:]SWEep:TIME:AUTO on page 648

[SENSe:]SWEep:TIME on page 648

Sweeptime Auto
Couples the sweep time to the span, video bandwidth (VBW) and resolution bandwidth (RBW) (not available for zero span). If the span, resolution bandwidth or video bandwidth is changed, the sweep time is automatically adjusted.

The analyzer always selects the shortest sweep time that is possible without falsifying the signal. The maximum level error is < 0.1 dB, compared to using a longer sweep time.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:
[SENSe:]SWEep:TIME:AUTO on page 648

Sweep Type
Opens a submenu to define the sweep type.

This function is not available in IQ Analyzer mode or for I/Q Digital Baseband input (option R&S FSV-B17).

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- "Sweep" on page 114
- "FFT" on page 114 (not available with 5-Pole filters, channel filters or RRC filters, see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121)
- "Auto" on page 114

Sweep ← Sweep Type
Sets the Sweep Type to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

SCPI command:
SWE:TYPE SWE, see [SENSe:]SWEep:TYPE on page 648

FFT ← Sweep Type
Sets the Sweep Type to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

FFT is not available when using 5-Pole filters, Channel filters or RRC filters.

Note: Not all measurement configurations allow for FFT mode. For instance, the Quasi peak detector does not support FFT. In this case, sweep mode is used. The same applies when a tracking generator (internal or external, options R&S FSV-B9/B10) is active.
FFT mode is also available for:

- sweep time
- video bandwidth
- all detectors except Quasi peak
- gated trigger measurements
- signal count

SCPI command:
SWE:TYPE FFT, see [SENSe:]SWEep:TYPE on page 648

Auto ← Sweep Type
Automatically sets the fastest available Sweep Type for the current measurement. Auto mode is set by default.

SCPI command:
`SWE:TYPE AUTO`, see `[SENSe:]SWEep:TYPE` on page 648

FFT Filter Mode ← Sweep Type
Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

Auto ← FFT Filter Mode ← Sweep Type
The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

SCPI command:
`[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT` on page 580

Narrow ← FFT Filter Mode ← Sweep Type
For an RBW ≤ 10kHz, the FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

SCPI command:
`[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT` on page 580

Coupling Ratio
Opens a submenu to select the coupling ratios for functions coupled to the bandwidth.

RBW/VBW Sine [1/1] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = resolution bandwidth"

This is the default setting for the coupling ratio resolution bandwidth/video bandwidth.

This is the coupling ratio recommended if sinusoidal signals are to be measured.

This setting is only effective for Video BW Auto.

SCPI command:
`BAND:VID:RAT 1`, see `[SENSe:]BANDwidth|BWIDth:VIDeo:RATio` on page 582

RBW/VBW Pulse [.1] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = 10 × resolution bandwidth or"

"video bandwidth = 10 MHz (= max. VBW)."

This coupling ratio is recommended whenever the amplitudes of pulsed signals are to be measured correctly. The IF filter is exclusively responsible for pulse shaping. No additional evaluation is performed by the video filter.

This setting is only effective for Video BW Auto.

SCPI command:
BAND:VID:RAT 10, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 582

RBW/VBW Noise [10] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = resolution bandwidth/10"

At this coupling ratio, noise and pulsed signals are suppressed in the video domain. For noise signals, the average value is displayed.

This setting is only effective for the Video BW Auto selection in the main menu.

SCPI command:
BAND:VID:RAT 0.1, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 582

RBW/VBW Manual ← Coupling Ratio
Activates the manual input of the coupling ratio.

The resolution bandwidth/video bandwidth ratio can be set in the range 0.001 to 1000.

This setting is only effective for the Video BW Auto selection in the main menu.

SCPI command:
BAND:VID:RAT 10, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 582

Span/RBW Auto [100] ← Coupling Ratio
Sets the following coupling ratio:

"resolution bandwidth = span/100"

This coupling ratio is the default setting of the analyzer.

This setting is only effective for the Res BW Auto selection in the main menu.

SCPI command:
BAND:VID:RAT 0.001, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 582

Span/RBW Manual ← Coupling Ratio
Activates the manual input of the coupling ratio.

This setting is only effective for the Res BW Auto selection in the main menu.

The span/resolution bandwidth ratio can be set in the range 1 to 10000.

SCPI command:
BAND:VID:RAT 0.1, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 582

Default Coupling ← Coupling Ratio

Sets all coupled functions to the default state ("AUTO"). In addition, the ratio "RBW/ VBW" is set to "SINE [1/1]" and the ratio "SPAN/RBW" to *100.*

SCPI command:

`[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO` on page 580

`[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO` on page 582

`[SENSe:]SWEep:TIME:AUTO` on page 648

Filter Type

Opens a submenu to select the filter type.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

The submenu contains the following softkeys:

- Normal (3dB)
- EMI (6dB)
- Channel
- RRC
- 5-Pole (not available for sweep type "FFT")

For detailed information on filters see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121 and chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122.

SCPI command:

`[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE` on page 581

3.2.6.2 Specifying the Bandwidth

1. Set the resolution bandwidth using the Res BW Manual or Res BW Auto softkey.

2. Set the video bandwidth using the Video BW Manual or Video BW Auto softkey.

3. Set the sweep time using the Sweeptime Manual or Sweeptime Auto softkey.

4. Press the Filter Type softkey and select the appropriate filters.

3.2.6.3 Selecting the Appropriate Filter Type

All resolution bandwidths are realized with digital filters.

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

The following filter types are available:

- Normal (3dB) (Gaussian) filters

The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.

- EMI (6dB) filters
  The available bandwidths are specified in the data sheet.

- Channel filters
  For details see chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122 .
  Channel filters do not support FFT mode.

- RRC filters
  For details see chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122 .
  RRC filters do not support FFT mode.

- 5-Pole filters
  The available bandwidths are specified in the data sheet.
  5-Pole filters do not support FFT mode.

3.2.6.4 List of Available RRC and Channel Filters

For power measurement a number of especially steep-edged channel filters are available (see the following table).

For filters of type RRC (Root Raised Cosine), the filter bandwidth indicated describes the sampling rate of the filter. For all other filters (CFILter) the filter bandwidth is the 3 dB bandwidth.

Table 3-3: Filter types

Filter Bandwidth	Filter Type	Application
100 Hz	CFILter	A0
200 Hz	CFILter	
300 Hz	CFILter	
500 Hz	CFILter	
1 kHz	CFILter	
1.5 kHz	CFILter	SSB
2 kHz	CFILter	
2.4 kHz	CFILter	DAB, Satellite
2.7 kHz	CFILter	
3 kHz	CFILter	ETS300 113 (12.5 kHz channels)
3.4 kHz	CFILter	AM Radio
4 kHz	CFILter	
4.5 kHz	CFILter	
5 kHz	CFILter	
6 kHz	CFILter	
8.5 kHz	CFILter	
9 kHz	CFILter	

Filter Bandwidth	Filter Type	Application
10 kHz	CFILter	CDMAone
12.5 kHz	CFILter	ETS300 113 (20 kHz channels)
14 kHz	CFILter	
15 kHz	CFILter	ETS300 113 (25 kHz channels)
16 kHz	CFILter	TETRA
18 kHz, α=0.35	RRC	PDC
20 kHz	CFILter	IS 136
21 kHz	CFILter	CDPD, CDMAone
24.3 kHz, α=0.35	RRC	
25 kHz	CFILter	
30 kHz	CFILter	
50 kHz	CFILter	
100 kHz	CFILter	FM Radio
150 kHz	CFILter	PHS
192 kHz	CFILter	
200 kHz	CFILter	J.83 (8-VSB DVB, USA)
300 kHz	CFILter	
500 kHz	CFILter	
1 MHz	CFILter	CDMAone
1.228 MHz	CFILter	CDMAone
1.28 MHz	RRC	DAB
1.5 MHz	CFILter	
2 MHz	CFILter	W-CDMA 3GPP
3 MHz	CFILter	W-CDMA NTT DOCoMo
3.75 MHz	CFILter	
3.84 MHz, α=0.22	RRC	
4.096 MHz, α=0.22	RRC	
5 MHz	CFILter	
20 MHz	CFILter	
28 MHz	CFILter	
40 MHz	CFILter	

3.2.7 Configuring the Sweep Mode – SWEEP Key

The SWEEP key is used to configure the sweep mode. Continuous sweep or single sweep is possible. The sweep time and the number of measured values are set.

To open the Sweep menu

- Press the SWEEP key.
  The "Sweep" menu is displayed.

Menu and softkey description

● chapter 3.2.7.1, "Softkeys of the Sweep Menu", on page 124

Task

● chapter 3.2.7.2, "Specifying the Sweep Settings", on page 129

3.2.7.1 Softkeys of the Sweep Menu

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

Continuous Sweep
Sets the continuous sweep mode: the sweep takes place continuously according to the trigger settings. This is the default setting. The trace averaging is determined by the sweep count value (see the "Sweep Count" softkey, "Sweep Count" on page 127).

SCPI command:
INIT:CONT ON, see INITiate<n>:CONTinuous on page 560

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

SCPI command:
INIT:CONT OFF, see INITiate<n>:CONTinuous on page 560

Continue Single Sweep

Repeats the number of sweeps set by using the Sweep Count softkey, without deleting the trace of the last measurement.

This is particularly of interest when using the trace configurations "Average" or "Max Hold" to take previously recorded measurements into account for averaging/maximum search.

For details on trace configuration refer to chapter 3.2.8, "Setting Traces – TRACE Key", on page 129.

SCPI command:

INITiate<n>:CONMeas on page 559

Sweeptime Manual

Opens an edit dialog box to enter the sweep time.

Sweep time	
absolute max. sweep time value:	16000 s
absolute min. sweep time value:	zero span: 1 µs
	span > 0: depends on device model (refer to data sheet)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or UPARROW/DNARROW key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the analyzer displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

SWE:TIME:AUTO OFF, see [SENSe:]SWEep:TIME:AUTO on page 648

[SENSe:]SWEep:TIME on page 648

Sweeptime Auto

Couples the sweep time to the span, video bandwidth (VBW) and resolution bandwidth (RBW) (not available for zero span). If the span, resolution bandwidth or video bandwidth is changed, the sweep time is automatically adjusted.

The analyzer always selects the shortest sweep time that is possible without falsifying the signal. The maximum level error is < 0.1 dB, compared to using a longer sweep time.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

[SENSe:]SWEep:TIME:AUTO on page 648

Sweep Type

Opens a submenu to define the sweep type.

This function is not available in IQ Analyzer mode or for I/Q Digital Baseband input (option R&S FSV-B17).

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- "Sweep" on page 114
- "FFT" on page 114 (not available with 5-Pole filters, channel filters or RRC filters, see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121)
- "Auto" on page 114

Sweep ← Sweep Type

Sets the Sweep Type to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

SCPI command:

SWE:TYPE SWE, see [SENSe:]SWEep:TYPE on page 648

FFT ← Sweep Type

Sets the Sweep Type to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

FFT is not available when using 5-Pole filters, Channel filters or RRC filters.

Note: Not all measurement configurations allow for FFT mode. For instance, the Quasi peak detector does not support FFT. In this case, sweep mode is used. The same applies when a tracking generator (internal or external, options R&S FSV-B9/B10) is active. FFT mode is also available for:

- sweep time
- video bandwidth
- all detectors except Quasi peak
- gated trigger measurements
- signal count

SCPI command:

SWE:TYPE FFT, see [SENSe:]SWEep:TYPE on page 648

Auto ← Sweep Type

Automatically sets the fastest available Sweep Type for the current measurement. Auto mode is set by default.

SCPI command:

SWE:TYPE AUTO, see [SENSe:]SWEep:TYPE on page 648

FFT Filter Mode ← Sweep Type

Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

Auto ← FFT Filter Mode ← Sweep Type

The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 580

Narrow ← FFT Filter Mode ← Sweep Type

For an RBW ≤ 10kHz, the FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 580

Sweep Count

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

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

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

For details on trace configuration see chapter 3.2.8, "Setting Traces – TRACE Key", on page 129.

Example:

● Press the TRACE key > Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6 softkey > "Max Hold" on page 131 softkey.
● Press the SWEEP key > "Sweep Count" softkey.
● In the "Average Sweep Count" dialog box, enter *10*.
● Press the "Single Sweep" on page 124 softkey:
  analyzer performs the "Max Hold" function over 10 sweeps.

SCPI command:

[SENSe:]SWEep:COUNt on page 643

Sweep Points

Opens an edit dialog box to enter the number of measured values to be collected during one sweep.

● Entry via rotary knob:
  – In the range from 101 to 1001, the sweep points are increased or decreased in steps of 100 points.
  – In the range from 1001 to 32001, the sweep points are increased or decreased in steps of 1000 points.
● Entry via keypad:
  All values in the defined range can be set.

The default value is 691 sweep points.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

[SENSe:]SWEep:POINts on page 648

Select Frame

For spectrogram measurements only.

Opens a dialog box to select a specific frame and loads the corresponding trace from the memory.

Note that activating a marker or changing the position of the active marker automatically selects the frame that belongs to that marker.

This softkey is available in single sweep mode or if the sweep is stopped.

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:FRAMe:SELect on page 536

Continue Frame (On Off)

For spectrogram measurements only.

Determines whether the results of the last measurement are deleted before starting a new measurement.

- **On**
  Repeats the single sweep measurement without deleting the spectrogram results of the last measurement. One of the following trace modes is to be used: Max Hold, Min Hold, Average.
- **Off**
  Deletes the last measurement results before performing a single sweep measurement.

This softkey is available in single sweep mode.

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:CONT on page 535

Frame Count

For spectrogram measurements only.

Opens a dialog box to set the number of frames to be captured in a single sweep.

Therefore, the frame count defines the number of traces the analyzer plots in the Spectrogram result display in a single sweep. The maximum number of possible frames depends on the history depth (see CALCulate<n>:SPECtrogram|SGRam:HDEPth on page 537).

The sweep count, on the other hand, determines how many sweeps are combined in one frame in the Spectrogram, i.e. how many sweeps the analyzer performs to plot one trace in the Spectrogram result display (see "Sweep Count" on page 127).

This softkey is available in single sweep mode.

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:FRAMe:COUNt on page 536

Spectrogram Clear

For spectrogram measurements only.

Resets the Spectrogram result display and clears its history buffer.

SCPI command:
CALCulate<n>:SPECtrogram|SGRam:CLEar[:IMMediate] on page 535

3.2.7.2 Specifying the Sweep Settings

1. Press the Sweep Count softkey and enter the sweep count.

2. Press the Sweeptime Manual or Sweeptime Auto softkey to set the sweep time.

3. Press the Sweep Type softkey to select the sweep type.

4. Press the Sweep Points softkey and enter the number of sweep points.

5. Press the Continuous Sweep or Single Sweep softkey to select the sweep mode.

6. Press the Continue Single Sweep softkey to repeat the single sweep.

3.2.8 Setting Traces – TRACE Key

The TRACE key is used to configure the data acquisition for measurement and the analysis of the measurement data.

The analyzer is capable of displaying up to six different traces at a time in a diagram. A trace consists of a maximum of 691 displayed measurement points on the horizontal axis (frequency or time). If more measured values than measurement points are available, several measured values are combined in one displayed measurement point.

The trace functions include the following:

*   Display mode of the trace
    For details on trace modes see chapter 3.2.8.4, "Trace Mode Overview",
    on page 140.

*   Evaluation of the trace as a whole
    For details on averaging see chapter 3.2.8.5, "Description of the Averaging Method", on page 142.

*   Evaluation of individual measurement points of a trace. For details on detectors see chapter 3.2.8.6, "Detector Overview", on page 143.

To open the Trace menu

*   Press the TRACE key.
    The "Trace" menu is displayed. The "Trace Configuration" dialog box is displayed.

Menu and softkey description

*   chapter 3.2.8.1, "Softkeys of the Trace Menu", on page 130

Further information

- chapter 3.2.8.4, "Trace Mode Overview", on page 140

- chapter 3.2.8.6, "Detector Overview", on page 143

- chapter 3.2.8.7, "ASCII File Export Format", on page 144

Tasks

- chapter 3.2.8.2, "Configuring Traces", on page 138

- chapter 3.2.8.3, "Specifying the Trace Settings", on page 140

3.2.8.1 Softkeys of the Trace Menu

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

Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Selects the active trace (1, 2, 3, 4, 5, 6) and opens the "Trace Mode" submenu for the selected trace. The default setting is trace 1 in the overwrite mode (see "Clear Write" on page 131), the other traces are switched off (see "Blank" on page 132).

For details see chapter 3.2.8.4, "Trace Mode Overview", on page 140.

Tip: To configure several traces in one step, press the Trace Wizard softkey to open a trace configuration dialog. See also chapter 3.2.8.2, "Configuring Traces", on page 138.

SCPI command:
Selected via numeric suffix of:`TRACe<1...6>` commands

Clear Write ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

All available detectors can be selected.

SCPI command:
`DISP:TRAC:MODE WRIT`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 548

Max Hold ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
The maximum value is determined over several sweeps and displayed. The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.

The detector is automatically set to "Positive Peak".

This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.

This mode is not available for statistics measurements.

SCPI command:
`DISP:TRAC:MODE MAXH`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 548

Min Hold ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
The minimum value is determined from several measurements and displayed. The analyzer saves for each sweep the smallest of the previously stored/currently measured values in the trace memory.

The detector is automatically set to "Negative Peak".

This mode is useful e.g. for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed whereas a CW signal is recognized by its constant level.

This mode is not available for statistics measurements.

SCPI command:
`DISP:TRAC:MODE MINH`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 548

Average ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
The average is formed over several sweeps. The "Sweep Count" determines the number of averaging procedures.

All available detectors can be selected. If the detector is automatically selected, the sample detector is used (see chapter 3.2.8.6, "Detector Overview", on page 143).

This mode is not available for statistics measurements.

For more information see

- "Sweep Count" on page 127

SCPI command:
DISP:TRAC:MODE AVER, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

View ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
The current contents of the trace memory are frozen and displayed.

If a trace is frozen, the instrument settings, apart from level range and reference level (see below), can be changed without impact on the displayed trace. The fact that the trace and the current instrument setting do not correspond any more is indicated by the ★ icon on the tab label.

If the level range or reference level is changed, the analyzer automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.

SCPI command:
DISP:TRAC:MODE VIEW, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

Blank ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Hides the selected trace.

SCPI command:
DISP:TRAC OFF, see DISPlay[:WINDow<n>]:TRACe<t>[:STATe] on page 548

Hold/Cont ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Switches on or off the reset of the traces in Min Hold, Max Hold and Average mode after some specific parameter changes have been made. The default setting is off.

Normally, the measurement is started anew after parameter changes, before the measurement results are evaluated (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.

SCPI command:
DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous on page 549

Detector ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Opens a submenu to select the detector manually, or activate automatic selection.

Note: In Spurious Emission Measurement mode, clicking this softkey will automatically open the Sweep List dialog, see "Sweep List dialog box" on page 233.

If a detector was selected manually, the "MAN" indicator is highlighted.

If "AUTO" is selected, the detector is defined automatically, depending on the selected trace mode:

Trace mode	Detector
Clear Write	Auto Peak
Max Hold	Positive Peak
Min Hold	Negative Peak
Average	Sample Peak
View	–
Blank	–

For details see chapter 3.2.8.6, "Detector Overview", on page 143.

Auto Select ← Detector ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Selects the optimum detector for the selected trace and filter mode. This is the default setting. For details see also chapter 3.2.8.6, "Detector Overview", on page 143.

Trace mode	Detector
Clear/Write	Auto Peak
Average	Sample
Max Hold	Max Peak
Min Hold	Min Peak

SCPI command:
[SENSe:][WINDow:]DETector<trace>[:FUNCtion]:AUTO on page 650

Auto Peak ← Detector ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Selects the "Auto Peak" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET APE, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion] on page 649

Positive Peak ← Detector ← Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6
Selects the "Positive Peak" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET POS, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion] on page 649

Negative Peak ← **Detector** ← **Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6**
Selects the "Negative Peak" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET NEG, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion]
on page 649

Sample ← **Detector** ← **Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6**
Selects the "Sample" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET SAMP, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion]
on page 649

RMS ← **Detector** ← **Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6**
Selects the "RMS" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET RMS, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion]
on page 649

Average ← **Detector** ← **Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6**
Selects the "Average" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET AVER, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion]
on page 649

Quasi Peak ← **Detector** ← **Trace 1/Trace 2/Trace 3/Trace 4/Trace 5/Trace 6**
Selects the "Quasi Peak" detector. For details see chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
DET QPE, see [SENSe:][WINDow:]DETector<trace>[:FUNCtion]
on page 649

More Traces
Opens a submenu to select one of the traces not currently displayed in the main menu.

Copy Trace
Opens an edit dialog box to enter the number of the trace memory in which the currently selected trace will be copied.

SCPI command:
TRACe<n>:COPY on page 677

Trace Wizard
Opens the "Trace Wizard" dialog. See chapter 3.2.8.2, "Configuring Traces", on page 138.

Spectrogram

Opens the submenu for the spectrogram view (firmware option analyzer-K14).

For details on this application refer to chapter 3.10, "Instrument Functions - Spectrogram Measurements", on page 370.

Average Mode

Opens a submenu to select the averaging method for the average trace mode. The following methods are available:

- Lin
- Log
- Power

Logarithmic averaging is preferred to display signals with a low signal to noise ratio. While positive peak values are decreased in logarithmic averaging due to the characteristics involved, it is also true that negative peaks are increased relative to the average value. If the distorted amplitude distribution is averaged, a value is obtained that is smaller than the actual average value. The difference is -2.5 dB.

Amplitude

Amplitude distribution (without averaging)

2.5 dB

Amplitude distribution (after averaging)

Probability distribution
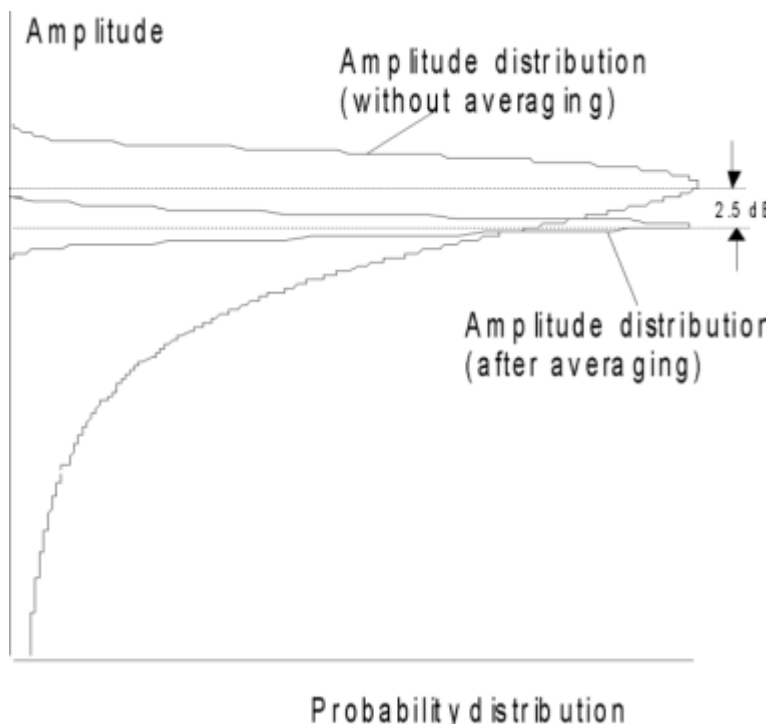
This low average value is usually corrected in noise power measurements by a 2.5 dB factor. Therefore the analyzer offers the selection of linear averaging. The trace data is converted to linear values prior to averaging, then averaged and reconverted to logarithmic values. After these conversions the data is displayed on the screen. The average value is always correctly displayed irrespective of the signal characteristic.

In case of stationary sinusoidal signals both logarithmic and linear averaging has the same results.

Lin ← Average Mode

Activates linear averaging. Linear averaging means that the power level values are converted into linear units prior to averaging. After the averaging, the data is converted back into its original unit.

This softkey takes effect if the grid is set to a linear scale (see "Range Linear" softkey, "Range Linear %" on page 107). In this case, the averaging is done in two ways (depending on the set unit – see "Unit" softkey):

● The unit is set to either W or dBm: the data is converted into W prior to averaging, i.e. averaging is done in W.
● The unit is set to either V, A, dBmV, dBμV, dBμA or dBpW: the data is converted into V prior to averaging, i.e. averaging is done in V.

SCPI command:
SENS:AVER1:TYPE LIN, see [SENSe:]AVERage<n>:TYPE on page 579

Log ← Average Mode

Activates logarithmic averaging.

This averaging method only takes effect if the grid is set to a logarithmic scale (see Range softkey), i.e. the unit of the data is dBm. In this case the values are averaged in dBm. Otherwise (i.e. with linear scaling), the behavior is the same as with linear averaging (see Lin softkey). For further information on logarithmic scaling refer to the "Average Mode" softkey.

SCPI command:
SENS:AVER1:TYPE VID, see [SENSe:]AVERage<n>:TYPE on page 579

Power ← Average Mode

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.

Unlike the linear mode, the averaging is always done in W.

SCPI command:
SENS:AVER1:TYPE POW, see [SENSe:]AVERage<n>:TYPE on page 579

ASCII Trace Export

Opens the "ASCII Trace Export Name" dialog box and saves the active trace in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the trace data. For details on an ASCII file see chapter 3.2.8.7, "ASCII File Export Format", on page 144.

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "Decim Sep" softkey (see "Decim Sep" on page 85).

SCPI command:
FORMat:DEXPort:DSEParator on page 558
MMEMory:STORe<n>:TRACe on page 572

Decim Sep

Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

Trace Math

Opens the "Trace Mathematics" dialog box to define which trace is subtracted from trace 1. The result is displayed in trace 1 and refers to the zero point defined with the Trace Math Position softkey. The following subtractions can be performed:

"T1"->"T1"-"T2"	Subtracts trace 2 from trace 1.
"T1"->"T1"-"T3"	Subtracts trace 3 from trace 1
"T1"->"T1"-"T4"	Subtracts trace 4 from trace 1
"T1"->"T1"-"T5"	Subtracts trace 5 from trace 1
"T1"->"T1"-"T6"	Subtracts trace 6 from trace 1

To switch off the trace math, use the Trace Math Off softkey.

SCPI command:

CALCulate<n>:MATH[:EXPression][:DEFine] on page 530

CALCulate<n>:MATH:STATe on page 531

Trace Math Mode

Opens a submenu to select the mode for the trace math calculations.

Lin ← Trace Math Mode

Activates linear subtraction, which means that the power level values are converted into linear units prior to subtraction. After the subtraction, the data is converted back into its original unit.

This softkey takes effect if the grid is set to a linear scale (see Range softkey). In this case, subtraction is done in two ways (depending on the set unit – see Unit softkey):

- The unit is set to either W or dBm: the data is converted into W prior to subtraction, i.e. averaging is done in W.
- The unit is set to either V, A, dBmV, dBμV, dBμA or dBpW: the data is converted into V prior to subtraction, i.e. subtraction is done in V.

SCPI command:

CALC:MATH:MODE LIN, see CALCulate<n>:MATH:MODE on page 531

Log ← Trace Math Mode

Activates logarithmic subtraction.

This subtraction method only takes effect if the grid is set to a logarithmic scale (see Range softkey), i.e. the unit of the data is dBm. In this case the values are subtracted in dBm. Otherwise (i.e. with linear scaling) the behavior is the same as with linear subtraction (see Lin softkey). For further information on logarithmic scaling refer to the Average Mode softkey.

SCPI command:
CALC:MATH:MODE LOG, see CALCulate<n>:MATH:MODE on page 531

Power ← Trace Math Mode
Activates linear power subtraction.

The power level values are converted into unit Watt prior to subtraction. After the subtraction, the data is converted back into its original unit.

Unlike the linear mode, the subtraction is always done in W.

SCPI command:
CALC:MATH:MODE POW, see CALCulate<n>:MATH:MODE on page 531

Trace Math Position
Opens an edit dialog box to define the zero point in % of the diagram height. The range of values extends from -100 % to +200 %.

SCPI command:
CALCulate<n>:MATH:POSition on page 531

Trace Math Off
Deactivates any previously selected trace math functions.

SCPI command:
CALC:MATH:STAT OFF, see CALCulate<n>:MATH:STATe on page 531

3.2.8.2 Configuring Traces

1. To open the trace wizard, press the TRACE key and then the "Trace Wizard" softkey (see "Trace Wizard" on page 134).

   Tip: Context-sensitive menus for traces. Traces have context-sensitive menus. If you right-click on a trace in the display or a trace setting in the information channel bar (or touch it for about 1 second), a menu is displayed which corresponds to the softkey functions available for traces. This is useful, for example, when the softkey display is hidden.
   If a menu entry contains an arrow to the right of it, a submenu is available for that entry.
   To close the menu, press the ESC key or click in the display outside of the menu.
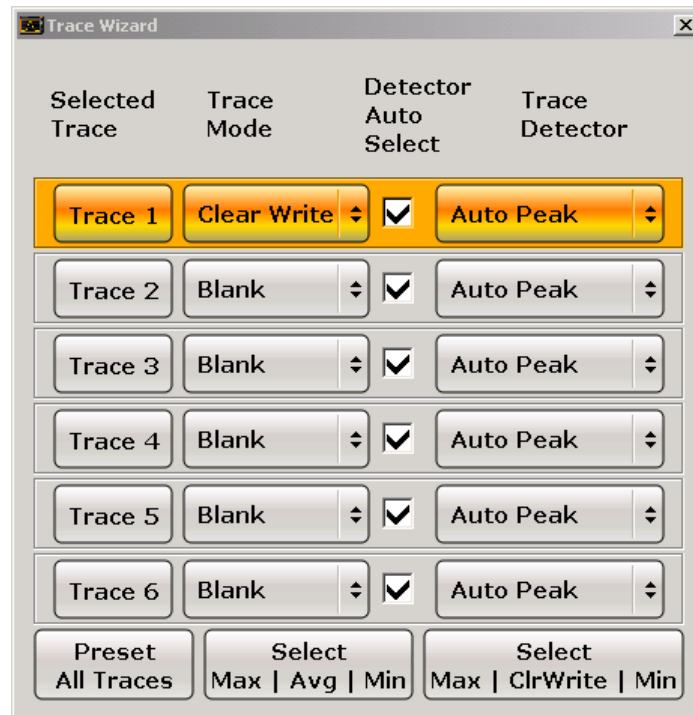
2. For each trace you can define the following settings:

Display Mode	• Clear Write • Max Hold • Min Hold • Average • View • Blank For details see chapter 3.2.8.4, "Trace Mode Overview", on page 140
Detector Auto Select	Activates automatic detector selection (see Auto Select softkey). If activated, the "Trace Detector" setting is ignored.
Trace Detector	Defines a specific trace detector. If one of the following settings is defined, the "Detector Auto Select" option is deactivated. • "Auto Select" on page 133 • "Auto Peak" on page 133 • "Positive Peak" on page 133 • "Negative Peak" on page 134 • "Sample" on page 134 • "RMS" on page 134 • "Average" on page 134 • "Quasi Peak" on page 134

3. To configure several traces to predefined display modes in one step, press the button for the required function:

Preset All Traces	Trace 1: Clear Write
	Trace 2-6: Blank
Select Max | Avg | Min	Trace 1: Max Hold
	Trace 2: Average
	Trace 3: Min Hold
	Trace 4-6: Blank
Select Max | ClrWrite | Min	Trace 1: Max Hold
	Trace 2: Clear Write
	Trace 3: Min Hold
	Trace 4-6: Blank

For details see chapter 3.2.8.4, "Trace Mode Overview", on page 140.

3.2.8.3 Specifying the Trace Settings

1. To configure one or more traces, see chapter 3.2.8.2, "Configuring Traces", on page 138.

2. To select the trace mode for the selected trace, press the softkey for the corresponding trace (for details see chapter 3.2.8.4, "Trace Mode Overview", on page 140).

3. To select a detector, press the Auto Select softkey for automatic detector selection, or press the Detector softkey (for details see chapter 3.2.8.6, "Detector Overview", on page 143).

4. To change the sweep count setting, which also determines trace averaging, press the Sweep Count softkey.

5. To deactivate the reset of the traces in "Min Hold" and "Max Hold" mode after some specific parameter changes, press the Trace Math softkey.

6. To copy a trace into another trace memory, press the Copy Trace softkey.
   Upon copying, the contents of the selected memory are overwritten and the new contents are displayed in the View mode.

7. To export the active trace in ASCII format:
   a) Press the "More" softkey.
   b) If necessary, press the Decim Sep softkey to change the decimal separator with floating-point numerals.
   c) Press the Average Mode softkey to enter the ASCII file export name.
      The active trace is saved in ASCII format on a floppy disk.

3.2.8.4 Trace Mode Overview

The traces can be activated individually for a measurement or frozen after completion of a measurement. Traces that are not activated are hidden. Each time the trace mode is changed, the selected trace memory is cleared.

The analyzer offers 6 different trace modes:

Clear Write

Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

All available detectors can be selected.

SCPI command:

DISP:TRAC:MODE WRIT, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

Max Hold

The maximum value is determined over several sweeps and displayed. The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.

The detector is automatically set to "Positive Peak".

This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.

This mode is not available for statistics measurements.

SCPI command:

DISP:TRAC:MODE MAXH, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

Min Hold

The minimum value is determined from several measurements and displayed. The analyzer saves for each sweep the smallest of the previously stored/currently measured values in the trace memory.

The detector is automatically set to "Negative Peak".

This mode is useful e.g. for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed whereas a CW signal is recognized by its constant level.

This mode is not available for statistics measurements.

SCPI command:

DISP:TRAC:MODE MINH, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

Average

The average is formed over several sweeps. The "Sweep Count" determines the number of averaging procedures.

All available detectors can be selected. If the detector is automatically selected, the sample detector is used (see chapter 3.2.8.6, "Detector Overview", on page 143).

This mode is not available for statistics measurements.

For more information see

- "Sweep Count" on page 127

SCPI command:

DISP:TRAC:MODE AVER, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 548

View

The current contents of the trace memory are frozen and displayed.

If a trace is frozen, the instrument settings, apart from level range and reference level (see below), can be changed without impact on the displayed trace. The fact that the trace and the current instrument setting do not correspond any more is indicated by the ★ icon on the tab label.

If the level range or reference level is changed, the analyzer automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.

SCPI command:

DISP:TRAC:MODE VIEW, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 548

Blank

Hides the selected trace.

SCPI command:

DISP:TRAC OFF, see DISPlay[:WINDow<n>]:TRACe<t>[:STATe] on page 548

3.2.8.5 Description of the Averaging Method

Averaging is carried out over the measurement points derived from the measurement samples. Several measured values may be combined in a measurement point. This means that with linear level display the average is formed over linear amplitude values. The sweep mode (continuous or single sweep, for details see chapter 3.2.7, "Configuring the Sweep Mode – SWEEP Key", on page 123) and running averaging apply to the average display analogously. In principle, two methods for calculating the average are used: continuous averaging and averaging over the selected number of sweeps.

● sweep count > 1
   Depending on the relation of the following two parameters, two different situations exist:
   n = number of sweeps performed since measurement start
   c = sweep count (number of sweeps forming one statistics cycle)
   – n ≤ c
      In single sweep or continuous sweep mode during the first statistics cycle, averaging over the selected number of sweeps is performed. The average trace "n" is calculated at each measurement point according to:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n)$$

Fig. 3-2: Equation 1

      with Avg = average trace; Curr = current trace
      Until the first statistics cycle is completed (n < c), a preliminary average is displayed which represents the arithmetic mean value over all measured sweeps. With n increasing, the displayed trace is increasingly smoothed since there are more single sweeps for averaging.

When the first statistics cycle is completed (n = c), the average trace is saved in the trace memory.

– n > c
In continuous sweep mode after the first statistics cycle, continuous averaging is performed. The average trace "n" is calculated at each measurement point according to:

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n)$$

Fig. 3-3: Equation 2

with Avg = average trace; Curr = current trace
In single sweep mode, the same formula is valid if the Continue Single Sweep softkey is pressed.

- sweep count = 0
In continuous sweep mode, a continuous average is calculated according to figure 3-3 with c = 10:

$$Avg(n) = \frac{9}{10} Avg(n-1) + \frac{1}{10} Curr(n)$$

Fig. 3-4: Equation 3

with Avg = average trace; Curr = current trace
Due to the weighting between the current trace and the average trace, past values have practically no influence on the displayed trace after about ten sweeps. With this setting, signal noise is effectively reduced without need for restarting the averaging process after a change of the signal.

- sweep count = 1
The current trace is displayed. No averaging is performed. This is a special case of figure 3-2 with n = 0.

3.2.8.6 Detector Overview

The measurement detector for the individual display modes can be selected directly by the user or set automatically by the analyzer. The detector activated for the specific trace is indicated in the corresponding trace display field by an abbreviation.

The detectors of the analyzer are implemented as pure digital devices. They collect signal power data within each measured point during a sweep. The default number of sweep points is 691. The following detectors are available:

Table 3-4: Detector types

Detector	Indicator	Function
Auto Peak	Ap	Determines the maximum and the minimum value within a measurement point (not available for SEM)
Positive Peak	Pk	Determines the maximum value within a measurement point

Detector	Indicator	Function
Negative Peak (min peak)	Mi	Determines the minimum value within a measurement point
RMS	Rm	Determines the root mean square power within a measurement point
Average	Av	Determines the linear average power within a measurement point
Sample	Sa	Selects the last value within a measurement point
Quasi Peak	QP	Determines the quasipeak power within a measurement point for EMI measurements (not available for SEM)

The result obtained from the selected detector within a measurement point is displayed as the power value at this measurement point.

All detectors work in parallel in the background, which means that the measurement speed is independent of the detector combination used for different traces.

Number of measured values

During a frequency sweep, the analyzer increments the first local oscillator in steps that are smaller than approximately 1/10 of the bandwidth. This ensures that the oscillator step speed is conform to the hardware settling times and does not affect the precision of the measured power.

The number of measured values taken during a sweep is independent of the number of oscillator steps. It is always selected as a multiple or a fraction of 691 (= default number of trace points displayed on the screen). Choosing less then 691 measured values (e.g. 125 or 251) will lead to an interpolated measurement curve, choosing more than 691 points (e.g. 1001, 2001 …) will result in several measured values being overlaid at the same frequency position.

RMS detector and VBW

If the RMS detector is selected, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used the sweep time should be increased to get more stable trace curves.

3.2.8.7 ASCII File Export Format

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 measurement) which are also separated by a semicolon.

File contents: header and data section	Description
Type;FSV;	Instrument model
Version;1.50;	Firmware version
Date;01.Apr 2010;	Date of data set storage
Screen;A;	Instrument mode
Points per Symbol;4;	Points per symbol
x Axis Start;-13;sym;	Start value of the x axis
x Axis Stop;135;sym;	Stop value of the x axis
Ref value y axis;-10.00;dBm;	Y axis reference value
Ref value position;100;%;	Y axis reference position
Trace;1;	Trace number
Meas;Result;	Result type
Meas Signal;Magnitude;	Result display
Demodulator;Offset QPSK;	Demodulation type
ResultMode;Trace;	Result mode
x unit;sym;	Unit of the x axis
y unit;dBm;	Unit of the y axis
Trace Mode;Clear Write;	Trace mode
Values;592;	Number of results
<values>	List of results

3.2.9 Triggering the Sweep – TRIG Key

The TRIG key is used to set trigger mode, trigger threshold, trigger delay, trigger polarity and for gated sweep the gate configuration.

To open the Trigger menu

● Press the TRIG key.
The "Trigger" menu is displayed.

Menu and softkey description

● chapter 3.2.9.1, "Softkeys of the Trigger Menu", on page 146

Tasks

● chapter 3.2.9.2, "Specifying the Trigger Settings", on page 151
● chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151

3.2.9.1   Softkeys of the Trigger Menu

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

Trg/Gate Source

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

As gate modes, all modes are available. For details see also chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

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

SCPI command:

TRIGger<n>[:SEQuence]:SOURce on page 692

[SENSe:]SWEep:EGATe:SOURce on page 645

Free Run ← Trg/Gate Source

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

SCPI command:

TRIG:SOUR IMM, see TRIGger<n>[:SEQuence]:SOURce on page 692

External ← Trg/Gate Source

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

SCPI command:

`TRIG:SOUR EXT`, see `TRIGger<n>[:SEQuence]:SOURce` on page 692

`SWE:EGAT:SOUR EXT` for gated triggering, see `[SENSe:]SWEep:EGATe:SOURce` on page 645

Video ← Trg/Gate Source

Defines triggering by the displayed voltage.

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

Video mode is only available in the time domain.

SCPI command:

`TRIG:SOUR VID`, see `TRIGger<n>[:SEQuence]:SOURce` on page 692

`SWE:EGAT:SOUR VID` for gated triggering, see `[SENSe:]SWEep:EGATe:SOURce` on page 645

IF Power/BB Power ← Trg/Gate Source

Defines triggering of the measurement using the second intermediate frequency.

For this purpose, the analyzer uses a level detector at the second intermediate frequency. Its threshold can be set in a range between -50 dBm and -10 dBm at the input mixer. The resulting trigger level at the RF input is calculated via the following formula:

"$mixerlevel_{min}$ + RFAtt – PreampGain ≤ Input Signal ≤ $mixerlevel_{max}$ + RFAtt – PreampGain"

The bandwidth at the intermediate frequency is 40 MHz. The analyzer is triggered as soon as the trigger threshold is exceeded within a 6 MHz range around the selected frequency (= start frequency in the frequency sweep).

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

For digital input via the Digital Baseband Interface (R&S FSV-B17), the baseband power ("BB Power") is used as the trigger source.

SCPI command:

`TRIG:SOUR IFP`, see `TRIGger<n>[:SEQuence]:SOURce` on page 692

`TRIG:SOUR BBP` for digital input

`SWE:EGAT:SOUR IFP` for gated triggering, see `[SENSe:]SWEep:EGATe:SOURce` on page 645

Time ← Trg/Gate Source

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

SCPI command:

`TRIG:SOUR TIME` `TRIGger<n>[:SEQuence]:SOURce` on page 692

Trg/Gate Level

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

For details see also chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

In the trigger mode "Time", this softkey is not available.

SCPI command:

TRIGger<n>[:SEQuence]:LEVel:IFPower on page 691

TRIGger<n>[:SEQuence]:LEVel:VIDeo on page 691

Trg/Gate Polarity
Sets the polarity of the trigger/gate source.

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

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

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

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

SCPI command:

TRIGger<n>[:SEQuence]:SLOPe on page 692

[SENSe:]SWEep:EGATe:POLarity on page 644

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

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)
	Only possible for span = 0 (e.g. I/Q Analyzer mode) and gated trigger switched off
	Maximum allowed range limited by the sweep time:
	pretrigger$_{max}$ = sweep time
	When using digital baseband interface (R&S FSV-B17) with I/Q Analyzer mode, the maximum range is limited by the number of pretrigger samples. See table 3-13.

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

Tip: To determine the trigger point in the sample (for "External" or "IF Power" trigger mode), use the TRACe<n>:IQ:TPISample command.

In the "Time" trigger mode, this softkey is not available.

SCPI command:

TRIGger<n>[:SEQuence]:HOLDoff[:TIME] on page 689

Repetition Interval

Opens an edit dialog box to define a repetition interval in which the measurement is triggered. The shortest interval is 2 ms. This softkey is only available if the trigger source "Time" is selected (see "Time" on page 147).

SCPI command:

TRIGger<n>[:SEQuence]:TIME:RINTerval on page 693

Trigger Hysteresis

Defines the value for the trigger hysteresis. 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. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

This softkey is only available if IF Power is the selected trigger source.

SCPI command:

TRIGger<n>[:SEQuence]:IFPower:HYSTeresis on page 690

Trigger Holdoff

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

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

SCPI command:

TRIGger<n>[:SEQuence]:IFPower:HOLDoff on page 690
For digital input via the Digital Baseband Interface, R&S FSV-B17:
TRIGger<n>[:SEQuence]:BBPower:HOLDoff on page 689

Gated Trigger

Switches the sweep mode with gate on or off.

This softkey requires the following "Trigger Mode" (see "Trg/Gate Source" on page 146):

span > 0	External or IF Power/BB PowerIF Power
span = 0	External or IF Power/BB PowerIF Power or Video

If a different mode is active, the IF Power/BB Power trigger mode is automatically selected.

If the gate is switched on, a gate signal applied to the rear panel connector "EXT TRIG-GER/GATE" or the internal IF power detector controls the sweep of the analyzer.

In the trigger mode Time, this softkey is not available.

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

SCPI command:

[SENSe:]SWEep:EGATe on page 643
[SENSe:]SWEep:EGATe:SOURce on page 645

Gate Settings

Opens a submenu to make all the settings required for gated sweep operation.

In the "Time" trigger mode, this softkey is not available.

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

Gate Mode (Lvl/Edge) ← Gate Settings
Sets the gate mode. As settings level-triggered or edge-triggered gate mode can be selected.

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

SCPI command:
[SENSe:]SWEep:EGATe:TYPE on page 647

Gate Delay ← Gate Settings
Opens an edit dialog box to enter the gate delay time between the gate signal and the continuation of the sweep. The delay position on the time axis in relation to the sweep is indicated by a line labeled "GD".

This is useful for e.g. taking into account a delay between the gate signal and the stabilization of an RF carrier.

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

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

SCPI command:
[SENSe:]SWEep:EGATe:HOLDoff on page 644

Gate Length (Gate Mode Edge) ← Gate Settings
Opens an edit dialog box to enter the gate length. The gate length in relation to the sweep is indicated by a line labeled "GL".

The length of the gate signal defines if the sweep is to be interrupted. Only in the edge-triggered mode the gate length can be set, while in the level-triggered the gate length depends on the length of the gate signal.

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

SCPI command:
[SENSe:]SWEep:EGATe:LENGth on page 644

Trg/Gate Source ← Gate Settings
See "Trg/Gate Source" on page 146.

Trg/Gate Level ← Gate Settings
See "Trg/Gate Level" on page 147.

Trg/Gate Polarity ← Gate Settings
See "Trg/Gate Polarity" on page 148.

Sweep Time ← Gate Settings
Opens an edit dialog box to change the sweep time in order to obtain a higher resolution for positioning gate delay and gate length. When leaving the "Gate Settings" submenu, the original sweep time is retrieved.

For details also see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

Res BW Manual ← Gate Settings

Opens an edit dialog box to enter a value for the resolution bandwidth. The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DNARROW key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the resolution bandwidth is indicated by a green bullet next to the "RBW" display in the channel bar.

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 580

[SENSe:]BANDwidth|BWIDth[:RESolution] on page 579

3.2.9.2   Specifying the Trigger Settings

1. Press the "Trg/Gate Source" softkey to select the trigger mode (for details see "Trg/Gate Source" on page 146.

2. Press the Trg/Gate Level softkey to set the trigger level.

3. Press the Trigger Offset softkey to set the trigger offset. In addition, a Trigger Hysteresis and Trigger Holdoff can be defined via the corresponding softkeys.

For details on gated sweep operation, see chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

3.2.9.3   Using Gated Sweep Operation

By using a gate in sweep mode and stopping the measurement while the gate signal is inactive, the spectrum for pulsed RF carriers can be displayed without the superposition of frequency components generated during switching. Similarly, the spectrum can also be examined for an inactive carrier. The sweep can be controlled by an external gate or by the internal power trigger.

Gated sweep operation is also possible for span = 0. This enables – e.g. in burst signals – level variations of individual slots to be displayed versus time.

1. Press the Gate Settings softkey to define the settings of the gate mode.
    At the center frequency a transition to zero span is made and the time parameters gate delay and gate length are displayed as vertical lines to adjust them easily.

    When quitting the Gate Settings submenu, the original span is retrieved so the desired measurement can be performed with the accurately set gate.

2. Setting the parameters gate delay and gate length highly accurate, press the Sweep Time softkey to alter the x-axis in a way that the signal range concerned (e.g. one full burst) is displayed.

3. Press the Gate Delay softkey to set the sampling time in a way that the desired portion of the signal is shown.

4. Press the Gate Mode (Lvl/Edge) softkey to set the gate mode.

5. If the "Edge" gate mode has been selected, press the Gate Length (Gate Mode Edge) softkey to set the sampling duration in a way that the desired portion of the signal is shown.

6. Press the Trg/Gate Polarity softkey to set the polarity of the trigger source.

7. Press the Gated Trigger softkey to activate the gated sweep mode.

    To indicate that a gate is used for the sweep, the enhancement label "GAT" is displayed on the screen. This label appears to the right of the window for which the gate is configured.
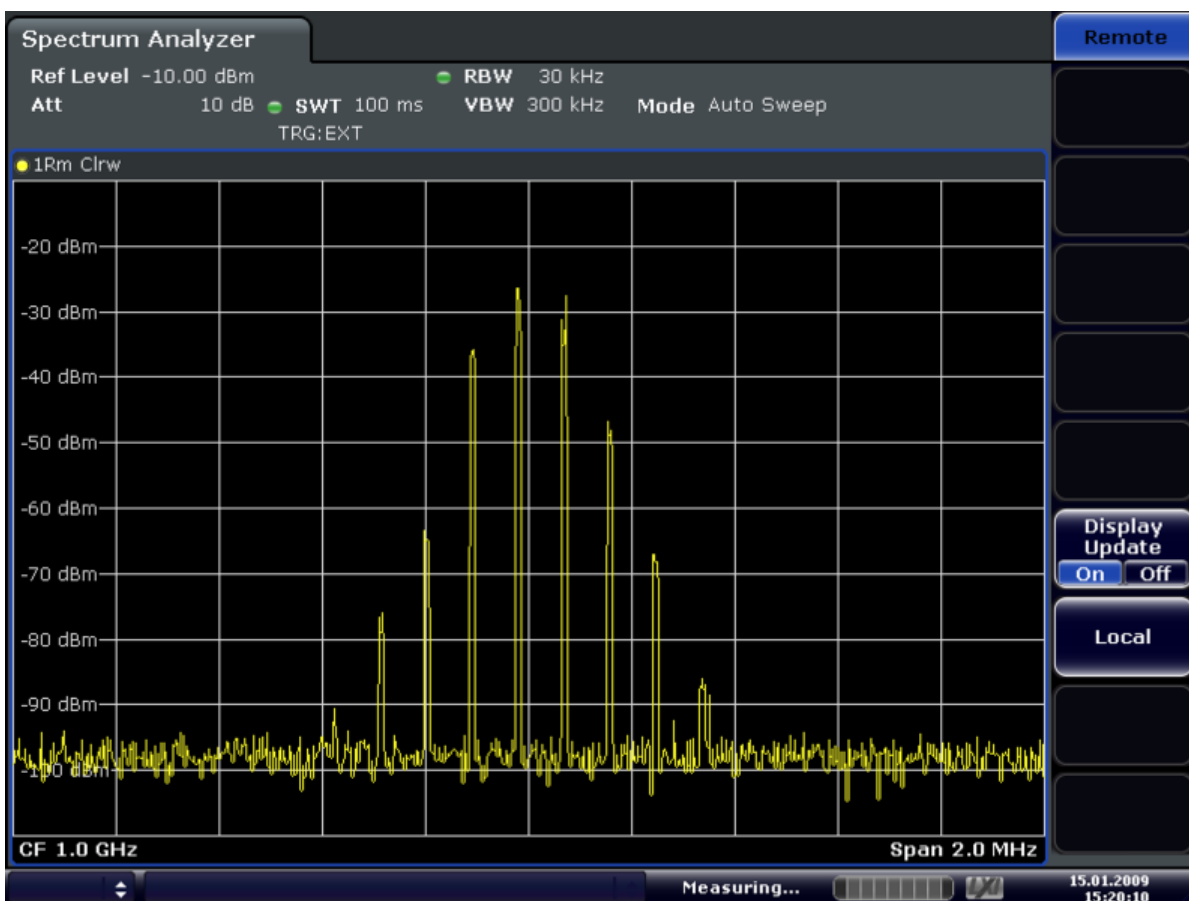
Fig. 3-5: TDMA signal with GATE OFF
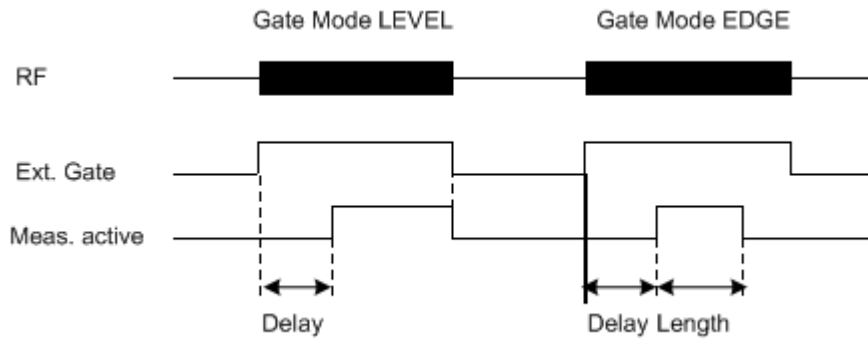
Fig. 3-6: Timing diagram for GATE, GATE DELAY and GATE LENGTH
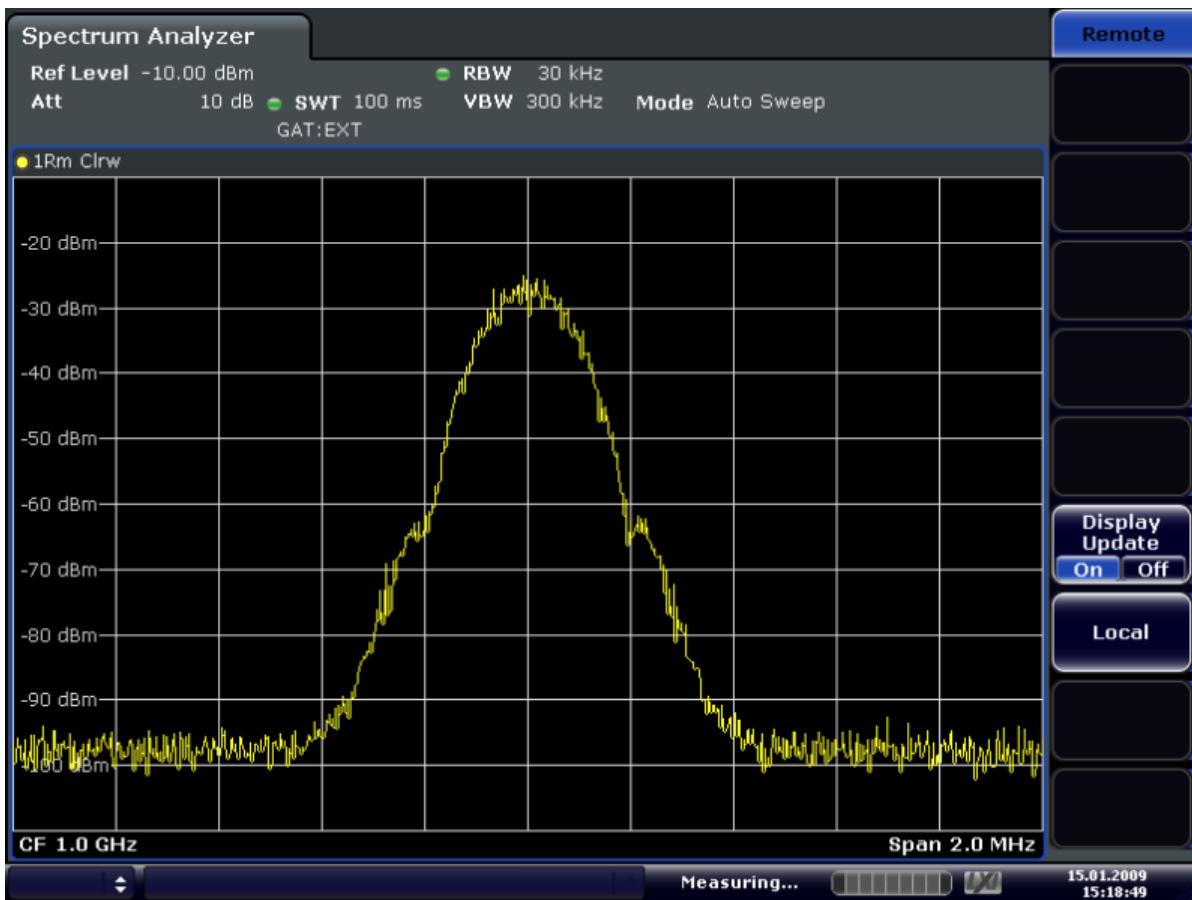
Fig. 3-7: TDMA signal with GATE ON

3.2.10 Working with I/Q Data

I/Q data can be captured either from RF input, or via the optional Digital Baseband Interface (R&S FSV-B17). The captured I/Q data can then be processed further, e.g. using the I/Q Analyzer, or in the applications that support the Digital Baseband Interface.

Working with digital input is described in chapter 3.7, "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)", on page 326 and in the applications that support that interface.

This section describes I/Q data processing of RF input, e.g. in the I/Q Analyzer.

The block diagram in figure 3-8 shows the analyzer hardware for active RF input from the IF section to the processor.

The A/D converter samples the IF signal at a rate of 128 MHz. The digital signal is down-converted to the complex baseband, lowpass-filtered, and the sample rate is reduced. The continuously adjustable sample rates are realized using an optimal decimation filter and subsequent resampling on the set sample rate.

The I/Q data is written to a single memory, the data acquisition is hardware-triggered.

Fig. 3-8: Block diagram illustrating the analyzer signal processing

Maximum number of samples

The maximum number of samples for RF input is 200 MS.

For digital input using the Digital Baseband Interface (R&S FSV-B17), see table 3-13.

3.2.10.1   Sample Rate and Maximum Usable Bandwidth (RF Input)

Information on sample rates and maximum usable bandwidths for Digital Baseband (I/Q) input is described in table 3-12.

Within the usable bandwidth range, the analog IF filter of the analyzer is equalized in regard to amplitude characteristic and group delay (provided that the analyzer is aligned; for details see "Alignment" on page 63). In consequence, signals within this bandwidth range are hardly distorted at all (provided the analyzer is not overloaded).

For the I/Q data acquisition, digital decimation filters are used internally. The passband of these digital filters corresponds to the maximum usable bandwidth. In consequence, signals within the usable bandwidth (passband) remain unchanged, while signals outside

the usable bandwidth (passband) are suppressed. Usually, the suppressed signals are noise, artifacts, and the second IF side band. If frequencies of interest to you are also suppressed, you should try to increase the sample rate, since this increases the maximum usable I/Q bandwidth.

As a rule, the usable bandwidth is proportional to the output sample. Yet, when the I/Q bandwidth reaches the bandwidth of the analog IF filter (at very high sample rates), the curve breaks.

analyzer with option R&S FSV-B70 (I/Q Bandwidth Extension):

This option is not available for analyzer 40 model 1307.9002K39.

maximum sample rate: 128 MHz

maximum bandwidth: 40 MHz

analyzer without option R&S FSV-B70 (I/Q Bandwidth Extension):

maximum sample rate: 45 MHz (analyzer40 model 1307.9002K39: 12.5 MHz)

maximum bandwidth: 28 MHz (analyzer40 model 1307.9002K39: 10 MHz)

Relationship between sample rate and usable bandwidth

The following diagram shows the maximum usable I/Q bandwidths depending on the user sample rates.

Fig. 3-9: Relation between maximum usable bandwidth and sample rate (RF input)

3.2.10.2 I/Q Gating

Sometimes in spectrum analysis, measurements are based on a certain length of time called the gate area. With I/Q gating, you can define the gate area using the gate length, the distance between the periods and the number of periods. This value is specified in samples.

Using I/Q gating, the gate area can be defined using the following methods:

● Edge triggered recording
  After a trigger signal, the gate period is defined by a gate length and a gate distance. All data in the gate period is recorded until the required number of samples has been recorded.

SCPI command: `TRACE:IQ:EGATE:TYPE EDGE`, see `TRACe<n>:IQ:EGATe:TYPE` on page 684

●   Level triggered recording
After a trigger signal, all data is recorded in which the gate signal is set to 1, which means it has exceeded a level. In this case, the gate signal can be generated by the IFP trigger, for example: each time the IFP level is exceeded, the IFP trigger signal is set to 1 and the samples in this area are recorded as gate samples.

SCPI command: `TRACE:IQ:EGATE:TYPE LEV`, see `TRACe<n>:IQ:EGATe:TYPE` on page 684

3.3   Measurement Functions

In this section all menus necessary for setting measurement functions are described. This includes the following topics and keys:

3.3.1 Using Markers and Delta Markers – MKR Key

The markers are used for marking points on traces, reading out measurement results and for selecting a display section quickly. The analyzer provides 16 markers per trace.
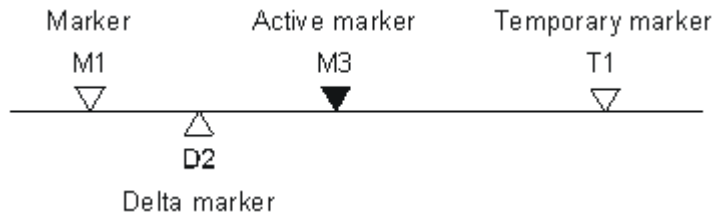
Fig. 3-10: Marker types

All markers can be used either as markers or delta markers. The marker that can be moved by the user is defined in the following as the active marker. Temporary markers are used in addition to the markers and delta markers to evaluate the measurement results. They disappear when the associated function is deactivated.

The measurement results of the active marker (also called marker values) are displayed in the marker field, which is located at the upper right corner of the diagram, or in a separate table beneath the diagram. The marker information includes the following:

- marker type (M1 in the example)
- trace in square brackets ([1] in the example)
- level (-33.09 dBm in the example)
- marker location (3 GHz in the example)

Fig. 3-11: Marker values

The MKR key is used to select and position the absolute and relative measurement markers (markers and delta markers). In addition, the functions for the frequency counter, a fixed reference point for relative measurement markers, and for enlargement of the measurement area are assigned to this key.

To open the Marker menu

- Press the MKR key.
  The "Marker" menu is displayed. If no marker is active, marker 1 is activated and a peak search on the trace is carried out. Otherwise, the edit dialog box for the last activated marker is opened and the current frequency/time value is displayed.

Further information

- chapter 3.3.1.3, "Displayed Marker Information", on page 164
- chapter 3.3.4, "Changing Settings via Markers – MKR-> Key", on page 178.

Menu and softkey description

- chapter 3.3.1.1, "Softkeys of the Marker Menu", on page 159

Tasks

● chapter 3.3.1.2, "Basic Marker Functions", on page 162

3.3.1.1 Softkeys of the Marker Menu

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

Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta
The "Marker X" softkey activates the corresponding marker and opens an edit dialog box to enter a value for the marker to be set to. Pressing the softkey again deactivates the selected marker.

If a marker value is changed using the rotary knob, the step size is defined via the Stepsize Standard or Stepsize Sweep Points softkeys.

Marker 1 is always the reference marker for relative measurements. If activated, markers 2 to 16 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Norm/Delta" softkey. If marker 1 is the active marker, pressing the "Marker Norm/Delta" softkey switches on an additional delta marker.

SCPI command:
CALCulate<n>:MARKer<m>[:STATe] on page 472
CALCulate<n>:MARKer<m>:X on page 481
CALCulate<n>:MARKer<m>:Y on page 483
CALCulate<n>:DELTamarker<m>[:STATe] on page 423
CALCulate<n>:DELTamarker<m>:X on page 433
CALCulate<n>:DELTamarker<m>:X:RELative on page 433
CALCulate<n>:DELTamarker<m>:Y on page 434

More Markers
Opens a sub-menu to select one of up to 16 available markers. See "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159.

Marker to Trace

Opens an edit dialog box to enter the number of the trace on which the marker is to be placed.

SCPI command:

CALCulate<n>:MARKer<m>:TRACe on page 480

CALCulate<n>:DELTamarker<m>:TRACe on page 432

Marker Wizard

Opens a configuration dialog for markers. The marker wizard allows you to configure and activate up to 16 different markers in one dialog. The first 8 markers are displayed on one tab, the last 8 markers on a second tab. For each marker, the following settings are available:
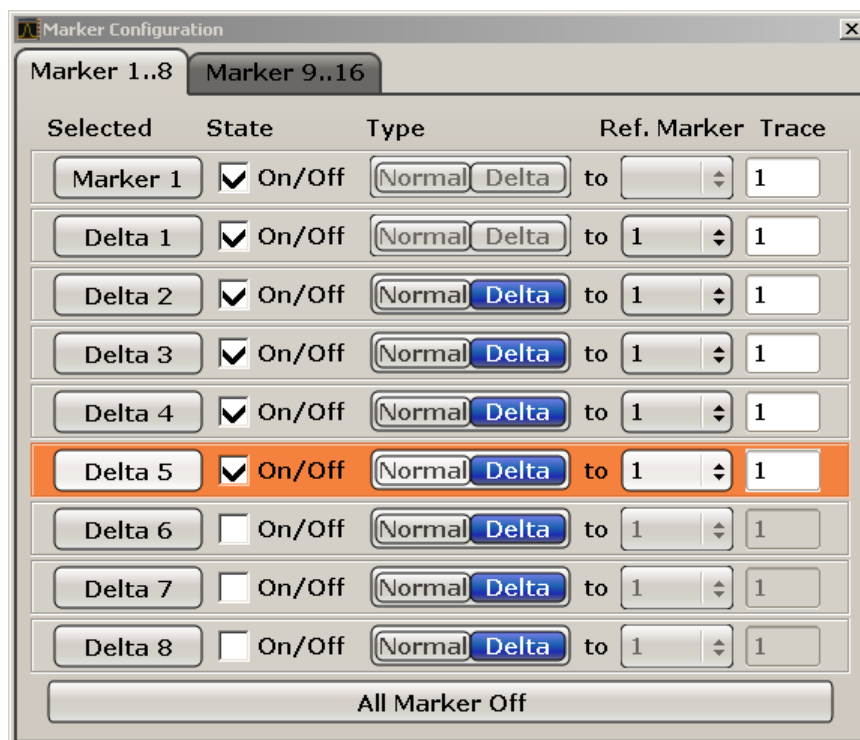
"Selected/ State"	When you press the "Selected" or "State" field the corresponding marker is activated and the marker row is highlighted.
"Normal/Delta"	Defines whether it is a normal marker or delta marker. For delta markers you can define a reference marker.
"Ref. Marker"	Reference marker for delta markers. The marker values for the delta marker are indicated relative to the specified reference marker. The reference marker can either be another active marker, or a fixed reference marker ("FXD", see "Ref Fixed" on page 169).

"Trace"   Trace for which the marker is to be set.

SCPI command:

CALCulate<n>:MARKer<m>[:STATe] on page 472

CALCulate<n>:DELTamarker<m>[:STATe] on page 423

CALCulate<n>:MARKer<m>:TRACe on page 480

CALCulate<n>:DELTamarker<m>:TRACe on page 432

CALCulate<n>:DELTamarker<m>:MREF on page 432

All Marker Off ← Marker Wizard
Switches all markers off. It also switches off all functions and displays that are associated with the markers/delta markers.

SCPI command:

CALCulate<n>:MARKer<m>:AOFF on page 472

All Marker Off
Switches all markers off. It also switches off all functions and displays that are associated with the markers/delta markers.

SCPI command:

CALCulate<n>:MARKer<m>:AOFF on page 472

Marker Table
Defines how the marker information is displayed.

For more information, see Displayed Marker Information.

"On"   Displays the marker information in a table in a separate area beneath the diagram.

"Off"   Displays the marker information within the diagram area.

"Aut"   (Default) The marker table is displayed automatically if more than 2 markers are active, and removed if only 1 or 2 markers are active. This helps keep the information in the display clear.

SCPI command:

DISPlay[:WINDow<n>]:MTABle on page 546

Marker Stepsize
Opens a submenu to set the step size of all markers and delta markers.

Default value for the marker step size is Stepsize Sweep Points.

Stepsize Standard ← Marker Stepsize
Moves the marker or delta marker from one measurement point to the next, if the marker or delta marker value is changed via the rotary knob ("Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" softkeys, see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159). If more measured values than measurement points exist, it is not possible to read out all measured values. In this case, use the Stepsize Sweep Points softkey.

SCPI command:

CALC:MARK:X:SSIZ STAN (see CALCulate<n>:MARKer<m>:X:SSIZe on page 483)

Stepsize Sweep Points ← Marker Stepsize

Moves the marker or delta marker from one measured value to the next, if the marker or delta marker value is changed via the rotary knob ("Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" softkeys, see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159). If more measured values than measurement points exist, every single measured value is accessible and its value is displayed in the marker field.

The number of measured values is defined in the ""Sweep"" menu via the Sweep Points softkey.

This functionality is available for all base unit measurements with the exception of statistics ("APD" and "CCDF" softkeys in the "Measurement" menu).

SCPI command:

`CALC:MARK:X:SSIZ POIN` (see `CALCulate<n>:MARKer<m>:X:SSIZe` on page 483)

Marker Zoom (span > 0)

Opens an edit dialog box to enter a display range for the zoom. The area around marker 1 is expanded accordingly and more details of the result can be seen. If no marker is activated, marker 1 is switched on and set on the largest signal.

The following sweep is stopped at the position of the reference marker. The frequency of the signal is counted and the measured frequency becomes the new center frequency. The zoomed display range is then configured and the new settings are used by the analyzer for further measurements.

If the display has not yet been switched to the new frequency display range and you press the softkey, the procedure is aborted. If an instrument setting is changed during this operation, the procedure is also aborted.

This function is not available in I/Q Analyzer mode.

SCPI command:

`CALCulate<n>:MARKer<m>:FUNCtion:ZOOM` on page 499

Link Mkr1 and Delta1

The delta marker 1 is linked to marker 1, so if the x-axis value of the marker 1 is changed, the delta marker 1 will follow on the same x-position. The link is off by default.

You can set the 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).

SCPI command:

`CALCulate<n>:DELTamarker<m>:LINK` on page 428

3.3.1.2 Basic Marker Functions

● To open the "Marker" menu, press the MKR key.
  Marker 1 is activated and positioned on the maximum value of the trace as a normal marker. If several traces are displayed, the marker is set to the maximum value (peak) of the trace which has the lowest number (1 to 3) and is not frozen (View mode). In case a marker is already located there, the new marker is set to the frequency of the next lowest level (next peak).

- To change marker settings quickly, right-click on the marker in the display (or touch it for about 1 second). A context-sensitive menu is displayed which corresponds to the softkey functions available for markers.

- To configure and activate several markers at once, select the "Marker Wizard" to open a configuration dialog for all markers.

- To change to another trace, press the "Marker to Trace" softkey ("Marker to Trace" on page 160) and enter the number of the trace on which the marker is to be placed. The marker changes to the selected trace, but remains on the previous frequency or time. If a trace is turned off, the corresponding markers and marker functions are also deactivated.

- To switch to another marker, click on the marker label in the diagram. Alternatively, select the corresponding softkey. If necessary, select the "More Markers" softkey ("More Markers" on page 159) first to open a submenu that contains all marker numbers.

- To move the marker to a different position, click the marker label in the diagram and then drag it to the new position. When a marker label is selected, a vertical line is displayed which indicates the marker's current x-value.
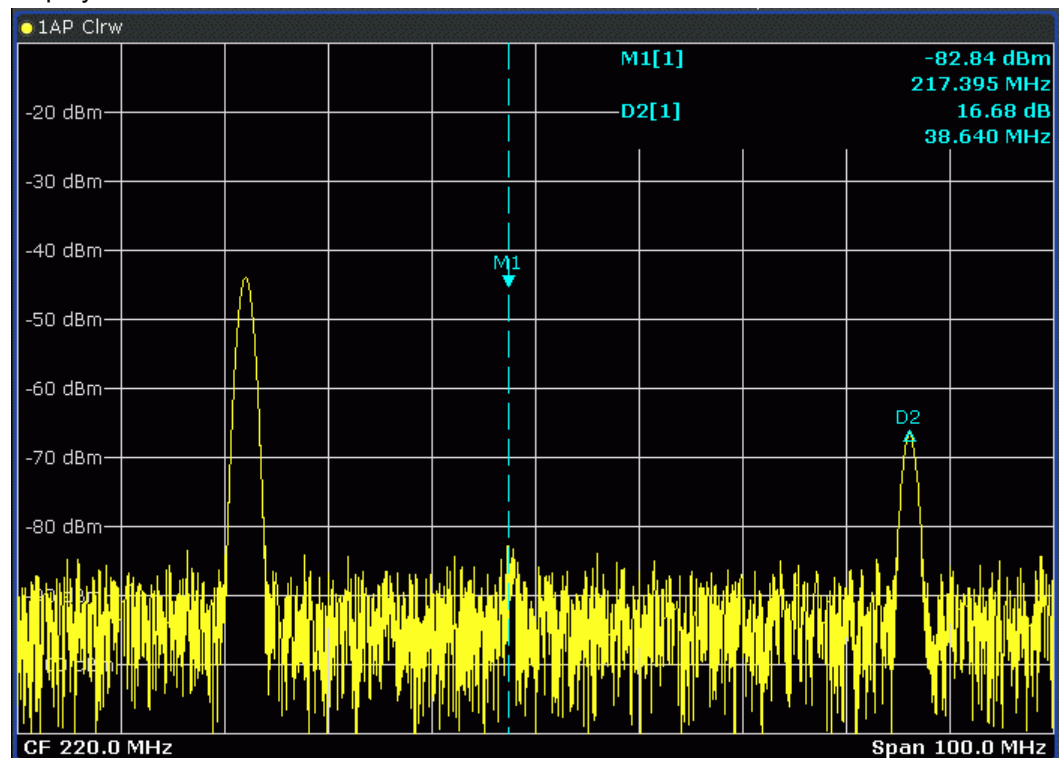
- To switch on a delta marker, select the softkey for the corresponding marker, then press the "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" ("Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159) until "Delta" is highlighted.
  The selected marker is switched on as a delta marker. The frequency and level of the marker are displayed in relation to marker 1 in the marker field.

- To change the marker type of a marker, select the softkey for the corresponding marker, then press the "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/

Delta" softkey ("Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159).

For a normal marker, the frequency and level are displayed as absolute values in the marker field. For a delta marker, the frequency and level of the marker are displayed in relation to marker 1 in the marker field.

- To switch off a marker, press the corresponding softkey again.
  The marker is deactivated. Marker 1 becomes the active marker for entry. The frequency and level of marker 1 are displayed in the marker field.

- To switch off all markers, press the "All Marker Off" softkey ("All Marker Off" on page 161).

- To change the stepsize between one measured value and the next when the marker or delta marker value is changed via the rotary knob, press either the "Stepsize Standard" ("Stepsize Standard" on page 161) or the "Stepsize Sweep Points" softkey ("Stepsize Sweep Points" on page 162).

- To zoom into the display around a marker, press the "Marker Zoom" softkey ("Marker Zoom (span > 0)" on page 162) and enter a span.

- To link the delta marker1 to marker1, so if the x-axis value of the marker 1 is changed, the delta marker 1 follows on the same x-position, press the "Link Mkr1 and Delta1" softkey (see "Link Mkr1 and Delta1" on page 162).

3.3.1.3 Displayed Marker Information

The following additional information is displayed within the diagram grid or in a marker table beneath the diagram. The marker table is displayed automatically if more than 2 markers are active. You can hide or show the table using the "Marker Table" softkey (see "Marker Table" on page 161).

Marker information in Diagram Grid

The x and y axis positions of the last 2 markers or delta markers that were set, as well as their index, are displayed within the diagram grid, if available. The value in the square brackets after the index indicates the trace to which the marker is assigned. (Example: M1[1] defines marker 1 on trace 1.) For more than 2 markers, a separate marker table is displayed beneath the diagram.

If applicable, the active measurement function for the marker and its main results are indicated, as well. The functions are indicated with the following abbreviations:

FXD	Reference fixed marker active
PHNoise	Phase noise measurement active
CNT	Frequency counter active
TRK	Signal track active
NOIse	Noise measurement active
MDepth	Measurement of the AM modulation depth active
TOI	TOI measurement active
Occ BW	Occupied bandwidth

Marker Information in Marker Table

In addition to the marker information displayed within the diagram grid, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

As of firmware version 1.50, the marker table also provides information from connected power sensors (requires option R&S FSV-K9).

See also chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

No.	Serial number
Type	Marker type: N (normal), D (delta), T (temporary, internal)
Dgr	Diagram number
Trc	Trace to which the marker is assigned
Stimulus	x-value of the marker
Response	y-value of the marker
Func	Activated marker or measurement function
Func.Result	Result of the active marker or measurement function

3.3.2 Performing Peak Searches with Markers – PEAK SEARCH Key

The PEAK SEARCH key is used to perform a peak search with the currently active marker. If no marker is active, marker 1 is activated in normal mode and set as the peak.

If the selected diagram does not support markers, this key is ignored.

3.3.3 Performing Marker Functions – MKR FUNC Key

The MKR FUNC key provides various functions for markers, e.g.

● Phase Noise processing
● Setting reference points
● Marker demodulation
● Defining Marker peak lists
● Setting signal counts
● Measuring the power for a band around the marker

To open the marker function menu

● Press the MKR FUNC key.
The "Mkr Func" (marker function) menu is displayed.

Menu and softkey description

-

Further information

-
-
-
-

Tasks

-
-
-

3.3.3.1 Softkeys of the Marker Function Menu

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

Select Marker (No)

Opens a submenu to select one of 16 markers and define whether the marker is a normal or a delta marker (see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/ Delta" on page 159). "(No)" indicates the number of the currently active marker.

See "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159.

Signal Count

Toggles the frequency counter on or off, and opens an edit dialog box to define the resolution of the frequency counter, if enabled. The frequency is counted at the position of the reference marker (marker 1). If no marker is activated, marker 1 is switched on and set at the largest signal.

The sweep stops at the reference marker until the frequency counter has delivered a result. The result is displayed in the marker field (see figure 3-11), labeled with [Tx CNT]. For more details see chapter 3.3.3.5, "Frequency Measurement with the Frequency Counter", on page 175.

SCPI command:

CALCulate<n>:MARKer<m>:COUNt on page 472

CALCulate<n>:MARKer<m>:COUNt:FREQuency on page 473

Noise Meas On/Off

Switches the noise measurement for the active marker on or off. The corresponding marker becomes the normal marker. For more details on noise measurement see chapter 3.3.3.6, "Measurement of Noise Density", on page 176.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:NOISe[:STATe] on page 496

CALCulate<n>:MARKer<m>:FUNCtion:NOISe:RESult on page 497

Phase Noise

This softkey opens the Phase noise submenu.

Phase Noise On/Off ← Phase Noise
Switches on or off the phase-noise measurement with all active delta markers. The correction values for the bandwidth and the log amplifier are taken into account in the measurement.

Marker 1 is activated, if necessary, and a peak search is performed. If marker 1 is activated, its position becomes the reference point for the measurement.

Deltamarker 2 is activated and can be used to read out the phase noise value at a given frequency offset.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] on page 426
CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:RESult on page 427

Ref Point Level ← Phase Noise
Opens an edit dialog box to enter a reference level value. All relative level values of the delta markers refer to this reference level.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y on page 425

Ref Point Frequency (span > 0)/Ref Point Time (zero span) ← Phase Noise
Opens an edit dialog box to enter a frequency reference or time value. All relative frequency or time values of the delta markers refer to this frequency reference. For phase noise measurement, input of reference time is not possible.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X on page 425

Peak Search ← Phase Noise
Sets the maximum value of the selected trace as the reference point.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]
on page 424

Ph. Noise Auto Peak Search ← Phase Noise
Activates an automatic peak search for the reference fixed marker 1 at the end of each particular sweep.

This function can be used to track a drifting source during a phase noise measurement. The delta marker 2, which shows the phase noise measurement result, keeps the delta frequency value. Therefore the phase noise measurement leads to reliable results in a certain offset although the source is drifting. Only if the marker 2 reaches the border of the span, the delta marker value is adjusted to be within the span. In these cases, select a larger span.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO on page 427

Select Marker (No) ← Phase Noise
Opens a submenu to select one of 16 markers and define whether the marker is a normal or a delta marker (see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/ Delta" on page 159). "(No)" indicates the number of the currently active marker.

Ref Fixed
Opens a submenu to set all values of a reference point. Instead of using the current values of the reference marker (marker 1) as reference point for the delta markers, level and frequency or time are set to fixed values and used as reference point.

Ref. Fixed On/Off ← Ref Fixed
Switches the relative measurement to a fixed reference value on or off. The level and frequency or time values of marker 1 immediately become the reference point, but can be altered using the corresponding softkeys ("Ref Point Level" on page 168, "Ref Point Frequency (span > 0)/Ref Point Time (zero span)" on page 168 and "Peak Search" on page 168).

When set to ON, all delta markers which previously referenced marker 1 are automatically set to reference the fixed marker.

The reference marker assignment can be changed using the "Marker Wizard" (see "Marker Wizard" on page 160).

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] on page 424

Ref Point Level ← Ref Fixed
Opens an edit dialog box to enter a reference level value. All relative level values of the delta markers refer to this reference level.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y on page 425

Ref Point Frequency (span > 0)/Ref Point Time (zero span) ← Ref Fixed
Opens an edit dialog box to enter a frequency reference or time value. All relative frequency or time values of the delta markers refer to this frequency reference. For phase noise measurement, input of reference time is not possible.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X on page 425

Peak Search ← Ref Fixed
Sets the maximum value of the selected trace as the reference point.

SCPI command:
CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:MAXimum[:PEAK] on page 424

Marker Demod
Opens a submenu to set the demodulation mode and duration. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175. This softkey is only available with option analyzer-B3 and is not available for Spectrum Emission Mask measurements.

Mkr Demod On/Off ← Marker Demod

Switches the demodulation on/off. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:DEModulation[:STATe] on page 488

AM ← Marker Demod

Sets AM as demodulation mode. This is the default setting. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175.

SCPI command:

CALC:MARK1:FUNC:DEM:SEL AM, see CALCulate<n>:MARKer<m>:FUNCtion:
DEModulation:SELect on page 488

FM ← Marker Demod

Sets FM as demodulation mode. Default setting is AM. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175.

SCPI command:

CALC:MARK1:FUNC:DEM:SEL FM, see CALCulate<n>:MARKer<m>:FUNCtion:
DEModulation:SELect on page 488

Mkr Stop Time ← Marker Demod

Opens an edit dialog box to enter the demodulation stop time for span > 0. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:DEModulation:HOLDoff on page 488

Continuous Demod (span > 0) ← Marker Demod

Switches the continuous demodulation on or off. If the sweep time is long enough, the set frequency range can be monitored acoustically. For more details see also chapter 3.3.3.4, "AF Demodulation", on page 175.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:DEModulation:CONTinuous
on page 487

n dB down

Opens an edit dialog box to enter a value to define the level spacing of the two temporary markers to the right and left of marker 1 (default setting: 3 dB). Activates the temporary markers T1 and T2. The values of the temporary markers (T1, T2) and the entered value (ndB) are displayed in the marker field.

If a positive value is entered, the markers T1 and T2 are placed below the active reference marker. If a negative value (e.g. for notch filter measurements) is entered, the markers T1 and T2 are placed above the active reference marker. Marker T1 is placed to the left and marker T2 to the right of the reference marker.

In the marker table, the following results are displayed:

Span setting	Parameter name	Description
span > 0	Bw	frequency spacing of the two temporary markers
	Q factor	quality of the displayed bandwidth value (Bw)
span = 0	PWid	pulse width between the two temporary markers

If it is not possible to form the frequency spacing for the n dB value (e.g. because of noise display), dashes instead of a measured value are displayed.

SCPI command:

CALC:MARK1:FUNC:NDBD:STAT ON, see CALCulate<n>:MARKer<m>:FUNCtion: NDBDown:STATe on page 495

CALC:MARK1:FUNC:NDBD 3dB, see CALCulate<n>:MARKer<m>:FUNCtion: NDBDown on page 493

CALC:MARK1:FUNC:NDBD:RES? , see CALCulate<n>:MARKer<m>:FUNCtion: NDBDown:RESult on page 495

CALC:MARK:FUNC:NDBD:QFAC?, see CALCulate<n>:MARKer<m>:FUNCtion: NDBDown:QFACtor on page 494

CALC:MARK1:FUNC:NDBD:FREQ? (span > 0), see CALCulate<n>:MARKer<m>: FUNCtion:NDBDown:FREQuency on page 494

CALC:MARK1:FUNC:NDBD:TIME? (span = 0), see CALCulate<n>:MARKer<m>: FUNCtion:NDBDown:TIME on page 496

Marker Peak List

Opens the ""Peak List"" dialog box and a submenu to define criteria for the sort order and the contents of the peak list. The number of listed peaks is indicated in the title bar. For all listed peaks the frequency and level values are given. Maximal 50 entries are listed.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt on page 490

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:X on page 491

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:Y on page 491

New Search ← Marker Peak List

Starts a new peak search and enters the results in the peak list.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt on page 490

Sort Mode Freq/Lvl ← Marker Peak List

Defines the criteria for sorting:

FREQ	sorting in ascending order of frequency values (span > 0) or time values (span = 0)
"Lvl"	sorting in ascending order of the level

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT on page 490

Peak Excursion ← Marker Peak List

Opens an edit dialog box for level measurements to enter 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.

For details see also "Specifying the suitable peak excursion" and "Effect of different peak excursion settings" in the description of the base unit.

SCPI command:

CALCulate<n>:MARKer<m>:PEXCursion on page 479

Left Limit ← Marker Peak List

Opens an edit dialog box to enter a value for the lower limit (left vertical line: S1 for span > 0; T1 for zero span). The search is performed between the lines of the left and right limit (see also Right Limit softkey).

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:LEFT on page 481

Right Limit ← Marker Peak List

Opens an edit dialog box to enter a value for the upper limit (left vertical line: S2 for span > 0; T2 for zero span). The search is performed between the lines of the left and right limit (see also Left Limit softkey). If no value is set, the upper limit corresponds to the stop frequency.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT on page 482

Threshold ← Marker Peak List

Opens an edit dialog box to define the threshold line. The threshold line represents the lower level limit for a "Peak" search and the upper level limit for a "Min" search.

SCPI command:

CALCulate<n>:THReshold:STATe on page 544

CALCulate<n>:THReshold on page 543

Peak List Off ← Marker Peak List

Switches the peak list function off.

ASCII File Export ← Marker Peak List

Opens the "ASCII File Export Name" dialog box and saves the active peak list in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the marker data. For details on an ASCII file see chapter 3.2.8.7, "ASCII File Export Format", on page 144.

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "Decim Sep" softkey (see "Decim Sep" on page 85).

An example of an output file for Spectrum Emission Mask measurements is given in "ASCII File Export Format (Spectrum Emission Mask)", on page 228.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

MMEMory:STORe<n>:LIST on page 571

Decim Sep ← Marker Peak List

Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

Band Power

Opens a submenu to activate and configure a band power marker. Band power markers allow you to measure the integrated power for a defined span (band) around a marker. The result can be displayed either as a power (dBm) or density (dBm/Hz). The span is indicated by lines in the diagram.

Band power markers are only available for standard frequency measurements in Spectrum mode (not zero span, I/Q Analyzer etc.).

For details see chapter 3.3.3.8, "Performing Band Power Measurements", on page 177.

Select Marker (No) ← Band Power

Opens a submenu to select one of 16 markers and define whether the marker is a normal or a delta marker (see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/ Delta" on page 159). "(No)" indicates the number of the currently active marker.

See "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta" on page 159.

Band Power On/Off ← Band Power

Activates or deactivates the band power marker. When switched to on, if no marker is active yet, marker 1 is activated. Otherwise, the currently active marker is used as a band power marker (all other marker functions for this marker are deactivated). All markers can be defined as band power markers, each with a different span.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe] on page 485

Span ← Band Power

Defines the span (band) around the marker for which the power is measured. The span is indicated by lines in the diagram.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:SPAN on page 486

Power ← Band Power

Selects the power mode for the band power marker, i.e. the result is displayed in dBm.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:MODE] on page 485

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult on page 486

Density ← Band Power

Selects the density mode for the band power marker, i.e. the result is displayed in dBm/Hz.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:MODE] on page 485

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult on page 486

3.3.3.2 Setting a Fixed Reference Point (Phase Noise Measurement)

1. Press the Phase Noise softkey.

   The submenu with the Phase Noise On/Off softkey switched on is displayed. The level and frequency or time values of marker 1 immediately become the reference point.

2. Setting the maximum of the selected trace as reference point, press the Peak Search softkey.

3. To define the values for the reference point, proceed as follows:

   a) Press the Ref Fixed softkey.
   b) Press the Ref Point Level softkey and enter a reference level value.
   c) If span > 0, press the Ref Point Frequency (span > 0)/Ref Point Time (zero span) softkey and enter a frequency reference value.
   d) If span = 0, press the "Ref Point Time" softkey and enter a reference time value (see "Ref Point Frequency (span > 0)/Ref Point Time (zero span)" on page 168).

3.3.3.3 Setting the Demodulation Mode and Duration

1. Press the Marker Demod softkey.

   The submenu with the Mkr Demod On/Off softkey switched on is displayed.

2. To change the demodulation mode, press the AM or FM softkey.

3. For details see chapter 3.3.3.4, "AF Demodulation", on page 175.

4. To modify the demodulation time for span > 0, press the Mkr Stop Time softkey.

5. To change to continuous demodulation for span > 0, press the Continuous Demod (span > 0) softkey.

3.3.3.4 AF Demodulation

The analyzer provides demodulators for AM and FM signals. With these demodulators, a displayed signal can be identified acoustically by using headphones.

⚠ **CAUTION**

Risk of hearing damage

To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.

The volume for the headphones is controlled using the rotary knob next to the "AF Output" interface on the front panel of the instrument.

For span > 0, the demodulation is not continuous. The frequency at which the demodulation takes place is set by the active marker. If the level of the selected frequency is above the threshold line, the sweep stops for the selected time (stop time) and the RF signal is demodulated. For span = 0, the demodulation is continuously active irrespective of the stop time set.

3.3.3.5 Frequency Measurement with the Frequency Counter

In order to accurately determine the frequency of a signal, the analyzer is equipped with a frequency counter which measures the frequency of the RF signal at the intermediate frequency. Using the measured IF, the analyzer calculates the frequency of the RF input signal by applying the known frequency conversion factors.

The frequency measurement uncertainty depends only upon the accuracy of the frequency reference used (external or internal reference). Although the analyzer always operates synchronously irrespective of the set span, the frequency counter delivers a more exact result than a measurement performed with a marker. This is due to the following:

● The marker measures only the position of the point on the trace and infers from this value the signal frequency. The trace, however, contains only a limited number of points. Depending upon the selected span, each point may contain many measurement values, which therefore limits the frequency resolution.

● The resolution with which the frequency can be measured with a marker is dependant on the selected resolution bandwidth, which in return affects the necessary measurement time. For this reason, the bandwidth is normally defined as wide as possible and the sweep time as short as possible. This results in a loss of frequency resolution. For the measurement with the frequency counter, the sweep is stopped at the reference marker, the frequency is counted with the desired resolution and then the sweep is allowed to continue.
In IQ Analyzer mode (see chapter 3.5, "Instrument Functions - I/Q Analyzer", on page 281), the resolution with which the frequency can be measured with a marker is always the filter bandwidth, which is derived from the defined sample rate.

3.3.3.6 Measurement of Noise Density

During noise measurement, the noise power density is measured at the position of the marker. For span = 0, all points of the trace are used to determine the noise power density. For span > 0, two points to the right and left of the marker are used for the measurement to obtain a stable result.

The noise power density is indicated in the marker field. With logarithmic amplitude units (dBm, dBmV, dBmµV, dBµA), the noise power density is output in dBm/Hz, i.e. as level in 1 Hz bandwidth with reference to 1 mW. With linear amplitude units (V, A, W), the noise voltage density is evaluated in µV/Hz, the noise current density in µA/Hz or the noise power density in µW/Hz.

In the default setting, the analyzer uses the sample detector for the noise function.

With the sample detector, the trace can additionally be set to AVERAGE to stabilize the measured values. With RMS detector used, trace averaging must not be used since in this case it produces too low noise levels which cannot be corrected. Instead, the sweep time can be increased to obtain stable measurement results.

Prerequisite settings

The following settings have to be made to ensure that the power density measurement yields correct values:

- Detector: Sample or RMS
- Video bandwidth:
  ≤ 0.1 resolution bandwidth with sample detector
  ≥ 3 x resolution bandwidth with RMS detector
- Trace averaging:
  With the sample detector, the trace can additionally be set to average to stabilize the measured values. With RMS detector used, trace averaging must not be used since in this case it produces too low noise levels which cannot be corrected. Instead, the sweep time can be increased to obtain stable measurement results.

Correction factors

The analyzer uses the following correction factors to evaluate the noise density from the marker level:

- Since the noise power is indicated with reference to 1 Hz bandwidth, the bandwidth correction value is deducted from the marker level. It is 10 x lg (1 Hz/BWNoise), where BWNoise is the noise or power bandwidth of the set resolution filter (RBW).
- RMS detector: With the exception of bandwidth correction, no further corrections are required since this detector already indicates the power with every point of the trace.
- Sample detector: As a result of video filter averaging and trace averaging, 1.05 dB is added to the marker level. This is the difference between the average value and the RMS value of white noise. With a logarithmic level axis, 1.45 dB is added additionally. Logarithmic averaging is thus fully taken into account which yields a value that is 1.45 dB lower than that of linear averaging.
- To allow a more stable noise display the adjacent (symmetric to the measurement frequency) points of the trace are averaged.

- For span > 0, the measured values are averaged versus time (after a sweep).

The analyzer noise figure can be calculated from the measured power density level. It is calculated by deducting the set RF attenuation (RF Att) from the displayed noise level and adding 174 to the result.

3.3.3.7 Measurement example for Phase Noise Auto Peak Search

The phase noise of a CW signal at 100 MHz with 0 dBm level is to be measured at 800 kHz from the carrier.

1. PRESET
   The R&S FSP is set to the default setting.

2. FREQ > "CENTER": *100 MHz*
   The center frequency is set to 100 MHz.

3. SPAN: *2 MHz*
   The span is set to 2 MHz.

4. AMPT: *0 dBm*
   The reference level is set to 0 dBm.

5. MKR FCTN > "MARKER 1"
   Marker 1 is switched on and positioned at the maximum of the displayed trace.

6. "PHASE NOISE": *800 kHz*
   The phase noise measurement is switched on. The delta marker is positioned on the main marker and the measured phase noise value is displayed in the marker info field. The sample detector is used and the video bandwidth is set to 3 × RBW. When the phase noise measurement function is enabled, the entry of the delta marker frequency is activated. It can be entered directly.

3.3.3.8 Performing Band Power Measurements

Band power markers allow you to measure the integrated power (similar to ACP measurements) for a defined span (band) around a marker. By default, 5 % of the current span is used. The span is indicated by colored lines in the diagram. The result can be displayed either as a power (dBm) or density (dBm/Hz).

Band power markers are only available for standard frequency measurements in Spectrum mode (not zero span, I/Q Analyzer etc.).
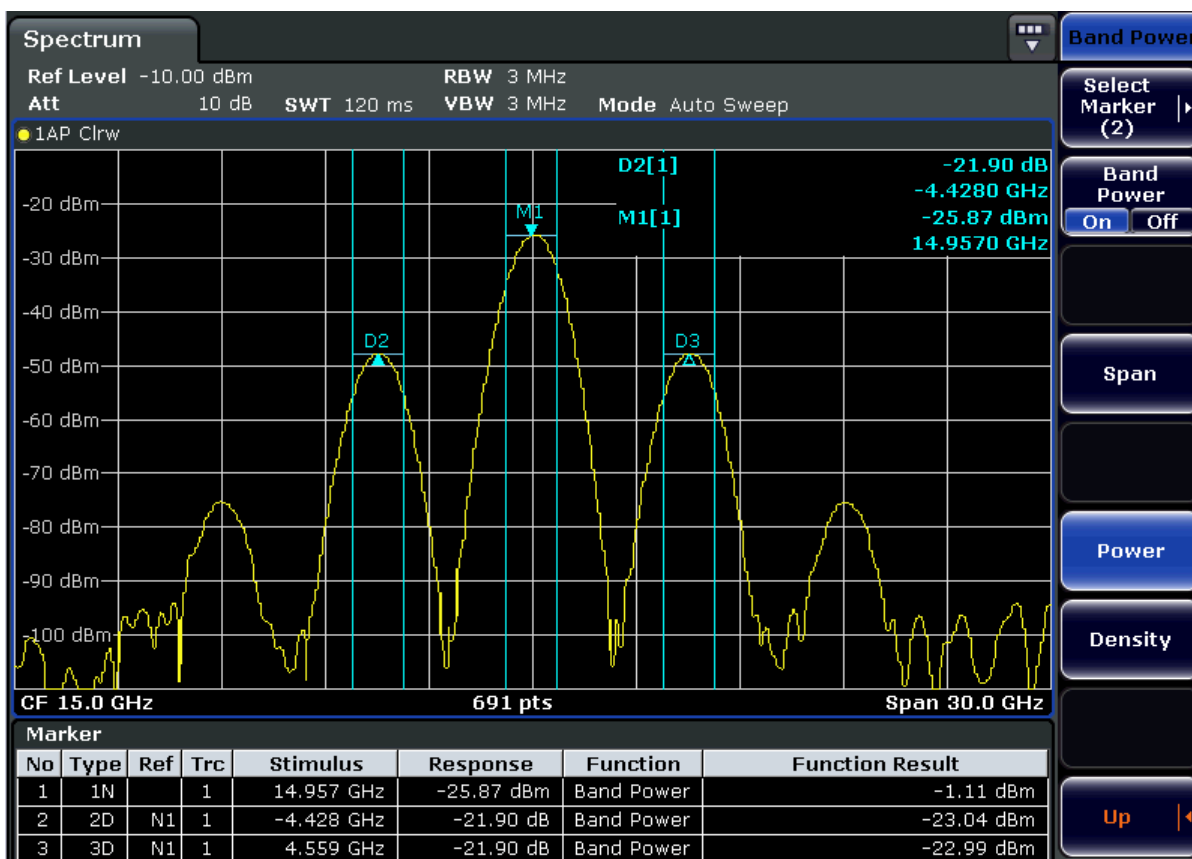
All markers can be defined as band power markers, each with a different span. When a band power marker is activated, if no marker is active yet, marker 1 is activated. Otherwise, the currently active marker is used as a band power marker (all other marker functions for this marker are deactivated).

If the detector mode for the marker trace is set to "AutoSelect", the RMS detector is used.

1. In the MKR FUNC menu, press "Band Power".

2. In the "Band Power" menu, press "Span" and enter the width of the band around the marker for which the power is to be measured.

3. To display the measurement result in dBm/Hz, press "Density". By default, the result is displayed as a power in dBm.

4. Press "Band Power On" to activate the band power marker.

   The measurement results are displayed as usual in the marker table or in the diagram.

3.3.4 Changing Settings via Markers – MKR-> Key

The MKR -> key is used for search functions of measurement markers, assignment of the marker frequency as center frequency, restriction of the search area and characterization of maxima and minima. For details on markers in general, see chapter 3.3.1, "Using Markers and Delta Markers – MKR Key", on page 158.

To open the Marker To menu

● Press the MKR -> key.
  The "Marker To" menu is displayed. If no marker is active, marker 1 will be activated
  and a peak search on the trace carried out. Otherwise, the edit dialog box for the last
  activated marker is opened and the current frequency/time value is displayed.

Menu and softkey description

● chapter 3.3.4.1, "Softkeys of the Marker To Menu", on page 179 Menu"

Further information

● chapter 3.3.4.8, "Effect of Different Peak Excursion Settings (Example)",
  on page 184

Tasks

● chapter 3.3.4.2, "Searching for a Maximum", on page 183
● chapter 3.3.4.3, "Searching for a Minimum", on page 183
● chapter 3.3.4.4, "Specifying the Search Limits", on page 183
● chapter 3.3.4.5, "Specifying the Search Range", on page 184
● chapter 3.3.4.6, "Examining a Signal at the Center in Detail", on page 184
● chapter 3.3.4.7, "Specifying the Suitable Peak Excursion", on page 184

3.3.4.1   Softkeys of the Marker To Menu

The following table shows all softkeys available in the "Marker To" menu. It is possible
that your instrument configuration does not provide all softkeys. If a softkey is only avail-
able with a special option, model or (measurement) mode, this information is provided in
the corresponding softkey description.

Select Marker (No)

Opens a submenu to select one of 16 markers and define whether the marker is a normal or a delta marker (see "Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/ Delta" on page 159). "(No)" indicates the number of the currently active marker.

Peak

Sets the active marker/delta marker to the highest maximum of the trace.

SCPI command:

CALCulate<n>:MARKer<m>:MAXimum[:PEAK] on page 474

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK] on page 429

Next Peak

Sets the active marker/delta marker to the next maximum of the selected trace.

SCPI command:

CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 475

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 429

Center =Mkr Freq (span > 0)

Sets the center frequency to the current marker or delta marker frequency. A signal can thus be set to as center frequency, for example to examine it in detail with a smaller span.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:CENTer on page 487

Ref Lvl =Mkr Lvl

Sets the reference level to the current marker level.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:REFerence on page 497

Marker to Trace

Opens an edit dialog box to enter the number of the trace on which the marker is to be placed.

SCPI command:

CALCulate<n>:MARKer<m>:TRACe on page 480

CALCulate<n>:DELTamarker<m>:TRACe on page 432

Min

Sets the active marker/delta marker to the minimum of the selected trace.

SCPI command:

CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 476

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 430

Next Min

Sets the active marker/delta marker to the next minimum of the selected trace.

SCPI command:

CALCulate<n>:MARKer<m>:MINimum:NEXT on page 478

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 432

Auto Max Peak/Auto Min Peak

Adds an automatic peak search action for marker 1 at the end of each particular sweep. This function may be used during adjustments of a device under test to keep track of the current peak marker position and level.

The current marker search limit settings (Left Limit, Right Limit, Threshold softkeys) are taken into account.

SCPI command:

CALCulate<n>:MARKer<m>:MAXimum:AUTO on page 475

CALCulate<n>:MARKer<m>:MINimum:AUTO on page 477

Search Limits

Opens a submenu to set the limits for maximum or minimum search in the x and y direction.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] on page 481

Left Limit ← Search Limits

Opens an edit dialog box to enter a value for the lower limit (left vertical line: S1 for span > 0; T1 for zero span). The search is performed between the lines of the left and right limit (see also Right Limit softkey).

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:LEFT on page 481

Right Limit ← Search Limits

Opens an edit dialog box to enter a value for the upper limit (left vertical line: S2 for span > 0; T2 for zero span). The search is performed between the lines of the left and right limit (see also Left Limit softkey). If no value is set, the upper limit corresponds to the stop frequency.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT on page 482

Threshold ← Search Limits

Opens an edit dialog box to define the threshold line. The threshold line represents the lower level limit for a "Peak" search and the upper level limit for a "Min" search.

SCPI command:

CALCulate<n>:THReshold:STATe on page 544

CALCulate<n>:THReshold on page 543

Use Zoom Limits ← Search Limits

Restricts the marker search to the zoomed area.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:ZOOM on page 482

Search Lim Off ← Search Limits

Deactivates all limits of the search range.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] on page 481

CALCulate<n>:THReshold:STATe on page 544

Next Mode

Selects the mode of the Next Peak or Next Min softkey.

Three settings are available:

"<"   Sets the active marker/delta marker to the next maximum/minimum left
             to the marker of the selected trace.

"abs"   Sets the active marker/delta marker to the next lower maximum/higher
             minimum of the selected trace.

">"   Sets the active marker/delta marker to the next maximum/minimum right
             to the marker of the selected trace.

SCPI command:
Next Peak:
CALC:MARK:MAX:LEFT (<): CALCulate<n>:MARKer<m>:MAXimum:LEFT
on page 475

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 429

CALC:MARK:MAX:RIGH (>): CALCulate<n>:MARKer<m>:MAXimum:RIGHt
on page 476

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 430

CALC:DELT:MAX:NEXT (abs): CALCulate<n>:MARKer<m>:MAXimum:NEXT
on page 475

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 429

Next Min:
CALC:MARK:MIN:LEFT (>): CALCulate<n>:MARKer<m>:MINimum:LEFT
on page 477

CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 431

CALC:MARK:MIN:RIGH (>): CALCulate<n>:MARKer<m>:MINimum:RIGHt
on page 478

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 431

CALC:MARK:MIN:NEXT (abs): CALCulate<n>:MARKer<m>:MINimum:NEXT
on page 478

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 432

Exclude LO

Switches the frequency range limit for the marker search functions on or off.

"ON"   minimum frequency ≥ 6 × resolution bandwidth (RBW)
             Because of the interference by the first local oscillator to the first inter-
             mediate frequency at the input mi XE r, the LO is represented as a signal
             at 0 Hz. To avoid the marker jumping to the LO at 0 Hz with the peak
             function when setting the display range, this frequency is excluded.

"OFF"   no restriction to the search range. The frequency 0 Hz is included in the
                marker search functions.

SCPI command:
CALCulate<n>:MARKer<m>:LOEXclude on page 474

Peak Excursion
Opens an edit dialog box for level measurements to enter 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.

For details see also "Specifying the suitable peak excursion" and "Effect of different peak
excursion settings" in the description of the base unit.

SCPI command:
CALCulate<n>:MARKer<m>:PEXCursion on page 479

3.3.4.2 Searching for a Maximum

● To search for the highest maximum, press the Peak softkey.

● To define the search mode for the next maximum, use the Next Mode softkey.

● To start the search, press the Next Peak softkey.

You can define an automatic peak search action for marker 1 at the end of each particular
sweep using the Auto Max Peak/Auto Min Peak softkey.

3.3.4.3 Searching for a Minimum

● To search for the minimum, press the Min softkey.

● To define the search mode for the next minimum, use the Next Mode softkey.

● To start the search, press the Next Min softkey.

You can define an automatic peak search action for marker 1 at the end of each particular
sweep using the Auto Max Peak/Auto Min Peak softkey.

3.3.4.4 Specifying the Search Limits

● To define the lower limit, press the "Left Limit" on page 172 softkey.

● To define the upper limit, press the "Right Limit" on page 172 softkey.

● To define the threshold, press the "Threshold" on page 172 softkey.

● To switch the search limits off, press the Search Lim Off softkey.

3.3.4.5 Specifying the Search Range

● Press the Exclude LO softkey to deactivate the "Exclude LO" mode in order to include the frequency down to 0 Hz in the marker search functions.

3.3.4.6 Examining a Signal at the Center in Detail

1. Press the PRESET key to set the analyzer to the default setting.

2. Press the MKR -> key to open the "Marker To" menu.

3. Marker 1 is activated and set to the largest signal of the trace.

4. Press the Center =Mkr Freq (span > 0) softkey to set to the marker frequency.

5. The span is adapted in such a way that the minimum frequency (= 0 Hz) or the maximum frequency is not exceeded.

6. Press the Ref Lvl =Mkr Lvl softkey to set the reference level to the measured marker level.

7. Press the SPAN key.

8. The edit dialog box to enter a frequency span is displayed.

9. Reduce the span, e.g. using the rotary knob.

3.3.4.7 Specifying the Suitable Peak Excursion

1. If the Peak Excursion softkey is used, the default value is sufficient, since, in this mode, the next lower maximum or next higher minimum will always be detected.

2. If the < or > of the softkey Next Mode is used, the 6 dB level change set as a default value may already be attained by the inherent noise of the instrument. To avoid identifying noise peaks as maxima or minima, enter a peak excursion value that is higher than the difference between the highest and the lowest value measured for the displayed inherent noise.

3.3.4.8 Effect of Different Peak Excursion Settings (Example)

The following figure shows a trace to be examined.
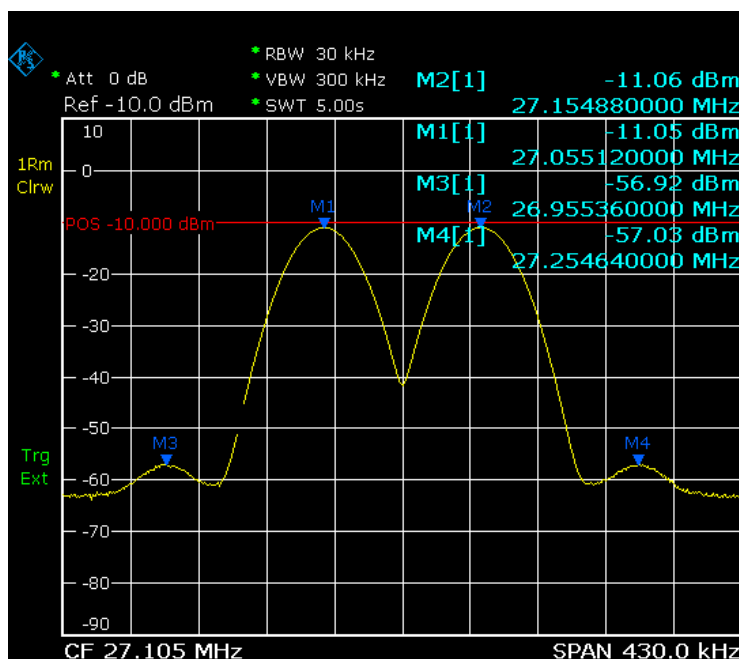
Fig. 3-12: Trace example

The following table lists the signals as indicated by the marker numbers in the diagram above, as well as the minimum of the amplitude decrease to both sides of the signal:

Signal #	Min. amplitude decrease to both sides of the signal
1	30 dB
2	29.85 dB
3	7 dB
4	7 dB

The detected signals and their order are different depending on the peak excursion setting and the peak search method (whether the next lower maximum or the next relative maximum is searched). The following results are obtained. All tests start with the marker set to signal 1 by pressing the Peak softkey.

● 40 dB peak excursion
  Result: With both methods apart from signal 1 no signal is detected, as the signal level does not decrease by more than 30 dB to either side of any signal.

Next lower maximum	Next relative maximum
Next Mode abs: signal 1	Next Mode <: signal 1
(no further signal detected)	(no further signal detected)
	Next Mode >: signal 1
	(no further signal detected)

● 20 dB peak excursion

Result: With both methods apart from signal 1 signal 2 is detected, as the signal level decreases at least by 29.85 dB to either side of this signal, which is now greater than the peak excursion.

Next lower maximum	Next relative maximum
Next Mode abs: signal 2	Next Mode <: signal 1 (no further signal detected)
Next Mode abs: signal 2 (no further signal detected)	Next Mode >: signal 2
	Next Mode >: signal 2 (no further signal detected)

- 6 dB peak excursion
  Result: With both methods all signals are detected.

Next lower maximum	Next relative maximum
Next Mode abs: signal 2	Next Mode <: signal 3
Next Mode abs: signal 3	Next Mode >: signal 1
Next Mode abs: signal 4	Next Mode >: signal 2
	Next Mode >: signal 4

3.3.5 Power Measurements – MEAS Key

With its power measurement functions, the analyzer is able to measure all the necessary parameters with high accuracy in a wide dynamic range.

A modulated carrier is almost always used (except e.g. SSB-AM) for high-frequency transmission of information. Due to the information modulated upon the carrier, the latter covers a spectrum which is defined by the modulation, the transmission data rate and the signal filtering. Within a transmission band each carrier is assigned a channel taking into account these parameters. In order to ensure error-free transmission, each transmitter must be conforming to the specified parameters. These include among others:

- the output power
- the occupied bandwidth, i.e. the bandwidth which must contain a defined percentage of the power
- the power dissipation allowed in the adjacent channels

The MEAS key is used for complex measurement functions as power measurements, occupied bandwidth, signal statistic, carrier to noise spacing, AM modulation depth, third-order intercept point, harmonics and spurious emissions. For measurement examples refer to the Quick Start Guide, "Basic Measurement Examples".

Further examples are described in chapter 2, "Advanced Measurement Examples", on page 11 and chapter 4.3, "Remote Control – Programming Examples", on page 780

The following measurements can be performed:

- Channel power and adjacent-channel power with span > 0 and with a single or several carriers ("CH Power ACLR" softkey, for details see chapter 3.3.5.2, "Measuring Channel Power and Adjacent-Channel Power", on page 190)

- Carrier-to-noise ratio ("C/N C/NO" softkey, for details see chapter 3.3.5.3, "Measuring the Carrier-to-Noise Ratio", on page 205)

- Occupied bandwidth ("OBW" softkey, for details see chapter 3.3.5.4, "Measuring the Occupied Bandwidth", on page 206)

- Spectrum Emission Mask measurements ("Spectrum Emission Mask" softkey, for details see chapter 3.3.5.5, "Measuring with Spectrum Emission Masks", on page 209)

- Spurious Emissions measurements ("Spurious Emissions" softkey, for details see chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231)

- Power in zero span ("Time Domain Power" softkey, for details see chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239).

- Amplitude probability distribution ("APD" and "CCDF" softkeys, for details see chapter 3.3.5.8, "Calculating Signal Statistics", on page 241)

- 3rd order intercept ("TOI" softkey, for details see chapter 3.3.5.9, "Measuring the Third Order Intercept Point (TOI)", on page 256)

- Modulation depth ("AM Mod Depth" softkey, for details see chapter 3.3.5.10, "Measuring the AM Modulation Depth", on page 257)

- Harmonic Distortion measurements ("Harmonic Distortion" softkey, for details see chapter 3.3.5.11, "Measuring Harmonic Distortion", on page 259)

To open the power measurement menu

- Press the MEAS key.
  The measurement menu for spectrum analysis is displayed (see chapter 3.3.5.1, "Softkeys of the Power Measurement Menu", on page 187).

3.3.5.1   Softkeys of the Power Measurement Menu

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

Ch Power ACLR

Activates the active channel or adjacent-channel power measurement either for a single carrier signal or for several carrier signals, depending on the current measurement configuration, and opens a submenu to configure the channel power measurement.

For details see chapter 3.3.5.2, "Measuring Channel Power and Adjacent-Channel Power", on page 190.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504

CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

C/N, C/No (span > 0)

Opens a submenu to configure the carrier/noise ratio measurement. Measurements without (C/N) and measurements with reference to the bandwidth (C/No) are possible.

For details see chapter 3.3.5.3, "Measuring the Carrier-to-Noise Ratio", on page 205.

OBW (span > 0)

Activates measurement of the occupied bandwidth according to the current configuration and opens a submenu to configure the measurement. For details see chapter 3.3.5.4, "Measuring the Occupied Bandwidth", on page 206.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504

CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

Spectrum Emission Mask

Opens a submenu to configure the Spectrum Emission Mask measurement.

The Spectrum Emission Mask (SEM) measurement defines a measurement that monitors compliance with a spectral mask.

For details see chapter 3.3.5.5, "Measuring with Spectrum Emission Masks", on page 209.

SCPI command:

SENS:SWE:MODE ESP, see [SENSe:]SWEep:MODE on page 647

Spurious Emissions

Opens a submenu to configure the Spurious Emissions measurement.

The Spurious Emissions measurement defines a measurement that monitors unwanted RF products outside the assigned frequency band generated by an amplifier.

For details see chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231.

SCPI command:

SENS:SWE:MODE LIST, see [SENSe:]SWEep:MODE on page 647

Time Domain Power (zero span)

Activates the power measurement in zero span and opens a submenu to configure the power measurement. For details see chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary[:STATe] on page 519

All Functions Off

Switches off all power measurement functions.

APD

Activates the function to measure the amplitude probability density (APD) and opens a submenu.

For details see chapter 3.3.5.8, "Calculating Signal Statistics", on page 241.

SCPI command:

CALCulate<n>:STATistics:APD[:STATe] on page 539

CCDF

Activates the function to measure the complementary cumulative distribution function (CCDF) and opens a submenu.

For details see chapter 3.3.5.8, "Calculating Signal Statistics", on page 241.

SCPI command:

CALCulate<n>:STATistics:CCDF[:STATe] on page 539

TOI

Opens a submenu and activates the measurement of the 3rd order intercept point.

For details see chapter 3.3.5.9, "Measuring the Third Order Intercept Point (TOI)", on page 256.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:TOI[:STATe] on page 497

CALCulate<n>:MARKer<m>:FUNCtion:TOI:RESult on page 498

AM Mod Depth

Opens a submenu and activates the measurement of the AM modulation depth. An AM-modulated carrier is required on the screen for ensuring correct operation.

For details see chapter 3.3.5.10, "Measuring the AM Modulation Depth", on page 257.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics[:STATe] on page 499

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth:RESult on page 493

Harmonic Distortion

Opens a submenu to determine the settings for harmonics measurement and activates the harmonic distortion measurement.

For details see chapter 3.3.5.11, "Measuring Harmonic Distortion", on page 259.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics[:STATe] on page 499

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:DISTortion on page 500

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:LIST on page 501

All Functions Off

Switches off all power measurement functions.

3.3.5.2 Measuring Channel Power and Adjacent-Channel Power

You can perform channel power and adjacent-channel power measurements with span > 0 and with a single or several carriers using the "CH Power ACLR" softkey (see "Softkeys for Channel and Adjacent-Channel Power Measurements", on page 191).

With default settings the measurement is performed by integrating the powers at the display points within the specified channels (IBW method).

If several TX channels (carriers) are activated, the number of sweep points is increased to ensure that adjacent-channel powers are measured with adequate accuracy.

Channel and adjacent-channel measurements can be performed using predefined standards, or configured using individual settings.

A measurement example is described in chapter 2.6.1, "Measuring Channel Power and Adjacent Channel Power", on page 38 and chapter 4.3, "Remote Control – Programming Examples", on page 780.

Measurement Result Display

For channel or adjacent-channel power measurements, the individual channels are indicated by different colored bars in the diagram. The height of each bar corresponds to the measured power of that channel. In addition, the name of the channel ("Adj", "Alt1", "TX1", etc. or a user-defined name) is indicated above the bar (separated by a line which has no further meaning).
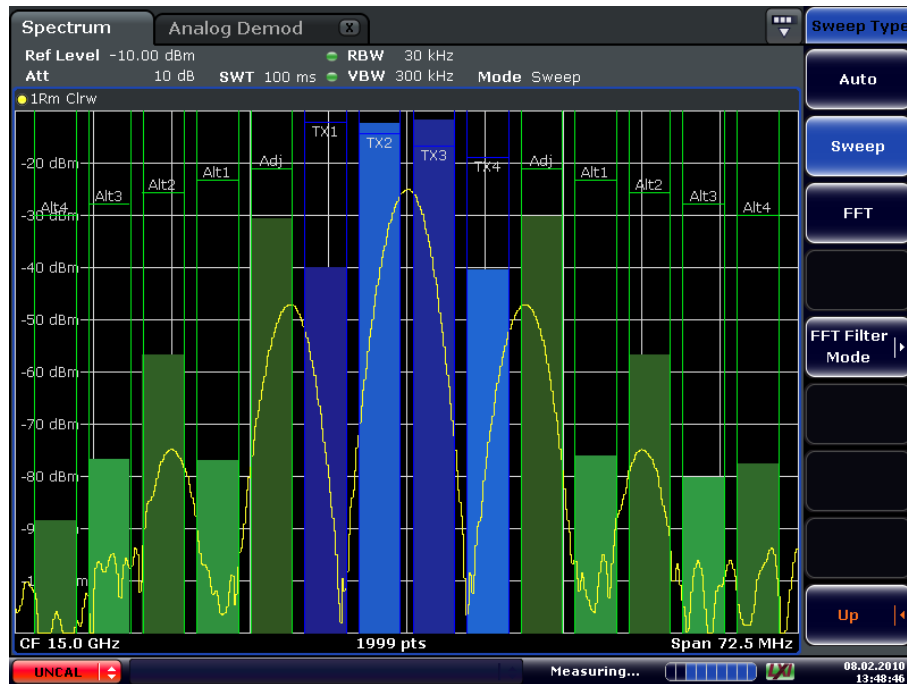
Setting the Channel Configuration

1. To activate channel or adjacent-channel power measurement, press the "Ch Power ACLR" softkey.

   The corresponding submenu is displayed. For details see "Softkeys for Channel and Adjacent-Channel Power Measurements", on page 191.

2. To use a predefined standard for measurement, press the "CP/ACLR Standard" softkey (see "CP/ACLR Standard" on page 193). For details on available standards see "Predefined CP/ACLR Standards", on page 202.
   To configure the parameters independently of the predefined standards, press the "CP/ACLR Settings" softkey (see "CP/ACLR Settings" on page 193), then "Channel Setup" (see "Channel Setup" on page 194).

3. To enter the sweep time, press the "Sweep Time" softkey (see "Sweep Time" on page 199).

4. To adjust the reference level to the measured channel power, press the "Adjust Ref Lvl" softkey (see "Adjust Ref Lvl" on page 202).

Softkeys for Channel and Adjacent-Channel Power Measurements

Ch Power ACLR

Activates the active channel or adjacent-channel power measurement either for a single carrier signal or for several carrier signals, depending on the current measurement configuration, and opens a submenu to configure the channel power measurement. With default settings the measurement is performed by integrating the powers at the display points within the specified channels (IBW method).

If several TX cahnnels (carriers) are activated, the number of measured values is increased to ensure that adjacent-channel powers are measured with adequate accuracy.

For general information on performing channel or adjacent-channel power measurements, see chapter 3.3.5.2, "Measuring Channel Power and Adjacent-Channel Power", on page 190.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504

CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

CP/ACLR Standard ← Ch Power ACLR

Opens an edit dialog box to select the settings according to predefined standards. For details on the available standards see "Predefined CP/ACLR Standards", on page 202. By default no standard is set.

The selection of the standard influences the following parameters (see "Optimized Settings for CP/ACLR Test Parameters", on page 203):

- channel spacing and adjacent-channel spacing
- channel bandwidth, adjacent-channel bandwidth, and type of filtering
- resolution bandwidth
- video bandwidth
- detector
- # of adjacent channels
- trace averaging (switched off)

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:PRESet on page 503

CP/ACLR Settings ← Ch Power ACLR

Opens a submenu to configure the channel power and adjacent channel power measurement independently of the predefined standards (for details see also "Predefined CP/ACLR Standards", on page 202 and "Optimized Settings for CP/ACLR Test Parameters", on page 203).

# of TX Chan ← CP/ACLR Settings ← Ch Power ACLR

Opens an edit dialog box to enter the number of carrier signals to be taken into account in channel and adjacent-channel power measurements. Values from 1 to 18 are allowed.

SCPI command:

[SENSe:]POWer:ACHannel:TXCHannel:COUNt on page 641

# of Adj Chan ← CP/ACLR Settings ← Ch Power ACLR

Opens an edit dialog box to enter the number of adjacent channels to be considered in the adjacent-channel power measurement. Values from 0 to 12 are allowed.

The following measurements are performed depending on the number of the channels:

0	Only the channel powers are measured.
1	The channel powers and the power of the upper and lower adjacent channel are measured.
2	The channel powers, the power of the upper and lower adjacent channel, and of the next higher and lower channel (alternate channel 1) are measured.
3	The channel power, the power of the upper and lower adjacent channel, the power of the next higher and lower channel (alternate channel 1), and of the next but one higher and lower adjacent channel (alternate channel 2) are measured.
…	…
12	The channel power, the power of the upper and lower adjacent channel, and the power of the all higher and lower channels (alternate channel 1 to 11) are measured.

SCPI command:

[SENSe:]POWer:ACHannel:ACPairs on page 633

Channel Setup ← CP/ACLR Settings ← Ch Power ACLR

Opens a dialog to define the channel settings for all channels, independant of the defined number of *used* TX or adjacent channels.

The dialog contains the following tabs:

- "Bandwidth" on page 194
- "Spacing" on page 195
- "Names" on page 196
- "Weighting Filter" on page 196
- "Limits" on page 197

Bandwidth ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR

Define the channel bandwidths for the transmission channels and the adjacent channels. "TX" is only available for the multi-carrier ACLR measurement. When you change the bandwidth for one channel, the value is automatically also defined for all subsequent channels of the same type.

The transmission-channel bandwidth is normally defined by the transmission standard. The correct bandwidth is set automatically for the selected standard (see "Optimized Settings for CP/ACLR Test Parameters", on page 203).

- Measurements in zero span (see Fast ACLR (On/Off) softkey) are performed in the zero span mode. The channel limits are indicated by vertical lines. For measurements requiring channel bandwidths deviating from those defined in the selected standard the IBW method is to be used.

- With the IBW method (see Fast ACLR (On/Off) softkey), the channel bandwidth limits are marked by two vertical lines right and left of the channel center frequency. Thus you can visually check whether the entire power of the signal under test is within the selected channel bandwidth.
  If measuring according to the IBW method ("Fast ACLR Off"), the bandwidths of the different adjacent channels are to be entered numerically. Since all adjacent channels often have the same bandwidth, the other alternate channels are set to the bandwidth of the adjacent channel when it is changed. Thus, only one value needs to be entered in case of equal adjacent channel bandwidths.

For details on available channel filters see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

SCPI command:

`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]`
on page 633

`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel` on page 633

`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<channel>`
on page 634

ACLR Reference ← Bandwidth ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR

Select the transmission channel to which the relative adjacent-channel power values should be referenced.

TX Channel 1	Transmission channel 1 is used.
Min Power TX Channel	The transmission channel with the lowest power is used as a reference channel.
Max Power TX Channel	The transmission channel with the highest power is used as a reference channel.
Lowest & Highest Channel	The outer left-hand transmission channel is the reference channel for the lower adjacent channels, the outer right-hand transmission channel that for the upper adjacent channels.

SCPI command:

`[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual` on page 639

`[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO` on page 639

Spacing ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR

Define the channel spacings for the TX channels and for the adjacent channels.

- TX channels (left column)

TX1-2	spacing between the first and the second carrier
TX2-3	spacing between the second and the third carrier
…	…

The spacings between all adjacent TX channels can be defined separately. When you change the spacing for one channel, the value is automatically also defined for all subsequent TX channels in order to set up a system with equal TX channel spacing quickly. For different spacings, a setup from top to bottom is necessary.

If the spacings are not equal, the channel distribution according to the center frequency is as follows:

Odd number of TX channels	The middle TX channel is centered to center frequency.
Even number of TX channels	The two TX channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

- Adjacent channels (right column)
  Since all the adjacent channels often have the same distance to each other, the modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, …): they are all multiplied by the same factor (new spacing value/old spacing value). Thus only one value needs to be entered in case of equal channel spacing. A modification of a higher adjacent-channel spacing (ALT1, ALT2, …) causes a change by the same factor in all higher adjacent-channel spacings, while the lower adjacent-channel spacings remain unchanged.
  Example:
  In the default setting, the adjacent channels have the following spacing: 20 kHz ("ADJ"), 40 kHz ("ALT1"), 60 kHz ("ALT2"), 80 kHz ("ALT3"), 100 kHz ("ALT4"), …
  If the spacing of the first adjacent channel ("ADJ") is set to 40 kHz, the spacing of all other adjacent channels is multiplied by factor 2 to result in 80 kHz ("ALT1"), 120 kHz ("ALT2"), 160 kHz ("ALT3"), …
  If, starting from the default setting, the spacing of the 5th adjacent channel ("ALT4") is set to 150 kHz, the spacing of all higher adjacent channels is multiplied by factor 1.5 to result in 180 kHz ("ALT5"), 210 kHz ("ALT6"), 240 kHz ("ALT7"), …
  If a ACLR or MC-ACLR measurement is started, all settings according to the standard including the channel bandwidths and channel spacings are set and can be adjusted afterwards.

SCPI command:

[SENSe:]POWer:ACHannel:SPACing:CHANnel<channel> on page 640

[SENSe:]POWer:ACHannel:SPACing[:ACHannel] on page 640

[SENSe:]POWer:ACHannel:SPACing:ALTernate<channel> on page 640

Names ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Define user-specific channel names for each channel. The names defined here are displayed in the result diagram and result table.

SCPI command:

[SENSe:]POWer:ACHannel:NAME:ACHannel on page 637

[SENSe:]POWer:ACHannel:NAME:ALTernate<channel> on page 637

[SENSe:]POWer:ACHannel:NAME:CHANnel<channel> on page 637

Weighting Filter ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Define weighting filters for all channels. Weighting filters are not available for all supported standards and cannot always be defined manually where they are available.

The dialog contains the following fields:

Field	Description
Channel	• TX 1-18: TX channels • ADJ: Adjacent channel • ALT1-11: Alternate channels
Active	Activates/Deactivates the weighting filter for the selected and any subsequent channels of the same type
Alpha	Defines the alpha value for the weighting filter for the selected and any subsequent channels of the same type

SCPI command:

`POW:ACH:FILT:CHAN1 ON`, see `[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel<channel>` on page 636

Activates the weighting filter for TX channel 1.

`POW:ACH:FILT:ALPH:CHAN1 0,35` see `[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<channel>` on page 635

Sets the alpha value for the weighting filter for TX channel 1 to 0,35.

`POW:ACH:FILT:ACH ON` see `[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel` on page 636

Activates the weighting filter for the adjacent channel.

`POW:ACH:FILT:ALPH:ACH 0,35` see `[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel` on page 634

Sets the alpha value for the weighting filter for the adjacent channel to 0,35.

`POW:ACH:FILT:ALT1 ON` see `[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTernate<channel>` on page 636

Activates the alpha value for the weighting filter for the alternate channel 1.

`POW:ACH:FILT:ALPH:ALT1 0,35` see `[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTernate<channel>` on page 635

Sets the alpha value for the weighting filter for the alternate channel 1 to 0,35.

Limits ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Activate and define the limits for the ACLR measurement.

Limit Checking ← Limits ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Activate or deactivate limit checking for the ACLR measurement.

The following rules apply for the limits:

- A separate limit can be defined for each adjacent channel. The limit applies to both the upper and the lower adjacent channel.
- A relative and/or absolute limit can be defined. The check of both limit values can be activated independently.
- The analyzer checks adherence to the limits irrespective of whether the limits are absolute or relative or whether the measurement is carried out with absolute or rel-

ative levels. If both limits are active and if the higher of both limit values is exceeded, the measured value is marked by a preceding asterisk.

SCPI command:

CALCulate<n>:LIMit<k>:ACPower[:STATe] on page 449

CALCulate<n>:LIMit<k>:ACPower:ACHannel:RESult on page 452

CALCulate<n>:LIMit<k>:ACPower:ALTernate<channel>[:RELative]
on page 453

Relative Limit ← Limits ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Defines a limit relative to the carrier signal.

SCPI command:

CALC:LIM:ACP ON, see CALCulate<n>:LIMit<k>:ACPower[:STATe]
on page 449
CALC:LIM:ACP:<adjacent-channel> 0dBc,0dBc
CALC:LIM:ACP:<adjacent-channel>:STAT ON

Absolute Limit ← Limits ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Defines an absolute limit.

SCPI command:

CALC:LIM:ACP ON, see CALCulate<n>:LIMit<k>:ACPower[:STATe]
on page 449
CALC:LIM:ACP:<adjacent-channel>:ABS -10dBm,-10dBm
CALC:LIM:ACP:<adjacent-channel>:ABS:STAT ON, see CALCulate<n>:
LIMit<k>:ACPower:ACHannel:ABSolute:STATe on page 451

Check ← Limits ← Channel Setup ← CP/ACLR Settings ← Ch Power ACLR
Activate or deactivate the limit to be considered during a limit check. The check of both limit values can be activated independently.

Chan Pwr/Hz ← CP/ACLR Settings ← Ch Power ACLR
If deactivated, the channel power is displayed in dBm. If activated, the channel power density is displayed instead. Thus, the absolute unit of the channel power is switched from dBm to dBm/Hz. The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:

"channel power density = channel power – $\log_{10}$(channel bandwidth)"

By means of this function it is possible e.g. to measure the signal/noise power density or use the additional functions "ACLR (Abs/Rel)" on page 199 and "ACLR Reference" on page 195 to obtain the signal to noise ratio.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult:PHZ on page 506

Power Mode ← CP/ACLR Settings ← Ch Power ACLR
Opens a submenu to select the power mode.

Clear/Write ← Power Mode ← CP/ACLR Settings ← Ch Power ACLR

If this mode is activated, the channel power and the adjacent channel powers are calculated directly from the current trace (default mode).

SCPI command:

CALC:MARK:FUNC:POW:MODE WRIT, see CALCulate<n>:MARKer<m>:FUNCtion:POWer:MODE on page 503

Max Hold ← Power Mode ← CP/ACLR Settings ← Ch Power ACLR

If this mode is activated, the power values are calculated from the current trace and compared with the previous power value using a maximum algorithm. The higher value is retained. If activated, the enhancement label "Pwr Max" is displayed.

SCPI command:

CALC:MARK:FUNC:POW:MODE MAXH, see CALCulate<n>:MARKer<m>:FUNCtion:POWer:MODE on page 503

Select Trace ← CP/ACLR Settings ← Ch Power ACLR

Opens an edit dialog box to enter the trace number on which the CP/ACLR measurement is to be performed. Only activated traces can be selected (for details on trace modes see chapter 3.2.8.4, "Trace Mode Overview", on page 140).

SCPI command:

[SENSe:]POWer:TRACe on page 642

ACLR (Abs/Rel) ← CP/ACLR Settings ← Ch Power ACLR

Switches between absolute and relative power measurement in the adjacent channels.

Abs	The absolute power in the adjacent channels is displayed in the unit of the y-axis, e.g. in dBm, dBμV.
Rel	The level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

SCPI command:

[SENSe:]POWer:ACHannel:MODE on page 636

Adjust Settings ← CP/ACLR Settings ← Ch Power ACLR

Automatically optimizes all instrument settings for the selected channel configuration (channel bandwidth, channel spacing) within a specific frequency range (channel bandwidth). The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

For details on the settings of span, resolution bandwidth, video bandwidth, detector and trace averaging see "Optimized Settings for CP/ACLR Test Parameters", on page 203.

SCPI command:

[SENSe:]POWer:ACHannel:PRESet on page 638

Sweep Time ← Ch Power ACLR

Opens an edit dialog box to enter the sweep time. With the RMS detector, a longer sweep time increases the stability of the measurement results.

The function of this softkey is identical to the Sweeptime Manual softkey in the "Bandwidth" menu.

SCPI command:

[SENSe:]SWEep:TIME on page 648

Fast ACLR (On/Off) ← Ch Power ACLR

Switches between the IBW method ("Fast ACLR Off") and the zero span method ("Fast ACLR On").

When switched on, the analyzer sets the center frequency consecutively to the different channel center frequencies and measures the power with the selected measurement time (= sweep time/number of channels). The RBW filters suitable for the selected standard and frequency offset are automatically used (e.g. root raised cos with IS 136). For details on available channel filters see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

The RMS detector is used for obtaining correct power measurement results. Therefore this requires no software correction factors.

Measured values are output as a list. The powers of the transmission channels are output in dBm, the powers of the adjacent channels in dBm.

The sweep time is selected depending on the desired reproducibility of results. Reproducibility increases with sweep time since power measurement is then performed over a longer time period. As a general approach, it can be assumed that approx. 500 non-correlated measured values are required for a reproducibility of 0.5 dB (99 % of the measurements are within 0.5 dB of the true measured value). This holds true for white noise. The measured values are considered as non-correlated if their time interval corresponds to the reciprocal of the measured bandwidth.

With IS 136 the measurement bandwidth is approx. 25 kHz, i.e. measured values at an interval of 40 μs are considered as non-correlated. A measurement time of 40 ms is thus required per channel for 1000 measured values. This is the default sweep time which the analyzer sets in coupled mode. Approx. 5000 measured values are required for a reproducibility of 0.1 dB (99 %), i.e. the measurement time is to be increased to 200 ms.

SCPI command:

[SENSe:]POWer:HSPeed on page 641

Set CP Reference ← Ch Power ACLR

Defines the currently measured channel power as the reference value if channel power measurement is activated. The reference value is displayed in the "Tx1 (Ref) Power" field; the default value is 0 dBm.

The softkey is available only for multi carrier ACLR measurements.

In adjacent-channel power measurement with one or several carrier signals, the power is always referenced to a transmission channel, i.e. no value is displayed for "Tx1 (Ref) Power".

SCPI command:

[SENSe:]POWer:ACHannel:REFerence:AUTO ONCE on page 639

User Standard ← Ch Power ACLR

Opens a submenu to configure customized standards.

Load ← User Standard ← Ch Power ACLR

Opens a dialog to select and load a user defined ACLR standard.

Note: Compatibility to R&S FSP. User standards created on an analyzer of the R&S FSP family are compatible to the R&S FSV. User standards created on an R&S FSV, however, are not necessarily compatible to the analyzers of the R&S FSP family and may not work there.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:CATalog on page 508

Queries all available standards

CALCulate<n>:MARKer<m>:FUNCtion:POWer:PRESet on page 503

Loads a standard

Save ← User Standard ← Ch Power ACLR

Saves the current ACLR configuration in an xml file in order for you to use it again at a later time. You can define the drive, path and file name in the corresponding dialog. The default location is C:\R_S\Instr\acp_std\.

Note that the ACLR user standard is not supported by Fast ACLR and Multi Carrier ACLR measurements.

If you create your own standard, you can customize the following parameters:

- number of adjacent channels
- channel bandwidth of transmission (Tx), adjacent (Adj) and alternate (Alt) channels
- channel spacings
- resolution and video bandwidth
- ACLR limits and their state
- sweep time and sweep time coupling
- detector
- trace mode

SCPI command:

"SENSe:POWer Subsystem", on page 632

to configure the ACLR settings

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:SAVE on page 509

to save the settings as a user standard

Delete ← User Standard ← Ch Power ACLR

Deletes the user standard that you select in the corresponding dialog box. Note that the analyzer deletes the file without further notice.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:DELete on page 508

Noise Correction ← Ch Power ACLR

If activated, the results are corrected by the instrument's inherent noise, which increases the dynamic range.

When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined.

The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A disable message is displayed on the screen.

To enable the correction function in conjunction with the changed setting, press the softkey once more. A new reference measurement is carried out.

SCPI command:

[SENSe:]POWer:NCORrection on page 642

Adjust Ref Lvl ← Ch Power ACLR
Adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the analyzer or limiting the dynamic range by a too small S/N ratio.

For details on manual settings see "Optimized Settings for CP/ACLR Test Parameters", on page 203.

The reference level is not influenced by the selection of a standard. To achieve an optimum dynamic range, the reference level has to be set in a way that places the signal maximum close to the reference level without forcing an overload message. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

SCPI command:

[SENSe:]POWer:AChannel:PRESet:RLEVel on page 638

Predefined CP/ACLR Standards

When using predefined standards for ACLR measurement, the test parameters for the channel and adjacent-channel measurements are configured automatically. The available standards are listed below.

Parameter	Standard
W-CDMA 3GPP FWD	W-CDMA 3.84 MHz forward
W-CDMA 3GPP REV	W-CDMA 3.84 MHz reverse
CDMA IS95A FWD	CDMA IS95A forward
EUTRa	EUTRA/LTE Square
REUTRa	EUTRA/LTE Square/RRC
CDMA IS95A REV	CDMA IS95A reverse
CDMA IS95C Class 0 FWD *)	CDMA IS95C Class 0 forward
CDMA IS95C Class 0 REV *)	CDMA IS95C Class 0 reverse
CDMA J-STD008 FWD	CDMA J-STD008 forward
CDMA J-STD008 REV	CDMA J-STD008 reverse
CDMA IS95C Class 1 FWD *)	CDMA IS95C Class 1 forward
CDMA IS95C Class 1 REV *)	CDMA IS95C Class 1 reverse
CDMA 2000	CDMA 2000

Parameter	Standard
TD SCDMA FWD	TD-SCDMA forward
TD SCDMA REV	TD-SCDMA reverse
WLAN 802.11A	WLAN 802.11A
WLAN 802.11B	WLAN 802.11B
WiMAX	WiMAX
WIBRO	WIBRO
RFID 14443	RFID 14443
TETRA	TETRA
PDC	PDC
PHS	PHS
CDPD	CDPD
GSM	GSM

For the analyzer, the channel spacing is defined as the distance between the center frequency of the adjacent channel and the center frequency of the transmission channel. The definition of the adjacent-channel spacing in standards IS95C and CDMA 2000 is different. These standards define the adjacent-channel spacing from the center of the transmission channel to the closest border of the adjacent channel. This definition is also used for the analyzer if the standards marked with an asterisk ***)** are selected.

Optimized Settings for CP/ACLR Test Parameters

The "Adjust Settings" softkey (see "Adjust Settings" on page 199) automatically optimizes all instrument settings for the selected channel configuration, as described in the following:

● **Frequency span**
  The frequency span must at least cover the channels to be measured plus a measurement margin of approx. 10 %.
  If the frequency span is large in comparison to the channel bandwidth (or the adjacent-channel bandwidths) being examined, only a few points on the trace are available per channel. This reduces the accuracy of the waveform calculation for the channel filter used, which has a negative effect on the measurement accuracy. It is therefore strongly recommended that the formulas mentioned be taken into consideration when selecting the frequency span.
  For channel power measurements the Adjust Settings softkey sets the frequency span as follows:
  "(No. of transmission channels – 1) x transmission channel spacing + 2 x transmission channel bandwidth + measurement margin"
  For adjacent-channel power measurements, the Adjust Settings softkey sets the frequency span as a function of the number of transmission channels, the transmission channel spacing, the adjacent-channel spacing, and the bandwidth of one of adja-

cent-channels ADJ, ALT1 or ALT2, whichever is furthest away from the transmission channels:

"(No. of transmission channels – 1) x transmission channel spacing + 2 x (adjacent-channel spacing + adjacent-channel bandwidth) + measurement margin"

The measurement margin is approx. 10 % of the value obtained by adding the channel spacing and the channel bandwidth.

- **Resolution bandwidth (RBW)**

  To ensure both, acceptable measurement speed and required selection (to suppress spectral components outside the channel to be measured, especially of the adjacent channels), the resolution bandwidth must not be selected too small or too large. As a general approach, the resolution bandwidth is to be set to values between 1% and 4% of the channel bandwidth.

  A larger resolution bandwidth can be selected if the spectrum within the channel to be measured and around it has a flat characteristic. In the standard setting, e.g. for standard IS95A REV at an adjacent channel bandwidth of 30 kHz, a resolution bandwidth of 30 kHz is used. This yields correct results since the spectrum in the neighborhood of the adjacent channels normally has a constant level.

  With the exception of the IS95 CDMA standards, the Adjust Settings softkey sets the resolution bandwidth (RBW) as a function of the channel bandwidth:

  "RBW ≤ 1/40 of channel bandwidth"

  The maximum possible resolution bandwidth (with respect to the requirement RBW ≤ 1/40) resulting from the available RBW steps (1, 3) is selected.

- **Video bandwidth (VBW)**

  For a correct power measurement, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). The video bandwidth should therefore be selected at least three times the resolution bandwidth:

  "VBW ≥ 3 x RBW"

  The Adjust Settings softkey sets the video bandwidth (VBW) as a function of the channel bandwidth (see formula above) and the smallest possible VBW with regard to the available step size will be selected.

- **Detector**

  The Adjust Settings softkey selects the RMS detector. This detector is selected since it correctly indicates the power irrespective of the characteristics of the signal to be measured. The whole IF envelope is used to calculate the power for each measurement point. The IF envelope is digitized using a sampling frequency which is at least five times the resolution bandwidth which has been selected. Based on the sample values, the power is calculated for each measurement point using the following formula:

$$P_{RMS} = \sqrt{\frac{1}{N} \cdot \sum_{i=1}^{N} s_i^2}$$

where:

"s_i = linear digitized video voltage at the output of the A/D converter"

"N = number of A/D converter values per measurement point"

"P_{RMS} = power represented by a measurement point"

When the power has been calculated, the power units are converted into decibels and the value is displayed as a measurement point.
In principle, the sample detector would be possible as well. Due to the limited number of measurement points used to calculate the power in the channel, the sample detector would yield less stable results.

- **Trace averaging**
  The Adjust Settings softkey switches off this function. Averaging, which is often performed to stabilize the measurement results, leads to a too low level indication and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel to be measured.

- **Reference level**
  The Adjust Settings softkey does not influence the reference level. It can be adjusted separately using the "Adjust Ref Lvl" softkey (see "Adjust Ref Lvl" on page 202).

3.3.5.3 Measuring the Carrier-to-Noise Ratio

1. Press the "C/N, C/NO" softkey to configure the carrier-to-noise ratio measurement.

   The corresponding submenu is displayed (see "C/N, C/No (span > 0)" on page 205).

2. To activate the measurements without reference to the bandwidth, press the "C/N" softkey (see "C/N (span > 0)" on page 206).

3. To activate the measurements with reference to the bandwidth, press the "C/NO" softkey (see "C/No (span > 0)" on page 206).

4. To change the channel bandwidth for the transmission channel, press the "Channel Bandwidth" softkey (see "Channel Bandwidth (span > 0)" on page 206).

To optimize the settings for the selected channel configuration, press the "Adjust Settings" softkey (see "Adjust Settings (span > 0)" on page 206). For details see also "Optimized Settings for CP/ACLR Test Parameters", on page 203.

Softkeys for Carrier-to-Noise Ratio Measurements

C/N, C/No (span > 0)
Opens a submenu to configure the carrier/noise ratio measurement. Measurements without (C/N) and measurements with reference to the bandwidth (C/No) are possible.

For general information on performing carrier-to-noise ratio measurements see chapter 3.3.5.3, "Measuring the Carrier-to-Noise Ratio", on page 205.

C/N (span > 0) ← **C/N, C/No (span > 0)**
Switches the measurement of the carrier/noise ratio on or off. If no marker is active, marker 1 is activated.

The measurement is performed on the trace where marker 1 is located. To shift marker 1 and measure another trace, use the Marker to Trace softkey in the "Marker To" menu. To determine the maximum value of the current trace, use the Phase Noise softkey in the "Marker Function" menu.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507
CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504
CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

C/No (span > 0) ← **C/N, C/No (span > 0)**
Switches the measurement of the carrier/noise ratio with reference to a 1 Hz bandwidth on or off. If no marker is active, marker 1 is activated.

The measurement is performed on the trace where marker 1 is located. To shift marker 1 and measure another trace, use the Marker to Trace softkey in the "Marker To" menu. To determine the maximum value of the current trace, use the Phase Noise softkey in the "Marker Function" menu.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507
CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504
CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

Channel Bandwidth (span > 0) ← **C/N, C/No (span > 0)**
Opens an edit dialog box to enter the measurement channel bandwidth for each channel.

The default setting is 14 kHz.

SCPI command:
[SENSe:]POWer:ACHannel:ACPairs on page 633

Adjust Settings (span > 0) ← **C/N, C/No (span > 0)**
Enables the RMS detector (see also chapter 3.2.8.6, "Detector Overview", on page 143) and adjusts the span to the selected channel bandwidth according to:

"4 x channel bandwidth + measurement margin"

The adjustment is performed once; if necessary, the setting can be changed later on.

SCPI command:
[SENSe:]POWer:ACHannel:PRESet on page 638

3.3.5.4 Measuring the Occupied Bandwidth

An important characteristic of a modulated signal is its occupied bandwidth. In a radio communications system for instance the occupied bandwidth must be limited to enable distortion-free transmission in adjacent channels. The occupied bandwidth is defined as the bandwidth containing a defined percentage of the total transmitted power. A percentage between 10 % and 99.9 % can be set.

The measurement principle is the following: The bandwidth containing 99% of the signal power is to be determined, for example. The routine first calculates the total power of all displayed points of the trace. In the next step, the points from the right edge of the trace are summed up until 0.5 % of the total power is reached. Auxiliary marker 1 is positioned at the corresponding frequency. Then the points from the left edge of the trace are summed up until 0.5 % of the power is reached. Auxiliary marker 2 is positioned at this point. 99 % of the power is now between the two markers. The distance between the two frequency markers is the occupied bandwidth which is displayed in the marker field.

To ensure correct power measurement, especially for noise signals, and to obtain the correct occupied bandwidth, the following prerequisites and settings are necessary:

● Only the signal to be measured is displayed on the screen. An additional signal would falsify the measurement.

● RBW << occupied bandwidth

● (approx. 1/20 of occupied bandwidth, for voice communication type 300 Hz or 1 kHz)

● VBW ≥ 3 x RBW

● RMS detector

● Span ≥ 2 to 3 x occupied bandwidth

Some of the measurement specifications (e.g. PDC, RCR STD-27B) require measurement of the occupied bandwidth using a peak detector. The detector setting of the analyzer has to be changed accordingly then.

A measurement example is described in chapter 4.3.5, "Occupied Bandwidth Measurement", on page 794.

Procedure

1. Press the "OBW" softkey to activate the measurement of the occupied bandwidth (see "OBW (span > 0)" on page 208).

   The corresponding submenu is displayed.

2. Press the "% Power Bandwidth" softkey to enter the percentage of power (see "% Power Bandwidth (span > 0)" on page 208).

3. To change the channel bandwidth for the transmission channel, press the "Channel Bandwidth" softkey (see "Channel Bandwidth (span > 0)" on page 208).

4. To optimize the settings for the selected channel configuration, press the "Adjust Settings" softkey (see "Adjust Settings" on page 199). For details see also "Optimized Settings for CP/ACLR Test Parameters", on page 203.

5. To adjust the reference level to the measured total power after the first sweep, press the "Adjust Ref Lvl" softkey (see "Adjust Ref Lvl" on page 202).

Softkeys for Occupied Bandwidth (OBW) Measurements

OBW (span > 0)

Activates measurement of the occupied bandwidth according to the current configuration and opens a submenu to configure the measurement. The occupied bandwidth is displayed in the marker display field and marked on the trace by temporary markers. For details see chapter 3.3.5.4, "Measuring the Occupied Bandwidth", on page 206.

The measurement is performed on the trace with marker 1. In order to evaluate another trace, marker 1 must be placed on another trace (see the Marker to Trace softkey in the "Marker" menu).

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect on page 507

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult on page 504

CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] on page 503

% Power Bandwidth (span > 0) ← OBW (span > 0)

Opens an edit dialog box to enter the percentage of total power in the displayed frequency range which defines the occupied bandwidth. Values from 10% to 99.9% are allowed.

SCPI command:

[SENSe:]POWer:BANDwidth|BWIDth on page 641

Channel Bandwidth (span > 0) ← OBW (span > 0)

Opens an edit dialog box to enter the channel bandwidth for the transmission channel. The specified channel bandwidth is used for optimization of the test parameters (for details see "Optimized Settings for CP/ACLR Test Parameters", on page 203). The default setting is 14 kHz.

For measurements in line with a specific transmission standard, the bandwidth specified by the standard for the transmission channel must be entered.

SCPI command:

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]
on page 633

Adjust Ref Lvl (span > 0) ← OBW (span > 0)

Adjusts the reference level to the measured total power of the signal. the softkey is activated after the first sweep with active measurement of the occupied bandwidth has been completed and the total power of the signal is thus known.

Adjusting the reference level ensures that the signal path will not be overloaded and the dynamic range not limited by too low a reference level. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is distinctly below the reference level. If the measured channel power is equal to the reference level, the signal path cannot be overloaded.

SCPI command:

[SENSe:]POWer:ACHannel:PRESet:RLEVel on page 638

Adjust Settings ← OBW (span > 0)

Automatically optimizes all instrument settings for the selected channel configuration (channel bandwidth, channel spacing) within a specific frequency range (channel bandwidth). The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

For details on the settings of span, resolution bandwidth, video bandwidth, detector and trace averaging see "Optimized Settings for CP/ACLR Test Parameters", on page 203.

SCPI command:

[SENSe:]POWer:ACHannel:PRESet on page 638

3.3.5.5 Measuring with Spectrum Emission Masks

The Spectrum Emission Mask (SEM) measurement defines a measurement that monitors compliance with a spectral mask. It is performed using the Spectrum Emission Mask softkey in the "Measurement" menu.

The SEM measurement of the base unit allows a flexible definition of all parameters in the SEM measurement. Most parameters are defined in the "Sweep List" dialog box (see "Sweep List dialog box" on page 211). After a preset, the sweep list contains a set of default ranges and parameters. For each range, you can change the parameters. For information on other SEM settings, see the description of the corresponding softkeys ("Spectrum Emission Mask" on page 210).

If you want a parameter set to be available permanently, you can create an XML file for this configuration and, if necessary, export this file to another application (for details refer to "Format Description of Spectrum Emission Mask XML Files", on page 223 and "ASCII File Export Format (Spectrum Emission Mask)", on page 228).

Some predefined XML files are provided that contain ranges and parameters according to the selected standard (see "Provided XML Files for the Spectrum Emission Mask Measurement", on page 220).

In order to improve the performance of the FSV for spectrum emission mask measurements, a "Fast SEM" mode is available. For details see "Fast Spectrum Emission Mask Measurements", on page 229.

A measurement example is described in chapter 4.3.12, "Spectrum Emission Mask Measurement", on page 805.

Softkeys for Spectrum Emission Mask (SEM) Measurements

Spectrum Emission Mask

Opens a submenu to configure the Spectrum Emission Mask measurement.

The Spectrum Emission Mask (SEM) measurement defines a measurement that moni-tors compliance with a spectral mask. The SEM measurement of the base unit allows a flexible definition of all parameters in the SEM measurement.

For general information on performing SEM measurements, see chapter 3.3.5.5, "Measuring with Spectrum Emission Masks", on page 209.

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-12.750 MHz	-8.000 MHz	1.000 MHz	90.720 MHz	-55.41 dBm	-58.80 dB	-30.26 dB
-8.000 MHz	-4.000 MHz	1.000 MHz	95.907 MHz	-54.36 dBm	-57.75 dB	-32.72 dB
-4.000 MHz	-3.515 MHz	30.000 kHz	96.056 MHz	-70.48 dBm	-73.87 dB	-37.11 dB
-3.515 MHz	-2.715 MHz	30.000 kHz	96.504 MHz	-71.29 dBm	-74.68 dB	-39.93 dB
-2.715 MHz	-2.515 MHz	30.000 kHz	97.425 MHz	-71.68 dBm	-75.07 dB	-49.48 dB
2.515 MHz	2.715 MHz	30.000 kHz	102.615 MHz	-69.91 dBm	-73.30 dB	-49.41 dB
2.715 MHz	3.515 MHz	30.000 kHz	103.496 MHz	-70.88 dBm	-74.27 dB	-38.67 dB
3.515 MHz	4.000 MHz	30.000 kHz	103.758 MHz	-69.18 dBm	-72.57 dB	-36.68 dB
4.000 MHz	8.000 MHz	1.000 MHz	104.870 MHz	-50.15 dBm	-53.54 dB	-30.65 dB
8.000 MHz	12.750 MHz	1.000 MHz	112.212 MHz	-54.11 dBm	-57.50 dB	-30.61 dB

SCPI command:

`SENS:SWE:MODE ESP`, see `[SENSe:]SWEep:MODE` on page 647

Sweep List ← Spectrum Emission Mask
Opens a submenu to edit the sweep list and displays the "Sweep List" dialog box

Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
After a preset, the sweep list contains a set of default ranges and parameters. For each range, you can change the parameters listed below. To insert or delete ranges, use the "Insert Before Range", "Insert After Range", "Delete Range" softkeys. The measurement results are not updated during editing but on closing the dialog box ("Edit Sweep List/ Close Sweep List" softkey, see "Edit Sweep List/Close Sweep List" on page 214).

The changes of the sweep list are only kept until you load another parameter set (by pressing PRESET or by loading an XML file). If you want a parameter set to be available permanently, create an XML file for this configuration (for details refer to "Format Description of Spectrum Emission Mask XML Files", on page 223).

If you load one of the provided XML files ("Load Standard" softkey, see "Load Standard" on page 219), the sweep list contains ranges and parameters according to the selected standard. For further details refer also to "Provided XML Files for the Spectrum Emission Mask Measurement", on page 220.

Note: If you edit the sweep list, always follow the rules and consider the limitations described in "Ranges and Range Settings", on page 220.

Range Start / Range Stop ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets the start frequency/stop frequency of the selected range. Follow the rules described in "Ranges and Range Settings", on page 220.

In order to change the start/stop frequency of the first/last range, select the appropriate span with the SPAN key. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Frequency values for each range have to be defined relative to the center frequency. The reference range has to be centered on the center frequency. The minimum span of the reference range is given by the current TX Bandwidth.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>[:FREQuency]:STARt on page 593
[SENSe:]ESPectrum:RANGe<range>[:FREQuency]:STOP on page 594

Fast SEM ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Activates Fast SEM mode for all ranges in the sweep list. For details see "Fast Spectrum Emission Mask Measurements", on page 229.

SCPI command:
[SENSe:]ESPectrum:HighSPeed on page 591

Filter Type ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets the filter type for this range. For details on filters see also chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:FILTer:TYPE on page 594

RBW ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets the RBW value for this range.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:BANDwidth on page 592

VBW ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets the VBW value for this range.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:BANDwidth:VIDeo on page 593

Sweep Time Mode ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Activates or deactivates the auto mode for the sweep time.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME:AUTO on page 599

Sweep Time ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Sets the sweep time value for the range.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME on page 599

Ref. Level ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Sets the reference level for the range.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:RLEVel on page 598

RF Att. Mode ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Activates or deactivates the auto mode for RF attenuation.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:INPut:ATTenuation:AUTO on page 595

RF Attenuator ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Sets the attenuation value for that range.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:INPut:ATTenuation on page 595

Preamp ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Switches the preamplifier on or off.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:INPut:GAIN:STATe on page 596

Transd. Factor ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Sets a transducer for the specified range. You can only choose a transducer that fulfills
the following conditions:

● The transducer overlaps or equals the span of the range.
● The x-axis is linear.
● The unit is dB.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:TRANsducer on page 599

Limit Check 1-4 ← **Sweep List dialog box** ← **Sweep List** ← **Spectrum Emission Mask**
Sets the type of limit check for all ranges. Possible states are:

Table 3-5: Spectrum Emission Mask measurements:

Absolute	Checks only the absolute limits defined.
Relative	Checks only the relative limits. Relative limits are defined as relative to the measured power in the reference range.
Abs and Rel	Combines the absolute and relative limit. The limit check fails when both limits are violated.
Abs or Rel	Combines the absolute and relative limit. The limit check fails when one of the limits is violated.

The limit state affects the availability of all limit settings ("Abs Limit Start" on page 214, "Abs Limit Stop" on page 214, "Rel Limit Start" on page 214, "Rel Limit Stop" on page 214).

Depending on the number of active power classes (see "Power Class" dialog box), the number of limits that can be set varies. Up to four limits are possible. The sweep list is extended accordingly.

SCPI command:

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:STATe on page 598

CALCulate<n>:LIMit<k>:FAIL on page 446

Abs Limit Start ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets an absolute limit value at the start frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "Limit Check 1-4" on page 213).

SCPI command:

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:ABSolute:STARt
on page 596

Abs Limit Stop ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets an absolute limit value at the stop frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "Limit Check 1-4" on page 213).

SCPI command:

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:ABSolute:STOP
on page 597

Rel Limit Start ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets a relative limit value at the start frequency of the range [dBc].

This parameter is only available if the limit check is set accordingly (see "Limit Check 1-4" on page 213).

SCPI command:

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:RELative:STARt
on page 597

Rel Limit Stop ← Sweep List dialog box ← Sweep List ← Spectrum Emission Mask
Sets a relative limit value at the stop frequency of the range [dBc].

This parameter is only available if the limit check is set accordingly (see "Sweep List dialog box" on page 211).

SCPI command:

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:RELative:STOP
on page 597

Edit Sweep List/Close Sweep List ← Sweep List ← Spectrum Emission Mask
Opens/closes the "Sweep List" dialog box. Closing the dialog box updates the measurement results.

Insert before Range ← **Sweep List** ← **Spectrum Emission Mask**

Inserts a new range to the left of the currently focused range. The range numbers of the currently focused range and all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:

`ESP:RANG3:INS BEF`, see `[SENSe:]ESPectrum:RANGe<range>:INSert` on page 596

Insert after Range ← **Sweep List** ← **Spectrum Emission Mask**

Inserts a new range to the right of the currently focused range. The range numbers of all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:

`ESP:RANG1:INS AFT`, see `[SENSe:]ESPectrum:RANGe<range>:INSert` on page 596

Delete Range ← **Sweep List** ← **Spectrum Emission Mask**

Deletes the currently focused range, if possible. The range numbers are updated accordingly. For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:

`[SENSe:]ESPectrum:RANGe<range>:DELete` on page 593

Edit Reference Range ← **Sweep List** ← **Spectrum Emission Mask**

Opens the "Reference Range" dialog box to edit the additional settings used for SEM measurements.

Two different power reference types are supported:

- "Peak Power"
  Measures the highest peak within the reference range.
- "Channel Power"
  Measures the channel power within the reference range (integral bandwidth method).

If the "Channel Power" reference power type is activated, the dialog box is extended to define additional settings:

- "Tx Bandwidth"
  Defines the bandwidth used for measuring the channel power:
  minimum span ≤ value ≤ span of reference range
- "RRC Filter State"
  Activates or deactivates the use of an RRC filter.
- "RRC Filter Settings"
  Sets the alpha value of the RRC filter. This window is only available if the RRC filter is activated.

For further details refer to .

SCPI command:

[SENSe:]ESPectrum:RTYPe on page 600

[SENSe:]ESPectrum:BWID on page 590

[SENSe:]ESPectrum:FILTer[:RRC][:STATe] on page 590

[SENSe:]ESPectrum:FILTer[:RRC]:ALPHa on page 590

List Evaluation ← Spectrum Emission Mask
Opens a submenu to edit the list evaluation settings.

List Evaluation (On/Off) ← List Evaluation ← Spectrum Emission Mask
Activates or deactivates the list evaluation.

SCPI command:
CALCulate<n>:PSEarch|PEAKsearch:AUTO on page 533

TRACe<n>[:DATA] on page 675

Margin ← List Evaluation ← Spectrum Emission Mask
Opens an edit dialog box to enter the margin used for the limit check/peak search.

SCPI command:
CALCulate<n>:PSEarch|PEAKsearch:MARGin on page 533

Show Peaks ← List Evaluation ← Spectrum Emission Mask
In the diagram, marks all peaks with blue squares that have been listed during an active list evaluation.

SCPI command:
CALCulate<n>:PSEarch|PEAKsearch:PSHow on page 534

Save Evaluation List ← List Evaluation ← Spectrum Emission Mask
Opens the "ASCII File Export Name" dialog box to save the result in ASCII format to a specified file and directory. For further details refer also to the "ASCII File Export" softkey ().

SCPI command:
MMEMory:STORe<n>:LIST on page 571

ASCII File Export ← Save Evaluation List ← List Evaluation ← Spectrum Emission Mask

Opens the "ASCII File Export Name" dialog box and saves the active peak list in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the marker data. For details on an ASCII file see chapter 3.2.8.7, "ASCII File Export Format", on page 144.

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "Decim Sep" softkey (see "Decim Sep" on page 85).

An example of an output file for Spectrum Emission Mask measurements is given in "ASCII File Export Format (Spectrum Emission Mask)", on page 228.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

MMEMory:STORe<n>:LIST on page 571

Decim Sep ← Save Evaluation List ← List Evaluation ← Spectrum Emission Mask

Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

Edit Reference Range ← Spectrum Emission Mask

Opens the "Reference Range" dialog box to edit the additional settings used for SEM measurements.

Two different power reference types are supported:

- "Peak Power"
  Measures the highest peak within the reference range.
- "Channel Power"

Measures the channel power within the reference range (integral bandwidth method). If the "Channel Power" reference power type is activated, the dialog box is extended to define additional settings:

● "Tx Bandwidth"
Defines the bandwidth used for measuring the channel power:
minimum span ≤ value ≤ span of reference range
● "RRC Filter State"
Activates or deactivates the use of an RRC filter.
● "RRC Filter Settings"
Sets the alpha value of the RRC filter. This window is only available if the RRC filter is activated.

For further details refer to

SCPI command:
`[SENSe:]ESPectrum:RTYPe` on page 600
`[SENSe:]ESPectrum:BWID` on page 590
`[SENSe:]ESPectrum:FILTer[:RRC][:STATe]` on page 590
`[SENSe:]ESPectrum:FILTer[:RRC]:ALPHa` on page 590

Edit Power Classes ← Spectrum Emission Mask
Opens a dialog box to modify the power class settings.
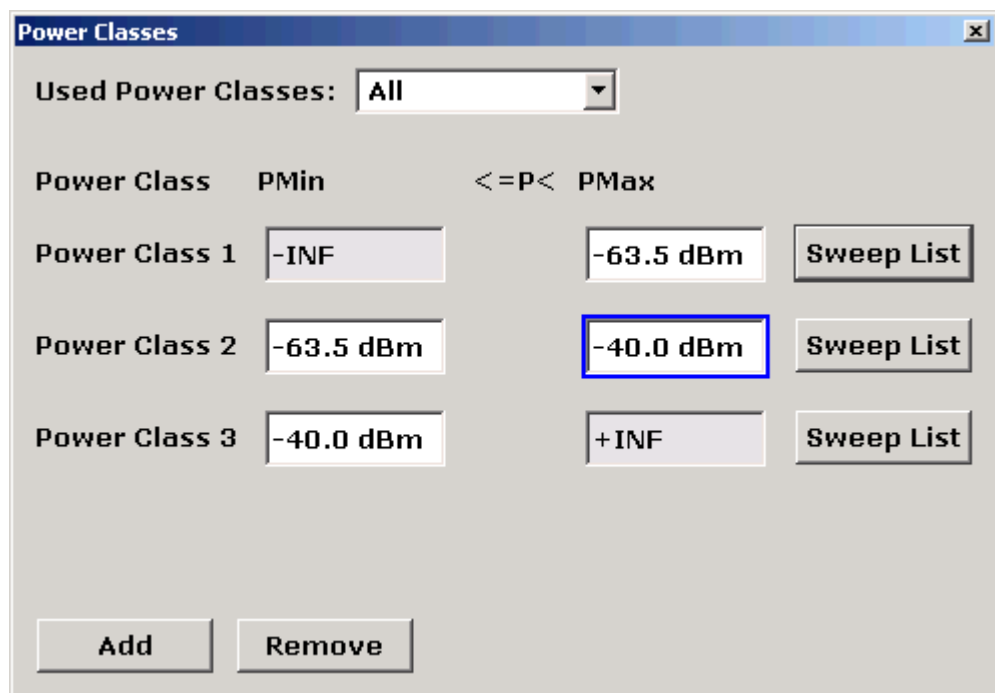
Used Power Classes ← Edit Power Classes ← Spectrum Emission Mask
Choose the power classes to be used from this dropdown menu. It is only possible to select either one of the defined power classes or all of the defined power classes together.

Only power classes for which limits are defined are available for selection.

If "All" is selected, the power class that corresponds to the currently measured power in the reference range is used. The limits assigned to that power class are applied (see "PMin/PMax" on page 219).

SCPI command:

`CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>[:EXCLusive]` on page 461

To define all limits in one step:

`CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:LIMit[:STATe]` on page 462

PMin/PMax ← **Edit Power Classes** ← **Spectrum Emission Mask**
Defines the level limits for each power class. The range always starts at -200 dBm (-INF) and always stops at 200 dBm (+INF). These fields cannot be modified. If more than one Power Class is defined, the value of "PMin" must be equal to the value of "PMax" of the last Power Class and vice versa.

Note that the power level may be equal to the lower limit, but must be lower than the upper limit:

$P_{min} \leqq P < P_{max}$

SCPI command:

`CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:MINimum` on page 463
`CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:MAXimum` on page 462

Sweep List ← **Edit Power Classes** ← **Spectrum Emission Mask**
See "Sweep List" on page 211

Add/Remove ← **Edit Power Classes** ← **Spectrum Emission Mask**
Activates or deactivates power classes to be defined. Up to four power classes can be defined. The number of active power classes affects the availability of the items of the Used Power Classes dropdown menu.

SCPI command:

`CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>[:EXCLusive]` on page 461

Load Standard ← **Spectrum Emission Mask**
Opens a dialog box to select an XML file which includes the desired standard specification. For details on the provided XML files refer to "Provided XML Files for the Spectrum Emission Mask Measurement", on page 220.

SCPI command:

`[SENSe:]ESPectrum:PRESet[:STANdard]` on page 591

Save As Standard ← **Spectrum Emission Mask**
Opens the "Save As Standard" dialog box, in which the currently used SEM settings and parameters can be saved and exported into an *.xml file. Enter the name of the file in the "File name" field. For details on the structure and contents of the XML file refer to "Format Description of Spectrum Emission Mask XML Files", on page 223.

SCPI command:

`[SENSe:]ESPectrum:PRESet:STORe` on page 592

Meas Start/Stop ← Spectrum Emission Mask

Aborts/restarts the current measurement and displays the status:

"Start"	The measurement is currently running.
"Stop"	The measurement has been stopped, or, in single sweep mode, the end of the sweep has been reached.

SCPI command:

ABORt on page 421

INITiate<n>:ESPectrum on page 560

Restore Standard Files ← Spectrum Emission Mask

Copies the XML files from the C:\R_S\instr\sem_backup folder to the C:\R_S\instr\sem_std folder. Files of the same name are overwritten.

SCPI command:

[SENSe:]ESPectrum:PRESet:RESTore on page 592

Ranges and Range Settings

In the Spectrum Emission Mask measurements, a range defines a segment for which you can define the following parameters separately: start and stop frequency, RBW, VBW, sweep time, sweep points, reference level, attenuator settings, and limit values. Via the sweep list, you define the ranges and their settings (for details on settings refer to "Sweep List dialog box" on page 211).

The following rules apply to ranges:

- The minimum span of a range is 20 Hz.
- The individual ranges must not overlap (but need not directly follow one another).
- The maximum number of ranges is 20.
- A minimum of three ranges is mandatory.
- The reference range cannot be deleted (it is marked in blue color).

In order to change the start/stop frequency of the first/last range, select the appropriate span with the SPAN key. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Frequency values for each range have to be defined relative to the center frequency. The reference range has to be centered on the center frequency. The minimum span of the reference range is given by the current TX Bandwidth.

Provided XML Files for the Spectrum Emission Mask Measurement

You can change the settings manually or via XML files. The XML files offer a quick way to change the configuration. A set of ready-made XML files for different standards is already provided. For details see table 3-6table 3-6. You can also create and use your own XML files (for details see "Format Description of Spectrum Emission Mask XML Files", on page 223). All XML files are stored under "C:\r_s\instr\sem_std". Use the "Load Standard" softkey for quick access to the available XML files (see "Load Standard" on page 219).

Table 3-6: Provided XML files

Path	XML file name	Displayed standard character-istics*
cdma2000\DL	default0.xml	CDMA2000 BC0 DL
	default1.xml	CDMA2000 BC1 DL
cdma2000\UL	default0.xml	CDMA2000 BC0 UL
	default1.xml	CDMA2000 BC1 UL
WCDMA\3GPP\DL	PowerClass_31_39.xml	W-CDMA 3GPP (31,39)dBm DL
	PowerClass_39_43.xml	W-CDMA 3GPP (39,43)dBm DL
	PowerClass_43_INF.xml	W-CDMA 3GPP (43,INF)dBm DL
	PowerClass_negINF_31.xml	W-CDMA 3GPP (-INF,31)dBm DL
WIBRO\DL	PowerClass_29_40.xml	WiBro TTA (29,40)dBm DL
	PowerClass_40_INF.xml	WiBro TTA (40,INF)dBm DL
	PowerClass_negINF_29.xml	WiBro TTA (-INF,29)dBm DL
WIBRO\UL	PowerClass_23_INF.xml	WiBro TTA (23,INF)dBm UL
	PowerClass_negINF_23.xml	WiBro TTA (23,INF)dBm UL
WIMAX\DL\ETSI\…MHz (1.75 MHz, 2.00 MHz, 3.5 MHz, 7.00 MHz, 14.00 MHz, 28 MHz)	System_Type_E.xml	WIMAX System Type E DL
	System_Type_F.xml	WIMAX System Type F DL
	System_Type_G.xml	WIMAX System Type G DL
WIMAX\DL\IEEE	10MHz.xml	WIMAX 10MHz DL
	20MHz.xml	WIMAX 20MHz DL
WIMAX\UL\ETSI…MHz (1.75 MHz, 2.00 MHz, 3.5 MHz, 7.00 MHz, 14.00 MHz, 28 MHz)	System_Type_E.xml	WIMAX System Type E UL
	System_Type_F.xml	WIMAX System Type F UL
	System_Type_G.xml	WIMAX System Type G UL
WIMAX\UL\IEEE	10MHz.xml	WIMAX 10MHz UL
	20MHz.xml	WIMAX 20MHz UL
WLAN\802_11_TURBO	ETSI.xml	IEEE 802.11
	IEEE.xml	IEEE 802.11
WLAN\802_11a	ETSI.xml	IEEE 802.11a
	IEEE.xml	IEEE 802.11a
WLAN\802_11b	IEEE.xml	IEEE 802.11b
WLAN\802_11j_10MHz	ETSI.xml	IEEE.802.11j

Path	XML file name	Displayed standard character-istics*
	IEEE.xml	IEEE.802.11j
WLAN\802_11j_20MHz	ETSI.xml	IEEE 802.11j
	IEEE.xml	IEEE 802.11j
EUTRA-LTE\DL\CategoryA\	BW_01_4_MHz__CFhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_01_4_MHz__CFlower1GHz.xml	LTE Cat. A <1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_03_0_MHz__CFhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_03_0_MHz__CFlower1GHz.xml	LTE Cat. A <1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_05_0_MHz__CFhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_05_0_MHz__CFlower1GHz.xml	LTE Cat. A <1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_10_0_MHz__Cfhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_10_0_MHz__Cflower1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_15_0_MHz__CFhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_15_0_MHz__CFlower1GHz.xml	LTE Cat. A <1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_20_0_MHz__CFhigher1GHz.xml	LTE Cat. A >1GHz DL
EUTRA-LTE\DL\CategoryA\	BW_20_0_MHz__CFlower1GHz.xml	LTE Cat. A <1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_01_4_MHz__CFhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_01_4_MHz__CFlower1GHz.xml	LTE Cat. B <1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_03_0_MHz__CFhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_03_0_MHz__CFlower1GHz.xml	LTE Cat. B <1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_05_0_MHz__CFhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_05_0_MHz__CFlower1GHz.xml	LTE Cat. B <1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_10_0_MHz__Cfhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_10_0_MHz__Cflower1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_15_0_MHz__CFhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_15_0_MHz__CFlower1GHz.xml	LTE Cat. B <1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_20_0_MHz__CFhigher1GHz.xml	LTE Cat. B >1GHz DL
EUTRA-LTE\DL\CategoryB\	BW_20_0_MHz__CFlower1GHz.xml	LTE Cat. B <1GHz DL

Path	XML file name	Displayed standard characteristics*
EUTRA-LTE\UL\Standard\	BW_05_0_MHz.xml	LTE UL
EUTRA-LTE\UL\Standard\	BW_10_0_MHz.xml	LTE UL
EUTRA-LTE\UL\Standard\	BW_15_0_MHz.xml	LTE UL
EUTRA-LTE\UL\Standard\	BW_20_0_MHz.xml	LTE UL

*Used abbreviations:

BC: band class

UL: uplink

DL: downlink

TTA: Telecommunications Technology Association

Format Description of Spectrum Emission Mask XML Files

The files for importing range settings are in XML format and therefore obey the rules of the XML standard. Below, the child nodes, attributes, and structure defined for the data import is described. Build your own XML files according to these conventions because the analyzer can only interpret XML files of a known structure. For example files look in the `C:\r_s\instr\sem_std directory`.

> Be sure to follow the structure exactly as shown below or else the analyzer is not able to interpret the XML file and error messages are shown on the screen. Therefore, we recommend you make a copy of an existing file (see "Save as Standard" softkey, "Save As Standard" on page 219) and edit the copy of the file. The default files can be found in the `C:\r_s\instr\sem_std` directory.
>
> Alternatively, edit the settings using the "Spectrum Emission Mask" softkey and the Sweep List dialog box and save the XML file with the (Save As Standard) softkey afterwards. This way, no modifications have to be done in the XML file itself.

Basically, the file consists of three elements that can be defined:

- "Format Description of Spectrum Emission Mask XML Files", on page 223
- "Format Description of Spectrum Emission Mask XML Files", on page 223
- "Format Description of Spectrum Emission Mask XML Files", on page 223

The "BaseFormat" element

It carries information about basic settings. In this element only the "ReferencePower" child node has any effects on the measurement itself. The other attributes and child nodes are used to display information about the Spectrum Emission Mask Standard on the measurement screen. The child nodes and attributes of this element are shown in table 3-7.

Spectrum Emission Mask Standard:			W-CDMA 3GPP DL (39,43)dBm			
Tx Power	-70.75 dBm	Tx Bandwidth	3.840 MHz	RBW		1 MHz
Range [Hz]		RBW [Hz]	Frequency [Hz]	PwrAbs [dBm]	PwrRel [dBc]	ΔLimit [dB]
-12.750 M	-8.000 M	1 M	2.991974 G	-77.89	-7.14	47.36 ↑
-8.000 M	-4.000 M	1 M	2.995923 G	-93.74	-22.99	-82.24
-4.000 M	-3.515 M	30 k	2.996404 G	-100.18	-29.43	-75.68
-3.515 M	-2.715 M	30 k	2.996512 G	-105.54	-34.78	-81.04
-2.715 M	-2.515 M	30 k	2.997318 G	-105.54	-34.78	-93.04
2.515 M	2.715 M	30 k	3.002548 G	-105.54	-34.78	-93.04
2.715 M	3.515 M	30 k	3.003382 G	-102.45	-31.70	-79.95
3.515 M	4.000 M	30 k	3.003919 G	-100.18	-29.43	-75.68
4.000 M	8.000 M	1 M	3.004026 G	-105.54	-34.78	-81.04
8.000 M	12.750 M	1 M	3.012724 G	-77.89	-7.14	47.36 ↑

In the example above ("`PowerClass_39_43.xml`" under "`C:
\r_s\instr\sem_std\WCDMA\3GPP`"), these attributes are defined as follows:

- Standard="W-CDMA 3GPP"
- LinkDirection="DL"
- PowerClass="(39,43)dBm"

The "PowerClass" element

It is embedded in the "BaseFormat" element and contains settings information about the power classes. Up to four different power classes can be defined. For details refer to the "Sweep List" softkey ("Sweep List" on page 211) and the corresponding parameter description. The child nodes and attributes of this element are shown in table 3-8.

The "Range" element

This element is embedded in the "PowerClass" element. It contains the settings information of the range. There have to be at least three defined ranges: one reference range and at least one range to either side of the reference range. The maximum number of ranges is 20. Note that the analyzer uses the same ranges in each power class. Therefore, the contents of the ranges of each defined power class have to be identical to the first power class. An exception are the Start and Stop values of the two Limit nodes that are used to determine the power class. Note also, that there are two Limit nodes to be defined: one that gives the limit in absolute values and one in relative values. Make sure units for the Start and Stop nodes are identical for each Limit node.

For details refer to the "Sweep List" softkey ("Sweep List" on page 211) and the corresponding parameter description. The child nodes and attributes of this element are shown in table 3-9.

The following tables show the child nodes and attributes of each element and show if a child node or attribute is mandatory for the analyzer to interpret the file or not. Since the hierarchy of the XML can not be seen in the tables, either view one of the default files already stored on the analyzer in the "`C:\r_s\instr\sem_std`" directory or check the structure as shown below.

Below, a basic example of the structure of the file is shown, containing all mandatory attributes and child nodes. Note that the "PowerClass" element and the range element are themselves elements of the "BaseFormat" element and are to be inserted where noted. The separation is done here simply for reasons of a better overview. Also, no

example values are given here to allow a quick reference to the tables above. Italic font shows the placeholders for the values.

- The "BaseFormat" element is structured as follows:
    - <RS_SEM_ACP_FileFormat Version=""1.0.0.0"">
      <Name>"Standard"</Name>
      <Instrument>
      <Type>"Instrument Type"</Type>
      <Application>"Application"</Application>
      </Instrument>
      <LinkDirection Name=""Name"">
      <ReferencePower>
      <Method>"Method"</Method>
      </ReferencePower>
      <PowerClass Index=""n"">
      <!-- For contents of the PowerClass node see
      table 3-8 -->
      <!-- Define up to four PowerClass nodes -->
      </PowerClass>
      </LinkDirection>
      </RS_SEM_ACP_File>

- The PowerClass element is structured as follows:
    - <PowerClass Index=""n"">
      <StartPower Unit=""dBm"" InclusiveFlag=""true"" Value=""StartPowerValue""/>
      <StopPower Unit=""dBm"" InclusiveFlag=""false"" Value=""StopPowerValue""/>
      <DefaultLimitFailMode>"Limit Fail Mode"</DefaultLimitFailMode>
      <Range Index=""n"">
      <!-- For contents of the Range node see table 3-9 -->
      <!-- Define up to twenty Range nodes -->
      </Range>
      …
      </PowerClass>

- The Range element is structured as follows:
    - <Range Index=""n"">
      <Name=""Name"">
      <ChannelType>"Channel Type"</Channel Type>
      <WeightingFilter>
      <Type>"FilterType"</Type>
      <RollOffFactor>"Factor"</RollOffFactor>
      <Bandwith>"Bandwidth"</Bandwidth>
      </WeightingFilter>
      <FrequencyRange>
      <Start>"RangeStart"</Start>
      <Stop>"RangeStop"</Stop>
      </FrequencyRange>
      <Limit>
      <Start Unit=""Unit"" Value=""Value""/>
      <Stop Unit=""Unit"" Value=""Value""/>
      </Limit>
      <Limit>

```
<Start Unit="""Unit""" Value="""Value"""/>
<Stop Unit="""Unit""" Value="""Value"""/>
</Limit>
<RBW Bandwidth="""Bandwidth""" Type="""FilterType"""/>
<VBW Bandwidth="""Bandwidth"""/>
<Detector>"Detector"</Detector>
<Sweep Mode="""SweepMode""" Time="""SweepTime"""/>
<Amplitude>
<ReferenceLevel Unit="""dBm""" Value="""Value"""/>
<RFAttenuation Mode="""Auto""" Unit="""dB""" Value="""Value"""/>
<Preamplifier State="""State"""/>
</Amplitude>
</Range>
```

Table 3-7: Attributes and child nodes of the BaseFormat element

Child Node	Attribute	Value	Parameter Description	Mand.
	FileFormatVersion	1.0.0.0		Yes
	Date	YYYY-MM-DD HH:MM:SS	Date in ISO 8601 format	No
Name		\<string>	Name of the standard	Yes
Instrument	Type	FSL	Name of the instrument	No
	Application	SA | K72 | K82	Name of the application	No
LinkDirection	Name	Downlink | Uplink | None		Yes
	ShortName	DL | UL		No
Reference-Power				Yes
Method	TX Channel Power | TX Channel Peak Power			Yes
Reference-Channel	\<string>			No

Table 3-8: Attributes and child nodes of the PowerClass element

Child Node	Attribute	Value	Parameter Description	Mand.
StartPower	Value	\<power in dBm>	The start power must be equal to the stop power of the previous power class. The Start-Power value of the first range is -200	Yes
	Unit	dBm		Yes
	InclusiveFlag	true		Yes
StopPower	Value	\<power in dBm>	The stop power must be equal to the start power of the next power class. The StopPower value of the last range is 200	Yes

Child Node	Attribute	Value	Parameter Description	Mand.
	Unit	dBm		
	InclusiveFlag	false		Yes
DefaultLimitFailMode		Absolute | Relative | Absolute and Relative | Absolute or Relative		Yes

Table 3-9: Attributes and child nodes of the Range element (normal ranges)

Child Node	Attribute	Value	Parameter Description	Mand.
	Index	0…19	Inde XE s are continuous and have to start with 0	Yes
	Name	<string>	Name of the range	Only if ReferenceChannel contains a name and the range is the reference range
	Short-Name	<string>	Short name of the range	No
ChannelType		TX | Adjacent		Yes
WeightingFilter				Only if ReferencePower method is TX Channel Power and the range is the reference range
Type		RRC | CFilter	Type of the weighting filter	Yes
Roll Off Factor		0…1	Excess bandwidth of the filter	Only if the filter type is RRC
Bandwidth		<bandwidth in Hz>	Filter bandwidth	Only if the filter type is RRC
FrequencyRange				Yes
Start		<frequency in Hz>	Start value of the range	Yes
Stop		<frequency in Hz>	Stop value of the range	Yes
Limit		dBm/Hz | dBm | dBc | dBr | dB	A Range must contain exactly two limit nodes; one of the limit nodes has to have a relative unit (e.g. dBc), the other one must have an absolute unit (e.g. dBm)	Yes
Start	Value	<numeric_value>	Power limit at start frequency	Yes
	Unit	dBm/Hz | dBm | dBc | dBr | dB	Sets the unit of the start value	
Stop	Value	<numeric_value>	Power limit at stop frequency	

Child Node	Attribute	Value	Parameter Description	Mand.
	Unit	dBm/Hz | dBm | dBc | dBr | dB	Sets the unit of the stop value	
LimitFailMode		Absolute | Relative | Absolute and Relative | Absolute or Relative	If used, it has to be identical to DefaultLimitFailMode	No
RBW	Bandwidth	<bandwidth in Hz>	"RBW" on page 212	Yes
	Type	NORM | PULS | CFIL | RRC		No
VBW	Bandwidth	<bandwidth in Hz>	"VBW" on page 212	Yes
Detector		NEG | POS | SAMP | RMS | AVER | QUAS	If used, it has to be identical in all ranges.	No
Sweep	Mode	Manual | Auto	"Sweep Time Mode" on page 212	Yes
	Time	<time in sec>	"Sweep Time" on page 213	No
Amplitude				No
ReferenceLevel	Value	<power in dBm>	"Ref. Level" on page 213	Yes, if the ReferenceLevel child node is used
	Unit	dBm	Defines dBm as unit	Yes, if the ReferenceLevel node is used
RFAttenuation	Mode	Manual | Auto	"RF Att. Mode" on page 213	Yes, if the ReferenceLevel child node is used
Preamplifier		ON | OFF	"Preamp" on page 213	Yes

ASCII File Export Format (Spectrum Emission Mask)

The first part of the file lists information about the signal analyzer and the general setup. For a detailed description refer to chapter 3.2.8.7, "ASCII File Export Format", on page 144.

File contents	Description
RefType; CPOWER; TxBandwidth;9540000;Hz Filter State; ON; Alpha;0.22;	reference range setup, for details see "Edit Reference Range" on page 215
PeaksPerRange;1; Values;4;	evaluation list information
0;-22500000;-9270000;1000000;2986455000;-74.762840 270996094; -10.576210021972656;-45.762840270996094;PASS; 1;-9270000;-4770000;100000;2991405000;-100.1769561 7675781; -35.990325927734375;-1.490325927734375;PASS 3;4770000;9270000;100000;3005445000;-100.17695617 675781; -35.990325927734375;-1.490325927734375;PASS; 4;9270000;22500000;1000000;3018225000;-74.7628402 70996094; -10.576210021972656;-45.762840270996094;PASS;	information about each peak: <range number>; <start frequency>; <stop frequency>; <resolution bandwidth of range>; <frequency of peak>; <absolute power in dBm of peak>; <relative power in dBc of peak (related to the channel power)>; <distance to the limit line in dB (positive value means above the limit)>; <limit fail (pass = 0, fail =1)>;

Fast Spectrum Emission Mask Measurements

In order to improve the performance of the FSV for spectrum emission mask measurements, a "Fast SEM" mode is available. If this mode is activated, several consecutive ranges with identical sweep settings are combined to one sweep internally, which makes the measurement considerably more efficient. The displayed results remain unchanged and still consist of several ranges. Thus, measurement settings that apply only to the results, such as limits or transducer factors, can nevertheless be defined individually for each range.

Prerequisites

Fast SEM mode is available if the following criteria apply:

● The frequency ranges are consecutive, without frequency gaps

● The following sweep settings are identical:
  – "Filter Type", see "Filter Type" on page 212
  – "RBW", see "RBW" on page 212
  – "VBW", see "VBW" on page 212
  – "Sweep Time Mode", see "Sweep Time Mode" on page 212
  – "Ref Level", see "Ref. Level" on page 213
  – "Rf Att. Mode", see "RF Att. Mode" on page 213
  – "RF Attenuator", see "RF Att. Mode" on page 213
  – "Preamp", see "Preamp" on page 213

Activating Fast SEM mode

Fast SEM mode is activated in the sweep list (see "Fast SEM" on page 212) or using a remote command. Activating the mode for one range automatically activates it for all ranges in the sweep list.

In the provided XML files for the Spectrum Emission Mask measurement, Fast SEM mode is activated by default.

SCPI command:
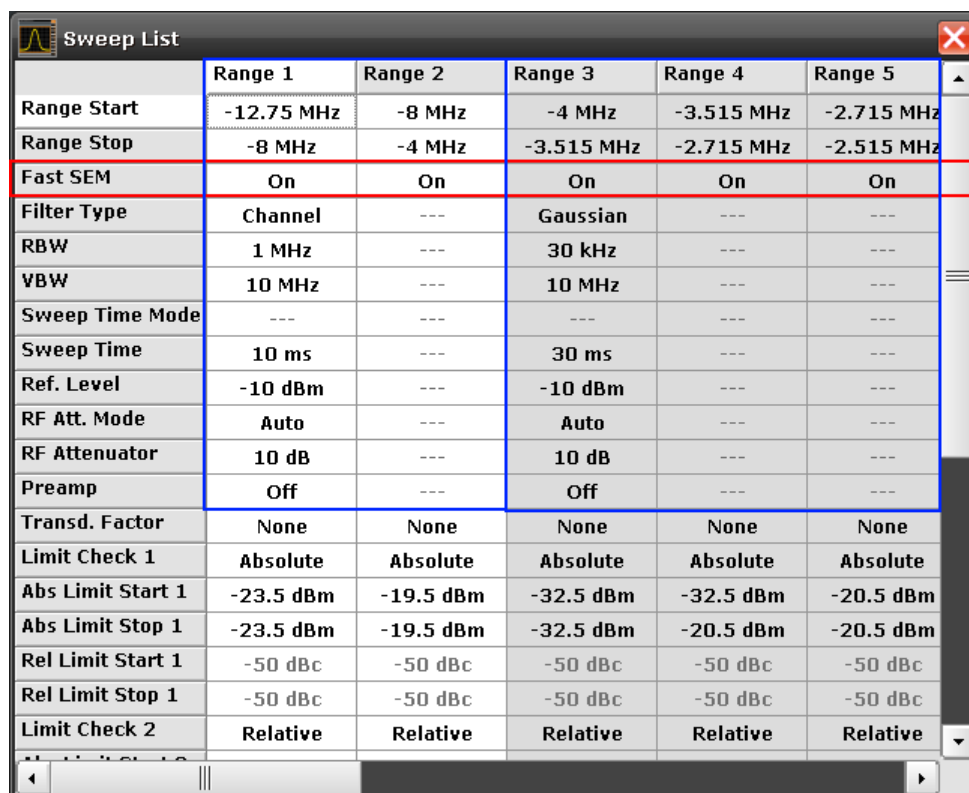
[SENSe:]ESPectrum:HighSPeed on page 591

Consequences

When the Fast SEM mode is activated, the ranges for which these criteria apply are displayed as one single range. The sweep time is defined as the sum of the individual sweep times, initially, but can be changed. When the Fast SEM mode is deactivated, the originally defined individual sweep times are reset.

Any other changes to the sweep settings of the combined range are applied to each included range and remain changed even after deactivating Fast SEM mode.

Example

Sweep List	Range 1	Range 2	Range 3	Range 4	Range 5
Range Start	-12.75 MHz	-8 MHz	-4 MHz	-3.515 MHz	-2.715 MHz
Range Stop	-8 MHz	-4 MHz	-3.515 MHz	-2.715 MHz	-2.515 MHz
Fast SEM	On	On	On	On	On
Filter Type	Channel	---	Gaussian	---	---
RBW	1 MHz	---	30 kHz	---	---
VBW	10 MHz	---	10 MHz	---	---
Sweep Time Mode	---	---	---	---	---
Sweep Time	10 ms	---	30 ms	---	---
Ref. Level	-10 dBm	---	-10 dBm	---	---
RF Att. Mode	Auto	---	Auto	---	---
RF Attenuator	10 dB	---	10 dB	---	---
Preamp	Off	---	Off	---	---
Transd. Factor	None	None	None	None	None
Limit Check 1	Absolute	Absolute	Absolute	Absolute	Absolute
Abs Limit Start 1	-23.5 dBm	-19.5 dBm	-32.5 dBm	-32.5 dBm	-20.5 dBm
Abs Limit Stop 1	-23.5 dBm	-19.5 dBm	-32.5 dBm	-20.5 dBm	-20.5 dBm
Rel Limit Start 1	-50 dBc	-50 dBc	-50 dBc	-50 dBc	-50 dBc
Rel Limit Stop 1	-50 dBc	-50 dBc	-50 dBc	-50 dBc	-50 dBc
Limit Check 2	Relative	Relative	Relative	Relative	Relative

Fig. 3-13: Sweep list using Fast SEM mode

In figure 3-13, a sweep list is shown for which Fast SEM is activated. The formerly 5 separately defined ranges are combined to 2 sweep ranges internally.

3.3.5.6   Measuring Spurious Emissions

The Spurious Emissions measurement defines a measurement that monitors unwanted RF products outside the assigned frequency band generated by an amplifier. The spurious emissions are usually measured across a wide frequency range. The Spurious Emissions measurement allows a flexible definition of all parameters.

Spurious Emissions measurements are performed using the "Spurious Emissions" softkey in the "Measurement" menu (see "Spurious Emissions" on page 232).

Most parameters are defined in the "Sweep List" dialog box (see "Sweep List dialog box" on page 233). For information on other parameters, see the corresponding softkeys ("Spurious Emissions" on page 232).

The following rules apply to ranges:

- The minimum span of a range is 20 Hz.
- The individual ranges must not overlap (but need not directly follow one another).
- The maximum number of ranges is 20.
- The maximum number of sweep points in all ranges is limited to 100001.

In order to change the start/stop frequency of the first/last range, select the appropriate span with the SPAN key. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Frequency values for each range have to be defined relative to the center frequency. The reference range has to be centered on the center frequency. The minimum span of the reference range is given by the current TX Bandwidth.

Defining ranges in Spurious Emissions measurements

In Spurious Emissions measurements, there are no remote commands to insert new ranges between existing ranges directly. However, you can delete or re-define the existing ranges to create the required order.

A remote command example for defining parameters and ranges in spurious emissions measurements can be found in chapter 7 "Remote Control – Programming Examples" of the Operating manual on the CD-ROM.

Softkeys for Spurious Emissions Measurement

Spurious Emissions

Opens a submenu to configure the Spurious Emissions measurement.

The Spurious Emissions measurement defines a measurement that monitors unwanted RF products outside the assigned frequency band generated by an amplifier. The spurious emissions are usually measured across a wide frequency range. The Spurious Emissions measurement allows a flexible definition of all parameters.

For general information on performing Spurious Emissions measurements see chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231.

SCPI command:

`[SENSe:]SWEep:MODE` on page 647

Sweep List ← Spurious Emissions
Opens a submenu to edit the sweep list and displays the "Sweep List" dialog box.

Note: If you edit the sweep list, always follow the rules described in chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231.

Sweep List dialog box ← Sweep List ← Spurious Emissions
After a preset, the sweep list contains a set of default ranges and parameters. For each range, you can change the parameters listed below. To insert or delete ranges, use the "Insert Before Range", "Insert After Range", "Delete Range" softkeys. The measurement results are not updated during editing but on closing the dialog box.

For details and limitations regarding spurious emissions configuration, see chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231.

Range Start / Range Stop ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the start frequency/stop frequency of the selected range. Follow the rules described in chapter 3.3.5.6, "Measuring Spurious Emissions", on page 231.

In order to change the start/stop frequency of the first/last range, select the appropriate span with the SPAN key. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Frequency values for each range have to be defined relative to the center frequency. The reference range has to be centered on the center frequency. The minimum span of the reference range is given by the current TX Bandwidth.

SCPI command:
[SENSe:]LIST:RANGe<range>[:FREQuency]:STARt on page 612
[SENSe:]LIST:RANGe<range>[:FREQuency]:STOP on page 613

Filter Type ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the filter type for this range. For details on filters see also chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

SCPI command:
[SENSe:]LIST:RANGe<range>:FILTer:TYPE on page 613

RBW ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the RBW value for this range.

SCPI command:
[SENSe:]LIST:RANGe<range>:BANDwidth[:RESolution] on page 610

VBW ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the VBW value for this range.

SCPI command:
[SENSe:]LIST:RANGe<range>:BANDwidth:VIDeo on page 610

Sweep Time Mode ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Activates or deactivates the auto mode for the sweep time.

SCPI command:
[SENSe:]LIST:RANGe<range>:SWEep:TIME:AUTO on page 616

Sweep Time ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the sweep time value for the range.

SCPI command:
[SENSe:]LIST:RANGe<range>:SWEep:TIME on page 616

Detector ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the detector for the range. For details refer to chapter 3.2.8.6, "Detector Overview", on page 143.

SCPI command:
[SENSe:]LIST:RANGe<range>:DETector on page 612

Ref. Level ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the reference level for the range.

SCPI command:
[SENSe:]LIST:RANGe<range>:RLEVel on page 616

RF Att. Mode ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Activates or deactivates the auto mode for RF attenuation.

SCPI command:
[SENSe:]LIST:RANGe<range>:INPut:ATTenuation:AUTO on page 614

RF Attenuator ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the attenuation value for that range.

SCPI command:
[SENSe:]LIST:RANGe<range>:INPut:ATTenuation on page 613

Preamp ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Switches the preamplifier on or off.

SCPI command:
[SENSe:]LIST:RANGe<range>:INPut:GAIN:STATe on page 614

Sweep Points ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the number of sweep points for the specified range.

SCPI command:
[SENSe:]LIST:RANGe<range>:POINts on page 615

Stop After Sweep ← Sweep List dialog box ← Sweep List ← Spurious Emissions
This command configures the sweep behavior.

"ON"   The analyzer stops after one range is swept and continues only if you confirm (a message box is displayed).

"OFF"   The analyzer sweeps all ranges in one go.

SCPI command:
[SENSe:]LIST:RANGe<range>:BREak on page 611

Transd. Factor ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets a transducer for the specified range. You can only choose a transducer that fulfills the following conditions:

● The transducer overlaps or equals the span of the range.
● The x-axis is linear.
● The unit is dB.

SCPI command:
[SENSe:]LIST:RANGe<range>:TRANsducer on page 617

Limit Check 1-4 ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets the type of limit check for all ranges. Possible states are:

Absolute	Checks the absolute limits defined.
None	No limit check performed.

The limit state affects the availability of all limit settings ("Abs Limit Start" on page 236, "Abs Limit Stop" on page 236).

SCPI command:

[SENSe:]LIST:RANGe<range>:LIMit:STATe on page 615

CALCulate<n>:LIMit<k>:FAIL on page 446

Abs Limit Start ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets an absolute limit value at the start frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "Limit Check 1-4" on page 235).

SCPI command:

[SENSe:]LIST:RANGe<range>:LIMit:STARt on page 614

Abs Limit Stop ← Sweep List dialog box ← Sweep List ← Spurious Emissions
Sets an absolute limit value at the stop frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "Limit Check 1-4" on page 235).

SCPI command:

[SENSe:]LIST:RANGe<range>:LIMit:STOP on page 615

Edit Sweep List/Close Sweep List ← Sweep List ← Spurious Emissions
Opens/closes the "Sweep List" dialog box. Closing the dialog box updates the measurement results.

Insert before Range ← Sweep List ← Spurious Emissions
Inserts a new range to the left of the currently focused range. The range numbers of the currently focused range and all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:

ESP:RANG3:INS BEF, see [SENSe:]ESPectrum:RANGe<range>:INSert on page 596

Insert after Range ← Sweep List ← Spurious Emissions
Inserts a new range to the right of the currently focused range. The range numbers of all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:

ESP:RANG1:INS AFT, see [SENSe:]ESPectrum:RANGe<range>:INSert on page 596

Delete Range ← Sweep List ← Spurious Emissions
Deletes the currently focused range, if possible. The range numbers are updated accordingly. For further details refer to "Ranges and Range Settings", on page 220.

SCPI command:
[SENSe:]ESPectrum:RANGe<range>:DELete on page 593

Adjust Ref Lvl (span > 0) ← Sweep List ← Spurious Emissions
Adjusts the reference level to the measured total power of the signal. The softkey is activated after the first sweep with active measurement of the occupied bandwidth has been completed and the total power of the signal is thus known.

Adjusting the reference level ensures that the signal path will not be overloaded and the dynamic range not limited by too low a reference level. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is distinctly below the reference level. If the measured channel power is equal to the reference level, the signal path cannot be overloaded.

SCPI command:
[SENSe:]POWer:ACHannel:PRESet:RLEVel on page 638

Adjust X-Axis ← Sweep List ← Spurious Emissions
Adjusts the frequency axis of measurement diagram automatically so that the start frequency matches the start frequency of the first sweep range, and the stop frequency of the last sweep range.

List Evaluation ← Spurious Emissions
Opens a submenu to edit the list evaluation settings.

List Evaluation (On/Off) ← List Evaluation ← Spurious Emissions
Activates or deactivates the list evaluation.

SCPI command:
CALCulate<n>:PSEarch|PEAKsearch:AUTO on page 533
TRACe<n>[:DATA] on page 675

Details On/Off ← List Evaluation ← Spurious Emissions
Configures the list contents.

On	Displays the whole list contents.
Off	Displays only the highest peaks (one peak per range).

Margin ← List Evaluation ← Spurious Emissions
Opens an edit dialog box to enter the margin used for the limit check/peak search.

SCPI command:
CALCulate<n>:PSEarch|PEAKsearch:MARGin on page 533

Peaks per Range ← List Evaluation ← Spurious Emissions

Opens an edit dialog box to enter the number of peaks per range that are stored in the list. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range. The maximum value is 50.

SCPI command:

CALCulate<n>:PSEarch|PEAKsearch:SUBRanges on page 534

Show Peaks ← List Evaluation ← Spurious Emissions

In the diagram, marks all peaks with blue squares that have been listed during an active list evaluation.

SCPI command:

CALCulate<n>:PSEarch|PEAKsearch:PSHow on page 534

Save Evaluation List ← List Evaluation ← Spurious Emissions

Opens the "ASCII File Export Name" dialog box and a submenu to save the result in ASCII format to a specified file and directory.

SCPI command:

MMEMory:STORe<n>:LIST on page 571

ASCII File Export ← Save Evaluation List ← List Evaluation ← Spurious Emissions

Saves the evaluation list in ASCII format to a specified file and directory.

SCPI command:

MMEMory:STORe<n>:LIST on page 571

Decim Sep ← Save Evaluation List ← List Evaluation ← Spurious Emissions

Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set.

SCPI command:

FORMat:DEXPort:DSEParator on page 558

Adjust Ref Lvl (span > 0) ← Spurious Emissions

Adjusts the reference level to the measured total power of the signal. The softkey is activated after the first sweep with active measurement of the occupied bandwidth has been completed and the total power of the signal is thus known.

Adjusting the reference level ensures that the signal path will not be overloaded and the dynamic range not limited by too low a reference level. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is distinctly below the reference level. If the measured channel power is equal to the reference level, the signal path cannot be overloaded.

SCPI command:

[SENSe:]POWer:ACHannel:PRESet:RLEVel on page 638

Adjust X-Axis ← Spurious Emissions

Adjusts the frequency axis of measurement diagram automatically so that the start frequency matches the start frequency of the first sweep range, and the stop frequency of the last sweep range.

Meas Start/Stop ← Spurious Emissions

Aborts/restarts the current measurement and displays the status:

"Start"   The measurement is currently running.

"Stop"   The measurement has been stopped, or, in single sweep mode, the end of the sweep has been reached.

3.3.5.7 Measuring the Power in Zero Span

With the aid of the power measurement function, the analyzer determines the power of the signal in zero span by summing up the power at the individual measurement points and dividing the result by the number of measurement points. In this way it is possible to measure for example the power of TDMA signals during transmission or during the muting phase. Both the mean power and the RMS power can be measured by means of the individual power values.

The result is displayed in the marker field. The measured values are updated after each sweep or averaged over a user-defined number of sweeps in order to determine e.g. the mean power over several bursts. For determination of the peak value the maximum value from several sweeps is displayed.

If both the on and off phase of a burst signal are displayed, the measurement range can be limited to the transmission or to the muting phase with the aid of vertical lines. The ratio between signal and noise power of a TDMA signal for instance can be measured by using a measurement as a reference value and after that varying the measurement range.

Upon switching on power measurement the sample detector is activated.

Procedure

1. Press the "Time Domain Power" softkey to activate the power measurement (see "Time Domain Power (zero span)" on page 240).

   The corresponding submenu is displayed.

2. To limit the power evaluation range, switch on the limits ("Limits (On/Off)" softkey, see "Limits (On/Off) (zero span)" on page 241) and enter the limits by using the "Left Limit" and "Right Limit" softkeys (see "Left Limit (zero span)" on page 241 and "Right Limit (zero span)" on page 241).

3. Select the type of power measurement by using the "Mean" or "RMS" softkey (see "Mean (zero span)" on page 240 or "RMS (zero span)" on page 240). This defines RMS or mean power, the settings for max hold and averaging, as well as the definition of limits.

4. To calculate and display the peak value, press the "Peak" softkey (see "Peak (zero span)" on page 240).

5. To calculate and display the standard deviation from the mean value, press the "Std Dev" softkey (see "Std Dev (zero span)" on page 241).

Softkeys for Time Domain Power Measurements

Time Domain Power (zero span)
Activates the power measurement in zero span and opens a submenu to configure the power measurement. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:SUMMary[:STATe] on page 519

Peak (zero span) ← **Time Domain Power (zero span)**
Activates the calculation of the peak value from the points of the displayed trace or a segment thereof. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PPEak[:STATe] on page 523
CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PPEak:RESult on page 525

RMS (zero span) ← **Time Domain Power (zero span)**
Activates the calculation of the RMS value from the points of the displayed trace or a segment thereof. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:RMS[:STATe] on page 526
CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:RMS:RESult on page 527

Mean (zero span) ← **Time Domain Power (zero span)**
Activates the calculation of the mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated.

This can be used for instance to measure the mean power during a GSM burst.

For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN[:STATe] on page 520

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN:RESult on page 522

Std Dev (zero span) ← Time Domain Power (zero span)
Activates the calculation of the standard deviation of measurement points from the mean value and displays them as measured value. The measurement of the mean power is automatically switched on at the same time. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation[:STATe] on page 528

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation:RESult on page 529

Limits (On/Off) (zero span) ← Time Domain Power (zero span)
Switches the limitation of the evaluation range on or off. Default setting is off.

If switched off, the evaluation range is not limited. If switched on, the evaluation range is defined by the left and right limit. If only one limit is set, it corresponds to the left limit and the right limit is defined by the stop frequency. If the second limit is also set, it defines the right limit.

For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] on page 481

Left Limit (zero span) ← Time Domain Power (zero span)
Opens an edit dialog box to enter a value for line 1. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:LEFT on page 481

Right Limit (zero span) ← Time Domain Power (zero span)
Opens an edit dialog box to enter a value for line 2. For more details see also chapter 3.3.5.7, "Measuring the Power in Zero Span", on page 239.

SCPI command:

CALCulate<n>:MARKer<m>:X:SLIMits:RIGHT on page 482

3.3.5.8 Calculating Signal Statistics

To measure the amplitude distribution, the analyzer has simple measurement functions to determine both the APD = Amplitude Probability Distribution and CCDF = Complementary Cumulative Distribution Function. In the APD display mode, the probability of

occurrence of a certain level is plotted against the level. In the CCDF display mode, the probability that the mean signal power will be exceeded is shown in percent.

● To activate and configure the measurement of the amplitude probability distribution (APD), press the "APD" softkey (see "APD" on page 189).
The corresponding submenu is displayed.

● To activate and configure the measurement of the complementary cumulative distribution (CCDF), press the "CCDF" softkey (see "CCDF" on page 189).
The corresponding submenu is displayed.

Statistic measurements on pulsed signals can be performed using a gated trigger. An external frame trigger is required as a time (frame) reference. For details see "Defining Gated Triggering for APD and CCDF", on page 253.

Measurement examples are described in chapter 2.6.2, "Amplitude Distribution Measurements", on page 48.

Softkeys for APD Measurements

APD

Activates the function to measure the amplitude probability density (APD) and opens a submenu.

For general information on calculating signal statistics see chapter 3.3.5.8, "Calculating Signal Statistics", on page 241.

SCPI command:

CALCulate<n>:STATistics:APD[:STATe] on page 539

Res BW ← APD

Opens an edit dialog box to set the resolution bandwidth directly.

For correct measurement of the signal statistics the resolution bandwidth has to be wider than the signal bandwidth in order to measure the actual peaks of the signal amplitude correctly. In order not to influence the peak amplitudes the video bandwidth is automatically set to 10 MHz. The sample detector is used for detecting the video voltage.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution] on page 579

# of Samples ← APD

Opens an edit dialog box to set the number of power measurements that are taken into account for the statistics.

Apart from the number of measurements the overall measurement time depends also on the set resolution bandwidth as the resolution bandwidth directly influences the sampling rate.

SCPI command:

CALCulate<n>:STATistics:NSAMples on page 540

Scaling ← APD

Opens a submenu to change the scaling parameters of x- and y-axis.

x-Axis Ref Level ← Scaling ← APD

Opens an edit dialog box to enter the reference level in the currently active unit (dBm, dBµV, etc). The function of this softkey is identical to the "Ref Level" softkey in the "Amplitude" menu (see "Ref Level" on page 106).

For the APD function this value is mapped to the right diagram border. For the CCDF function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the measured mean power.

SCPI command:

CALCulate<n>:STATistics:SCALe:X:RLEVel on page 542

x-Axis Range ← Scaling ← APD

Opens the "Range" submenu to select a value for the level range to be covered by the statistics measurement selected.

SCPI command:

CALCulate<n>:STATistics:SCALe:X:RANGe on page 542

Range Log 100 dB ← x-Axis Range ← Scaling ← APD

Sets the level display range to 100 dB.

SCPI command:

DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 100DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 50 dB ← x-Axis Range ← Scaling ← APD
Sets the level display range to 50 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 50DB`
Sets the level display range to 50 dB (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 10 dB ← x-Axis Range ← Scaling ← APD
Sets the level display range to 10 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 10DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 5 dB ← x-Axis Range ← Scaling ← APD
Sets the level display range to 5 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 5DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 1 dB ← x-Axis Range ← Scaling ← APD
Sets the level display range to 1 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 1DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log Manual ← x-Axis Range ← Scaling ← APD
Opens an edit dialog box to enter a value for logarithmic scaling for the level display range.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551

Range Linear % ← **x-Axis Range** ← **Scaling** ← **APD**

Selects linear scaling in % for the level display range, i.e. the horizontal grid lines are labeled in %. The grid is divided in decadal steps.

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

SCPI command:

DISP:TRAC:Y:SPAC LIN,see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550

Range Lin. Unit ← **x-Axis Range** ← **Scaling** ← **APD**

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

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

SCPI command:

DISP:TRAC:Y:SPAC LDB, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550

y-Axis Max Value ← **Scaling** ← **APD**

Opens an edit dialog box to define the upper limit of the displayed probability range. Values on the y-axis are normalized which means that the maximum value is 1.0. The y-axis scaling is defined via the "Y-unit %/Abs" softkey (see "y-Unit %/Abs" on page 245). The distance between max and min value must be at least one decade.

SCPI command:

CALCulate<n>:STATistics:SCALe:Y:UPPer on page 543

y-Axis Min Value ← **Scaling** ← **APD**

Opens an edit dialog box to define the lower limit of the displayed probability range. Values in the range *1e^{-9} < value < 0.1* are allowed. The y-axis scaling is defined via the "y-Unit %/Abs" on page 245 softkey. The distance between max and min value must be at least one decade.

SCPI command:

CALCulate<n>:STATistics:SCALe:Y:LOWer on page 542

y-Unit %/Abs ← **Scaling** ← **APD**

Defines the scaling type of the y-axis. The default value is absolute scaling.

SCPI command:

CALCulate<n>:STATistics:SCALe:Y:UNIT on page 543

Default Settings ← **Scaling** ← **APD**

Resets the x- and y-axis scalings to their preset values.

x-axis ref level:	-10 dBm
x-axis range APD:	100 dB
x-axis range CCDF:	20 dB

y-axis upper limit:	1.0
y-axis lower limit:	1E-6

SCPI command:

CALCulate<n>:STATistics:PRESet on page 540

Adjust Settings ← Scaling ← APD

Adjusts the level settings according to the measured difference between peak and minimum power for APD measurement or peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal. For details see also the "Adjust Ref Lvl" softkey ("Adjust Ref Lvl" on page 202).

SCPI command:

CALCulate<n>:STATistics:SCALe:AUTO ONCE on page 541

Gated Trigger (On/Off) ← APD

Activates and deactivates the gating for statistics functions for the ACP and the CCDF channel. The trigger source is changed to "EXTERN" if this function is switched on. The gate ranges are defined using the "Gate Ranges" softkey (see "Gate Ranges" on page 246).

SCPI command:

[SENSe:]SWEep:EGATe on page 643

[SENSe:]SWEep:EGATe:SOURce on page 645

Gate Ranges ← APD

Opens a dialog to configure up to 3 gate ranges for each trace.

For details on configuration, see "Defining Gated Triggering for APD and CCDF", on page 253.

Gate Ranges	Trace 1	Trace 2	Trace 3	Trace 4	Trace 5	Trace 6
Comment	SlotA					
Period	8 ms	8 ms	8 ms	8 ms	8 ms	8 ms
Range 1 Start	1 ms	1 µs	1 µs	1 µs	1 µs	1 µs
Range 1 Stop	3 ms	1 µs	1 µs	1 µs	1 µs	1 µs
Range 1 Use	On	Off	Off	Off	Off	Off
Range 2 Start	1 µs	1 µs	1 µs	1 µs	1 µs	1 µs
Range 2 Stop	1 µs	1 µs	1 µs	1 µs	1 µs	1 µs
Range 2 Use	Off	Off	Off	Off	Off	Off
Range 3 Start	1 µs	1 µs	1 µs	1 µs	1 µs	1 µs
Range 3 Stop	1 µs	1 µs	1 µs	1 µs	1 µs	1 µs
Range 3 Use	Off	Off	Off	Off	Off	Off

SCPI command:

`SWE:EGAT ON` (see `[SENSe:]SWEep:EGATe` on page 643)

Switches on the external gate mode.

`SWE:EGAT:TRAC1:COMM "SlotA"` (see `[SENSe:]SWEep:EGATe:TRACe<k>: COMMent` on page 645)

Adds a comment to trace 1.

`SWE:EGAT:TRAC1:STAT1 ON` (see `[SENSe:]SWEep:EGATe:TRACe<k>[: STATe<range>]` on page 645)

Activates tracing for range 1 of trace 1.

`SWE:EGAT:TRAC1:STAR1 3ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: STARt<range>` on page 646)

Sets the starting point for range 1 on trace 1 at 3 ms.

`SWE:EGAT:TRAC1:STop1 5ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: STOP<range>` on page 646)

Sets the stopping point for range 1 on trace 1 at 5 ms.

`SWE:EGAT:TRAC1:PER 5ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: PERiod` on page 646)

Defines the period for gated triggering to 5 ms.

Adjust Settings ← APD

Adjusts the level settings according to the measured difference between peak and minimum power for APD measurement or peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal. For details see also the "Adjust Ref Lvl" softkey ("Adjust Ref Lvl" on page 202).

SCPI command:

`CALCulate<n>:STATistics:SCALe:AUTO ONCE` on page 541

Softkeys for CCDF Measurements

CCDF

Activates the function to measure the complementary cumulative distribution function (CCDF) and opens a submenu.

After a CCDF measurement, the results are displayed in a table beneath the diagram.

Mean	Mean power
Peak	Peak power
Crest	Crest factor (peak power – mean power)
0,01 %	Level values over 0,01 % above mean power
0,1 %	Level values over 0,1 % above mean power
1 %	Level values over 1 % above mean power
10 %	Level values over 10 % above mean power

In addition, a red reference line indicating the calculated Gauss distribution is displayed.

SCPI command:

CALCulate<n>:STATistics:CCDF[:STATe] on page 539

Activates the CCDF measurement.

CALCulate<n>:STATistics:CCDF:X<Trace> on page 539

Reads out the level values for 1 % probability.

Percent Marker ← CCDF

Opens an edit dialog box to enter a probability value and to position marker 1. Thus, the power which is exceeded with a given probability can be determined very easily. If marker 1 is deactivated, it will be switched on automatically.

As all markers, the percent marker can be moved simply by touching it with a finger or mouse cursor and dragging it to the desired position.

SCPI command:

CALCulate<n>:MARKer<m>:Y:PERCent on page 484

Res BW ← CCDF

Opens an edit dialog box to set the resolution bandwidth directly.

For correct measurement of the signal statistics the resolution bandwidth has to be wider than the signal bandwidth in order to measure the actual peaks of the signal amplitude correctly. In order not to influence the peak amplitudes the video bandwidth is automatically set to 10 MHz. The sample detector is used for detecting the video voltage.

SCPI command:

[SENSe:]BANDwidth|BWIDth[:RESolution] on page 579

# of Samples ← CCDF

Opens an edit dialog box to set the number of power measurements that are taken into account for the statistics.

Apart from the number of measurements the overall measurement time depends also on the set resolution bandwidth as the resolution bandwidth directly influences the sampling rate.

SCPI command:

CALCulate<n>:STATistics:NSAMples on page 540

Scaling ← CCDF

Opens a submenu to change the scaling parameters of x- and y-axis.

x-Axis Ref Level ← Scaling ← CCDF

Opens an edit dialog box to enter the reference level in the currently active unit (dBm, dBμV, etc). The function of this softkey is identical to the "Ref Level" softkey in the "Amplitude" menu (see "Ref Level" on page 106).

For the APD function this value is mapped to the right diagram border. For the CCDF function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the measured mean power.

SCPI command:

CALCulate<n>:STATistics:SCALe:X:RLEVel on page 542

x-Axis Range ← Scaling ← CCDF

Opens the "Range" submenu to select a value for the level range to be covered by the statistics measurement selected.

SCPI command:

CALCulate<n>:STATistics:SCALe:X:RANGe on page 542

Range Log 100 dB ← x-Axis Range ← Scaling ← CCDF

Sets the level display range to 100 dB.

SCPI command:

DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 100DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 50 dB ← x-Axis Range ← Scaling ← CCDF
Sets the level display range to 50 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 50DB`
Sets the level display range to 50 dB (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 10 dB ← x-Axis Range ← Scaling ← CCDF
Sets the level display range to 10 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 10DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 5 dB ← x-Axis Range ← Scaling ← CCDF
Sets the level display range to 5 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 5DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 1 dB ← x-Axis Range ← Scaling ← CCDF
Sets the level display range to 1 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISP:WIND:TRAC:Y 1DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log Manual ← x-Axis Range ← Scaling ← CCDF
Opens an edit dialog box to enter a value for logarithmic scaling for the level display range.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`
(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551

Range Linear % ← x-Axis Range ← Scaling ← CCDF

Selects linear scaling in % for the level display range, i.e. the horizontal grid lines are labeled in %. The grid is divided in decadal steps.

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

SCPI command:

DISP:TRAC:Y:SPAC LIN, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

Range Lin. Unit ← x-Axis Range ← Scaling ← CCDF

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

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

SCPI command:

DISP:TRAC:Y:SPAC LDB, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

y-Axis Max Value ← Scaling ← CCDF

Opens an edit dialog box to define the upper limit of the displayed probability range. Values on the y-axis are normalized which means that the maximum value is 1.0. The y-axis scaling is defined via the "Y-unit %/Abs" softkey (see "y-Unit %/Abs" on page 245). The distance between max and min value must be at least one decade.

SCPI command:

`CALCulate<n>:STATistics:SCALe:Y:UPPer` on page 543

y-Axis Min Value ← Scaling ← CCDF

Opens an edit dialog box to define the lower limit of the displayed probability range. Values in the range *1e^-9 < value < 0.1* are allowed. The y-axis scaling is defined via the "y-Unit %/Abs" on page 245 softkey. The distance between max and min value must be at least one decade.

SCPI command:

`CALCulate<n>:STATistics:SCALe:Y:LOWer` on page 542

y-Unit %/Abs ← Scaling ← CCDF

Defines the scaling type of the y-axis. The default value is absolute scaling.

SCPI command:

`CALCulate<n>:STATistics:SCALe:Y:UNIT` on page 543

Default Settings ← Scaling ← CCDF

Resets the x- and y-axis scalings to their preset values.

x-axis ref level:	-10 dBm
x-axis range APD:	100 dB
x-axis range CCDF:	20 dB

y-axis upper limit:	1.0
y-axis lower limit:	1E-6

SCPI command:

CALCulate<n>:STATistics:PRESet on page 540

Adjust Settings ← Scaling ← CCDF

Adjusts the level settings according to the measured difference between peak and minimum power for APD measurement or peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal. For details see also the "Adjust Ref Lvl" softkey ("Adjust Ref Lvl" on page 202).

SCPI command:

CALCulate<n>:STATistics:SCALe:AUTO ONCE on page 541

Gated Trigger (On/Off) ← CCDF

Activates and deactivates the gating for statistics functions for the ACP and the CCDF channel. The trigger source is changed to "EXTERN" if this function is switched on. The gate ranges are defined using the "Gate Ranges" softkey (see "Gate Ranges" on page 246).

SCPI command:

[SENSe:]SWEep:EGATe on page 643

[SENSe:]SWEep:EGATe:SOURce on page 645

Gate Ranges ← CCDF

Opens a dialog to configure up to 3 gate ranges for each trace.

For details on configuration, see "Defining Gated Triggering for APD and CCDF", on page 253.

SCPI command:

`SWE:EGAT ON` (see `[SENSe:]SWEep:EGATe` on page 643)

Switches on the external gate mode.

`SWE:EGAT:TRAC1:COMM "SlotA"` (see `[SENSe:]SWEep:EGATe:TRACe<k>: COMMent` on page 645)

Adds a comment to trace 1.

`SWE:EGAT:TRAC1:STAT1 ON` (see `[SENSe:]SWEep:EGATe:TRACe<k>[: STATe<range>]` on page 645)

Activates tracing for range 1 of trace 1.

`SWE:EGAT:TRAC1:STAR1 3ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: STARt<range>` on page 646)

Sets the starting point for range 1 on trace 1 at 3 ms.

`SWE:EGAT:TRAC1:STop1 5ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: STOP<range>` on page 646)

Sets the stopping point for range 1 on trace 1 at 5 ms.

`SWE:EGAT:TRAC1:PER 5ms` (see `[SENSe:]SWEep:EGATe:TRACe<k>: PERiod` on page 646)

Defines the period for gated triggering to 5 ms.

Adjust Settings ← CCDF

Adjusts the level settings according to the measured difference between peak and minimum power for APD measurement or peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adjusts the reference level to the current input signal. For details see also the "Adjust Ref Lvl" softkey ("Adjust Ref Lvl" on page 202).

SCPI command:

`CALCulate<n>:STATistics:SCALe:AUTO ONCE` on page 541

Defining Gated Triggering for APD and CCDF

Statistic measurements on pulsed signals can be performed using GATED TRIGGER. An external frame trigger is required as a time (frame) reference.

The gate ranges define the part of the I/Q capture data taken into account for the statistics calculation. These ranges are defined relative to a reference point T=0. The gate interval is repeated for each period until the end of the I/Q capture buffer.

The reference point T=0 is defined by the external trigger event and the instrument's trigger offset.

For each trace you can define up to 3 separate ranges of a single period to be traced.
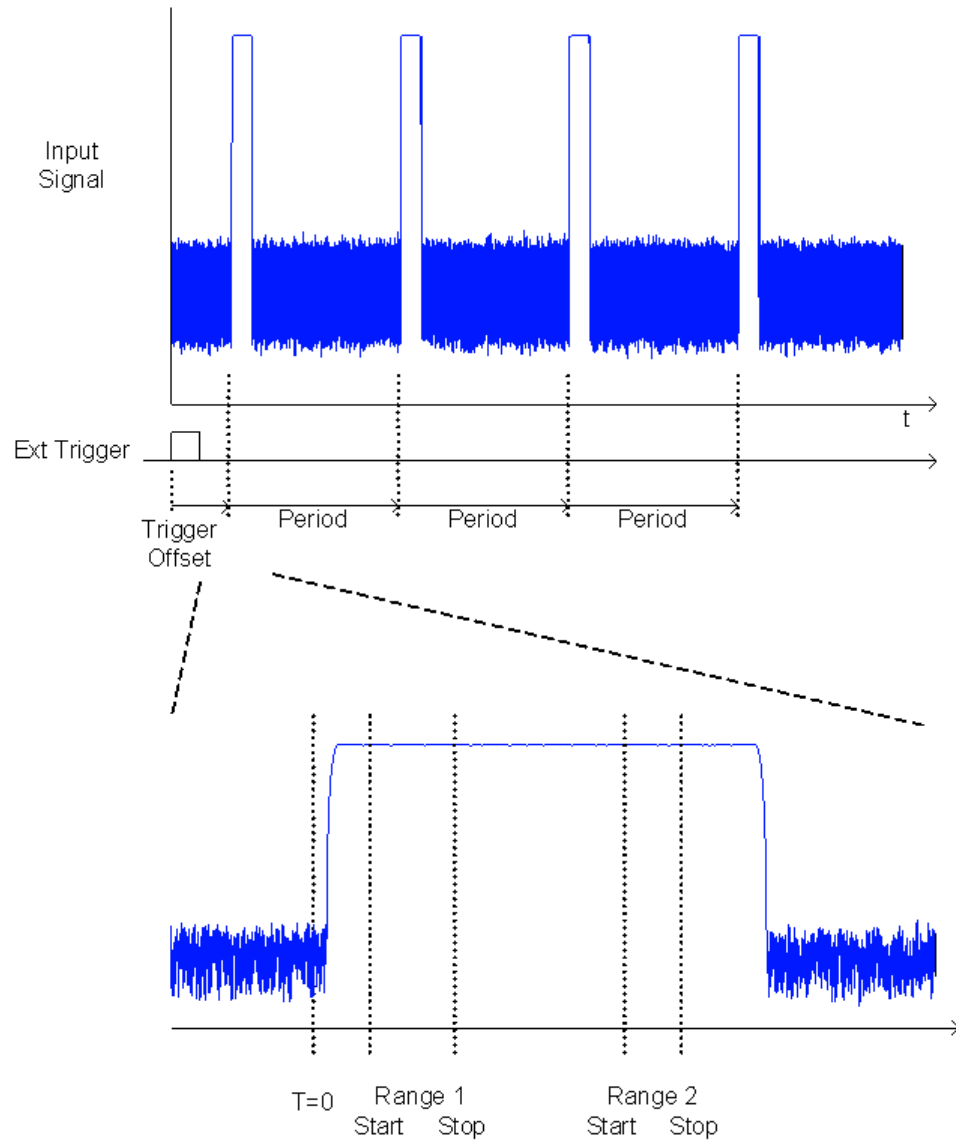
Defining gated triggering

1. Press the "Gated Trigger" softkey to activate gated triggering (see "Gated Trigger (On/Off)" on page 246).

2. Press the "Gate Ranges" softkey to open the "Gate Ranges" dialog (see "Gate Ranges" on page 246).

3. Define the length of the period to be analyzed in the "Period" field.

   Note: The period is the same for all traces. If you change the period for one trace, it is automatically changed for all traces.

Make sure the defined period is not longer than the acquisition time of the current measurement. Keep in mind that the acquisition time depends on the bandwidth and the number of samples settings.

4. Optionally, define a description of the trace in the "Comment" field.

5. Activate tracing for the range by selecting "On" in the "Range <number> Use" field for the corresponding range and trace.

   The start and stop time edit fields are ready for input.

   Note: The time values have full numerical resolution and are only rounded for display.

6. Define the starting point of the range within the period.

7. Define the stopping point for the range within the period. Make sure the value for the stopping time is smaller than the length of the period.

8. To define further ranges for the same period in the same trace, repeat steps 5- 7 for the same trace.

   To define further ranges for the same period in a different trace, repeat steps 4- 7 for a different trace.

9. If necessary, activate the configured traces in the "Trace" menu.

Gated statistics configuration example

A statistics evaluation has to be done over the useful part of the signal between t3 and t4. The period of the GSM signal is 4.61536 ms
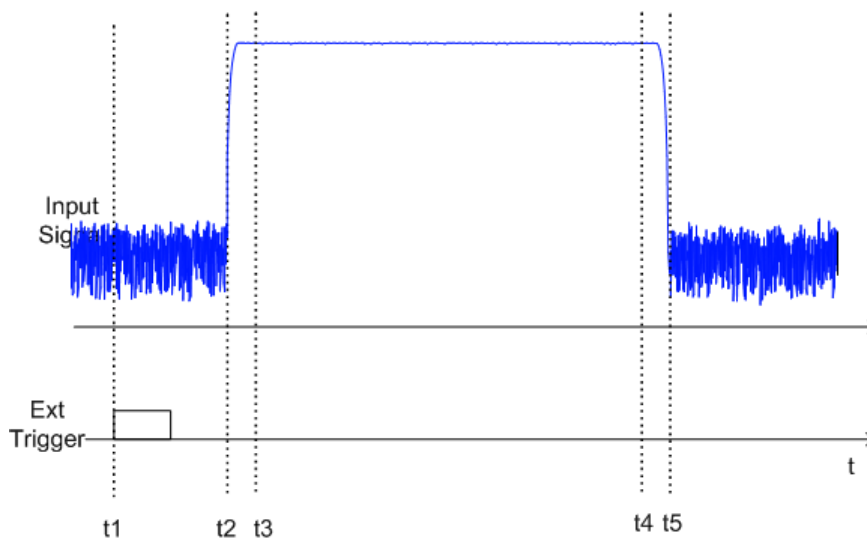
t1: External positive trigger slope

t2: Begin of burst (after 25 µs)

t3: Begin of useful part, to be used for statistics (after 40 µs)

t4: End of useful part, to be used for statistics (after 578 µs)

t5: End of burst (after 602 µs)

The instrument has to be configured as follows:

Trigger Offset	t2 – t1 = 25 μs	now the gate ranges are relative to t2
Range1 Start	t3 – t2 = 15 μs	start of range 1 relative to t2
Range1 End	t4 – t2 = 553 μs	end of range 1 relative to t2

3.3.5.9 Measuring the Third Order Intercept Point (TOI)

In order to measure the third order intercept point (TOI), a two-tone signal with equal carrier levels is expected at the analyzer input. Marker 1 and marker 2 (both normal markers) are set to the maximum of the two signals. Marker 3 and marker 4 are placed on the intermodulation products.

The analyzer calculates the third order intercept point from the level difference between the first 2 markers and the markers 3 and 4 and displays it in the marker field.

The third order intercept point is measured using the "TOI" softkey, see "TOI" on page 189.

A measurement example is described in chapter 4.3.2.2, "Measuring the Third Order Intercept Point", on page 788.

Softkeys for TOI Measurements

TOI

Opens a submenu and activates the measurement of the 3rd order intercept point.

A two-tone signal with equal carrier levels is expected at the analyzer input. Marker 1 and marker 2 (both normal markers) are set to the maximum of the two signals. Marker 3 and marker 4 are placed on the intermodulation products.

The analyzer calculates the third order intercept point from the level difference between the first 2 markers and the markers 3 and 4 and displays it in the marker field.

For general information on measuring the TOI see chapter 3.3.5.9, "Measuring the Third Order Intercept Point (TOI)", on page 256.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:TOI[:STATe] on page 497

CALCulate<n>:MARKer<m>:FUNCtion:TOI:RESult on page 498

Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta ← TOI
The "Marker X" softkey activates the corresponding marker and opens an edit dialog box to enter a value for the marker to be set to. Pressing the softkey again deactivates the selected marker.

If a marker value is changed using the rotary knob, the step size is defined via the Stepsize Standard or Stepsize Sweep Points softkeys.

Marker 1 is always the reference marker for relative measurements. If activated, markers 2 to 16 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Norm/Delta" softkey. If marker 1 is the active marker, pressing the "Marker Norm/Delta" softkey switches on an additional delta marker.

SCPI command:

CALCulate<n>:MARKer<m>[:STATe] on page 472

CALCulate<n>:MARKer<m>:X on page 481

CALCulate<n>:MARKer<m>:Y on page 483

CALCulate<n>:DELTamarker<m>[:STATe] on page 423

CALCulate<n>:DELTamarker<m>:X on page 433

CALCulate<n>:DELTamarker<m>:X:RELative on page 433

CALCulate<n>:DELTamarker<m>:Y on page 434

Search Signals ← TOI
Activates all markers.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:TOI:RESult on page 498

3.3.5.10   Measuring the AM Modulation Depth

You can measure the modulation depth of a modulated signal using the "AM Mod Depth" softkey (see "AM Mod Depth" on page 189). An AM-modulated carrier is required on the screen for ensuring correct operation.

The level value of marker 1 is taken as the carrier level. When this function is activated, marker 2 and marker 3 are automatically set symmetrically to the carrier on the adjacent peak values of the trace as delta markers.

The analyzer calculates the power at the marker positions from the measured levels. The AM modulation depth is calculated from the ratio between the power values at the reference marker and at the delta markers. If the powers of the two AM side bands are unequal, the mean value of the two power values is used for AM modulation depth calculation.

A measurement example is described in chapter 4.3.2.3, "Measuring the AM Modulation Depth", on page 789 and in the Quick Start Guide in chapter "Measurement Examples"".

Softkeys for AM Modulation Depth Measurements

AM Mod Depth
Opens a submenu and activates the measurement of the AM modulation depth. An AM-modulated carrier is required on the screen for ensuring correct operation.

The level value of marker 1 is taken as the carrier level. When this function is activated, marker 2 and marker 3 are automatically set symmetrically to the carrier on the adjacent peak values of the trace as delta markers and marker 2 is activated for the entry.

When the position of marker 2 (delta) is changed, marker 3 (delta) is moved symmetrically with respect to the reference marker (marker 1).

If the edit dialog box is opened for marker 3, the latter can be moved for fine adjustment irrespective of marker 2.

The analyzer calculates the power at the marker positions from the measured levels. The AM modulation depth is calculated from the ratio between the power values at the reference marker and at the delta markers. If the powers of the two AM side bands are unequal, the mean value of the two power values is used for AM modulation depth calculation.

For general information on measuring the AM modulation depth see chapter 3.3.5.10, "Measuring the AM Modulation Depth", on page 257.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics[:STATe] on page 499

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth:RESult on page 493

Marker 1 / Marker 2 / Marker 3 / … Marker 16,/ Marker Norm/Delta ← AM Mod Depth
The "Marker X" softkey activates the corresponding marker and opens an edit dialog box to enter a value for the marker to be set to. Pressing the softkey again deactivates the selected marker.

If a marker value is changed using the rotary knob, the step size is defined via the Stepsize Standard or Stepsize Sweep Points softkeys.

Marker 1 is always the reference marker for relative measurements. If activated, markers 2 to 16 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Norm/Delta" softkey. If marker 1 is the active marker, pressing the "Marker Norm/Delta" softkey switches on an additional delta marker.

SCPI command:

CALCulate<n>:MARKer<m>[:STATe] on page 472

CALCulate<n>:MARKer<m>:X on page 481

CALCulate<n>:MARKer<m>:Y on page 483

CALCulate<n>:DELTamarker<m>[:STATe] on page 423

CALCulate<n>:DELTamarker<m>:X on page 433

CALCulate<n>:DELTamarker<m>:X:RELative on page 433

CALCulate<n>:DELTamarker<m>:Y on page 434

Search Signals ← AM Mod Depth
Activates all markers.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:TOI:RESult on page 498

3.3.5.11 Measuring Harmonic Distortion

The harmonics and their distortion can be measured using the "Harmonic Distortion" softkey (see "Harmonic Distortion" on page 189). For details on the parameters see the corresponding softkeys.

With span > 0 Hz, an automatic search for the first harmonic is carried out within the set frequency range. Also the level is adjusted. In zero span, the center frequency is unchanged.

In the upper window, the zero span sweeps on all harmonics are shown, separated by display lines. This provides a very good overview of the measurement. In the lower window, the mean RMS results are displayed in numerical values. The THD (total harmonic distortion) values are displayed in the marker field.

A measurement example is described in chapter 2.2, "Measurement of Harmonics", on page 12

Softkeys for Harmonic Distortion Measurements

Harmonic Distortion
Opens a submenu to determine the settings for harmonics measurement and activates the harmonic distortion measurement.

With this measurement it is possible to measure the harmonics e.g. from a VCO easily. In addition the THD (total harmonic distortion) is calculated in % and dB.

With span > 0 Hz, an automatic search for the first harmonic is carried out within the set frequency range. Also the level is adjusted. In zero span, the center frequency is unchanged.

In the upper window, the zero span sweeps on all harmonics are shown, separated by display lines. This provides a very good overview about the measurement. In the lower window, the mean RMS results are displayed in numerical values. The THD values are displayed in the marker field.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics[:STATe] on page 499
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:DISTortion on page 500
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:LIST on page 501

No. of Harmonics ← Harmonic Distortion
Sets the number of harmonics that shall be measured. The range is from 1 to 26.
SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:NHARmonics on page 502

Harmonic Sweep Time ← Harmonic Distortion

For details refer to the Sweeptime Manual softkey in the "Bandwidth" menu.

Harmonic RBW Auto ← Harmonic Distortion

Enables/disables the automatic adjustment of the resolution bandwidth for filter types Normal (3dB) (Gaussian) and 5-Pole filters. The automatic adjustment is carried out according to:

"$RBW_n = RBW_1 * n$"

If RBW_n is not available, the next higher value is used.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:BANDwidth:AUTO
on page 500

Adjust Settings ← Harmonic Distortion

Activates the frequency search in the frequency range that was set before starting the harmonic measurement (if harmonic measurement was with span > 0) and adjusts the level.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:PRESet on page 502

3.3.6 Measurement Configuration – MEAS CONFIG Key

The MEAS CONFIG key displays the submenu of the currently activated and running measurement function, e.g. the submenu of "TOI" or "Harmonic Distortion" (see chapter 3.3.5, "Power Measurements – MEAS Key", on page 186, for quick access to the measurement configuration. If no measurement function is activated, this key has no effect.

3.3.7 Using Limit Lines and Display Lines – LINES Key

The LINES key is used to configure limit and display lines.

To open the Lines menu

● Press the LINES key.

The "Lines" menu and the "Select Limit Line" dialog box are displayed. For details on the "Select Limit Line" dialog box refer to chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

Menu and softkey description

● chapter 3.3.7.1, "Softkeys of the Lines Menu", on page 261

Further information

● chapter 3.3.7.2, "Display Lines", on page 265
● chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265

Tasks

- chapter 3.3.7.4, "Working with Lines", on page 266
- chapter 3.3.7.5, "Selecting a Limit Line", on page 266
- chapter 3.3.7.6, "Creating a New Limit Line", on page 267
- chapter 3.3.7.7, "Editing an Existing Limit Line", on page 270
- chapter 3.3.7.8, "Creating a New Limit Line Based upon an Existing Limit Line", on page 270
- chapter 3.3.7.9, "Activating/Deactivating a Limit Line", on page 270

3.3.7.1 Softkeys of the Lines Menu

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

Further information

- chapter 3.3.7.2, "Display Lines", on page 265
- chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265

Tasks

- chapter 3.3.7.4, "Working with Lines", on page 266
- chapter 3.3.7.5, "Selecting a Limit Line", on page 266
- chapter 3.3.7.6, "Creating a New Limit Line", on page 267
- chapter 3.3.7.7, "Editing an Existing Limit Line", on page 270
- chapter 3.3.7.8, "Creating a New Limit Line Based upon an Existing Limit Line", on page 270
- chapter 3.3.7.9, "Activating/Deactivating a Limit Line", on page 270

Select Traces to check
Opens a dialog box to activate the selected limit line for a trace. One limit line can be
activated for several traces simultaneously. For details see also chapter 3.3.7.9, "Acti-
vating/Deactivating a Limit Line", on page 270.

SCPI command:
CALCulate<n>:LIMit<k>:TRACe on page 447
CALCulate<n>:LIMit<k>:STATe on page 447

Deselect All
Deactivates the selected limit line for all assigned traces. For details see also chap-
ter 3.3.7.9, "Activating/Deactivating a Limit Line", on page 270.

SCPI command:
CALCulate<n>:LIMit<k>:STATe on page 447

New
Opens the "Edit Limit Line" dialog box and a submenu to define a new limit line. For details
see also chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265 and chap-
ter 3.3.7.5, "Selecting a Limit Line", on page 266.

Edit Name ← New
Sets the focus on the "Name" field to enter or change the limit line name. All names must
be compatible with the Windows XP conventions for file names. The limit line data are
stored under this name. The instrument stores all limit lines with LIM as extension.

SCPI command:
CALCulate<n>:LIMit<k>:LOWer:MODE on page 466

Edit Comment ← New
Sets the focus on the "Comment" field to enter or change a comment for the limit line.
The text must not exceed 40 characters.

SCPI command:
CALCulate<n>:LIMit<k>:COMMent on page 445

Edit Margin ← New
Sets the focus on the "Margin" field to enter or change a margin for the limit line. The
default setting is 0 dB (i.e. no margin).

Edit Value ← New
Opens an edit dialog box to change an existing x or y value, depending on the selected
column. The softkey is only available if an existing value is selected.

The desired data points are entered in ascending order (two repeated frequencies/time values are permitted).

SCPI command:

CALCulate<n>:LIMit<k>:CONTrol[:DATA] on page 457

CALCulate<n>:LIMit<k>:UPPer[:DATA] on page 468

CALCulate<n>:LIMit<k>:LOWer[:DATA] on page 464

Insert Value ← New
Creates an empty line above the selected data point to enter a new data point.

It is also possible to add a data point at the end of the list, if the focus is set below the last entry line of the list.

The data points are entered in ascending order (two repeated frequencies/time values are permitted). If the entered values are not in accordance with the ascending order rule, an error message is displayed and the values are discarded.

Delete Value ← New
Deletes the selected data point (x and y value). All succeeding data points are shifted up accordingly. This softkey is only available if an existing value is selected.

Save Limit Line ← New
Saves the currently edited limit line under the name defined in the "Name" field.

Edit
Opens a submenu to edit limit lines. For details see also chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265 and chapter 3.3.7.7, "Editing an Existing Limit Line", on page 270.

The submenu contains the same commands as the "New" menu, see "New" on page 262.

SCPI command:
chapter 4.3.3, "Limit Lines and Limit Test", on page 789

Copy to
Copies the data of the selected limit line and displays it in the "Edit Limit Line" dialog box. If the limit line is edited and saved under a new name, a new limit line can be easily generated by parallel translation or editing of an existing limit line.

For details see also chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265 and chapter 3.3.7.8, "Creating a New Limit Line Based upon an Existing Limit Line", on page 270.

The submenu contains the same commands as the "New" menu, see "New" on page 262.

SCPI command:
CALCulate<n>:LIMit<k>:COPY on page 445

Delete
Deletes the selected limit line.

SCPI command:
CALCulate<n>:LIMit<k>:DELete on page 446

X Offset

Horizontally shifts a limit line that has been specified for relative frequencies or times (x-axis). The softkey opens an edit dialog box in which the value for shifting can be entered numerically or via the rotary knob.

Note: This softkey does not have any effect on limit lines that represent absolute values for the x-axis.

SCPI command:

CALCulate<n>:LIMit<k>:CONTrol:OFFSet on page 459

Y Offset

Vertically shifts a limit line that has relative values for the y-axis (levels or linear units such as volt). The softkey opens an edit dialog box in which the value for shifting can be entered numerically or via the rotary knob.

Note: This softkey does not have any effect on limit lines that represent absolute values for the y-axis.

SCPI command:

CALCulate<n>:LIMit<k>:LOWer:OFFSet on page 465

CALCulate<n>:LIMit<k>:UPPer:OFFSet on page 469

Display Lines

Opens a submenu to enable, disable and set display lines. Which softkeys are available depends on the display mode (frequency or time range). For details see also chapter 3.3.7.2, "Display Lines", on page 265 and chapter 3.3.7.4, "Working with Lines", on page 266.

The submenu contains the following commands:

- "Display Line 1 / Display Line 2" on page 264
- "Display Line 1 / Display Line 2" on page 264
- "Frequency Line 1 / Frequency Line 2 " on page 264
- "Frequency Line 1 / Frequency Line 2 " on page 264
- "Time Line 1 / Time Line 2" on page 265
- "Time Line 1 / Time Line 2" on page 265

Display Line 1 / Display Line 2 ← Display Lines

Enables or disables the level lines 1/2 and opens an edit dialog box to enter the position of the lines. For details see also chapter 3.3.7.2, "Display Lines", on page 265 and chapter 3.3.7.4, "Working with Lines", on page 266.

SCPI command:

CALCulate<n>:DLINe<k>:STATe on page 441

CALCulate<n>:DLINe<k> on page 441

Frequency Line 1 / Frequency Line 2 ← Display Lines

Enables or disables the frequency lines 1/2 (span > 0) and opens an edit dialog box to enter the position of the lines. For details see also chapter 3.3.7.2, "Display Lines", on page 265 and chapter 3.3.7.4, "Working with Lines", on page 266.

SCPI command:

CALCulate<n>:FLINe<k>:STATe on page 444

CALCulate<n>:FLINe<k> on page 443

Time Line 1 / Time Line 2 ← Display Lines
Enables or disables the time lines 1/2 (zero span) and opens an edit dialog box to enter the position of the lines. For details see also chapter 3.3.7.2, "Display Lines", on page 265 and chapter 3.3.7.4, "Working with Lines", on page 266.

SCPI command:
CALCulate<n>:TLINe<Line>:STATe on page 544
CALCulate<n>:TLINe<Line> on page 544

3.3.7.2 Display Lines

Display lines help to evaluate a trace – as do markers. The function of a display line is comparable to that of a ruler that can be shifted on the trace in order to mark absolute values. They are used exclusively to visually mark relevant frequencies or points in time (span = 0), as well as constant level values. It is not possible to check automatically whether the points are below or above the marked level values.

For details on setting and switching the display lines on/off see chapter 3.3.7.4, "Working with Lines", on page 266.

Two different types of display lines are provided:

- Two horizontal level lines for marking levels – Display Line 1 and 2
  The level lines are continuous horizontal lines across the entire width of a diagram and can be shifted in y direction.

- Two vertical frequency or time lines for marking frequencies or points in time – Frequency/Time Line 1 and 2
  The frequency or time lines are continuous vertical lines across the entire height of the diagram and can be shifted in x direction.
  Each line is identified by one of the following abbreviations:
  – D1: Display Line 1
  – D2: Display Line 2
  – F1: Frequency Line 1
  – F2: Frequency Line 2
  – T1: Time Line 1
  – T2: Time Line 2

3.3.7.3 Limit Lines (Frequency/Time Lines)

Limit lines are used to define amplitude curves or spectral distribution boundaries on the display screen which are not to be exceeded. They indicate, for example, the upper limits for interference radiation or spurious waves which are allowed from a device under test (DUT). For transmission of information in TDMA systems (e.g. GSM), the amplitude of the bursts in a timeslot must adhere to a curve that falls within a specified tolerance band. The lower and upper limits may each be specified by a limit line. Then, the amplitude curve can be controlled either visually or automatically for any violations of the upper or lower limits (GO/NOGO test).

The instrument supports limit lines with a maximum of 50 data points. 8 of the limit lines stored in the instrument can be activated simultaneously. The number of limit lines stored

in the instrument is only limited by the capacity of the flash disk used. Which softkeys are available depends on the display mode (frequency or time range). For details see also chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

Limit lines are compatible with the current measurement settings, if the following applies:

● The x unit of the limit line has to be identical to the current setting.

● The y unit of the limit line has to be identical to the current setting with the exception of dB based units; all dB based units are compatible with each other.

At the time of entry, the analyzer immediately checks that all limit lines are in accordance with the following guidelines:

● The frequencies/times for each data point must be entered in ascending order, however, for any single frequency/time, two data points may be entered (vertical segment of a limit line).

● The data points are allocated in order of ascending frequency/time. Gaps are not allowed. If gaps are desired, two separate limit lines must be defined and then both enabled.

● The entered frequencies/times need not necessarily be selectable in analyzer. A limit line may also exceed the specified frequency or time range. The minimum frequency for a data point is -200 GHz, the maximum frequency is 200 GHz. For the time range representation, negative times may also be entered. The allowed range is -1000 s to +1000 s.

3.3.7.4 Working with Lines

If a line is switched on, the softkey is highlighted.

Switching a line on or off:

1. Press the Display Lines softkey.

2. Press the softkey for the required line, e.g. Display Line 1 / Display Line 2.

    An edit dialog box is opened to enter the position of the line (by rotary knob, step keys or numerical entry). If the line was switched off, it is switched on. If it was switched on, it remains switched on.

3. If another softkey is pressed, the edit dialog box for the line is closed, but the line remains switched on (softkey with highlighted background).

4. When you press the Display Line 1 / Display Line 2 softkey for the second time, the edit dialog box for the line is opened again.

5. When you press the Display Line 1 / Display Line 2 softkey the third time, the line is switched off (softkey without highlighted background).

3.3.7.5 Selecting a Limit Line

● To display the "Select Limit Line" dialog box, press the LINES key.

All limit lines saved in the default directory and all subdirectories are displayed. For each limit line, the following information is given:

"Unit"	unit of the y-axis
"Traces"	selected traces to check
"Show"	limit line displayed in the measurement diagram or hidden
"Compatible"	compatibility of the limit line to the current measurement settings
"Offset"	user-definable X- and Y-offset for the limit line
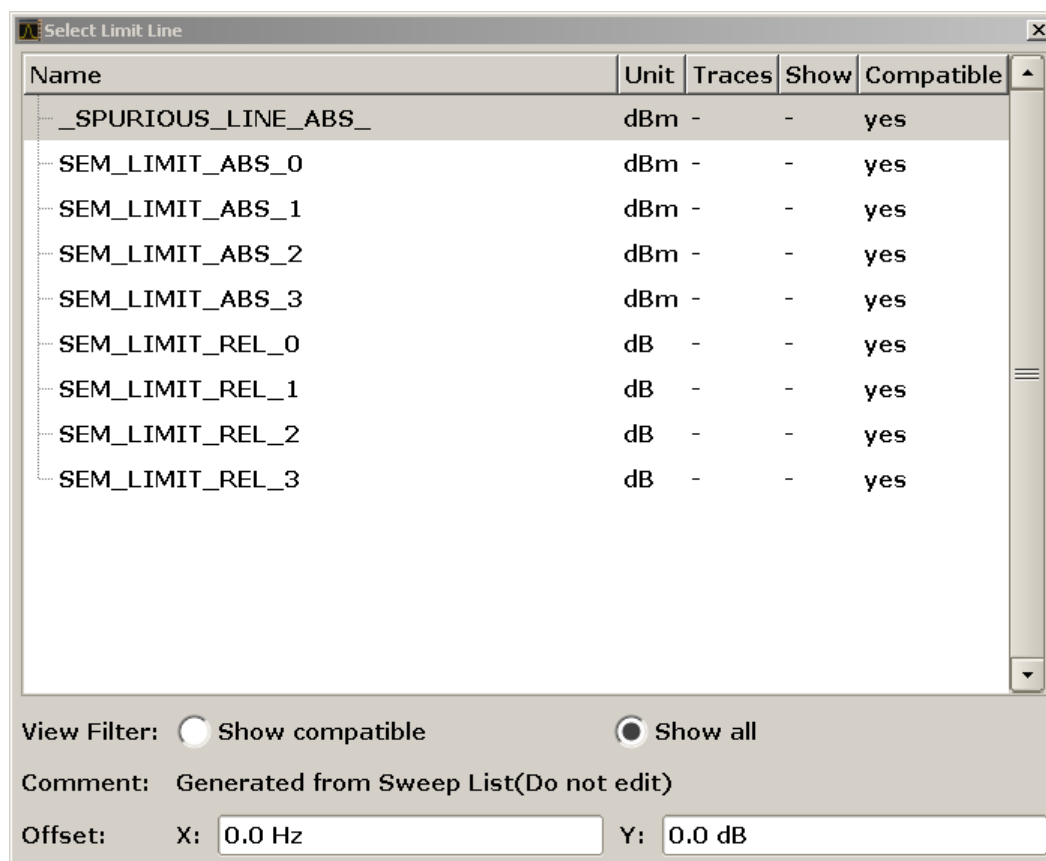
- To display only the limit lines that are compatible, activate the "Show compatible" option. For details on compatibility refer to chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265.

3.3.7.6 Creating a New Limit Line

Press the New softkey to define a new limit line.

The "Edit Limit Line" dialog box is displayed. For more details on limit lines refer also to chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265. The following settings can be defined:

Setting	Description
Name	The name under which the limit line is to be stored in the main directory.
	To save the limit line in an existing subdirectory, enter the relative path. A new subdirectory can only be created using the FILE key (for details refer to "Save File / Recall File" on page 82.
Comment	Optional description
Threshold	Absolute threshold value that works as a lower limit for the relative limit values (only for relative scaling of the y-axis).
Margin	A signal-level distance to the limit line.
Position	Position of data point
Value	Value of data point
X-Axis:	
Span setting	"Hz" for span > 0 Hz "s" for zero span
Scale mode	- Absolute: The frequencies or times are interpreted as absolute physical units. - Relative: In the data point table, the frequencies are referred to the currently set center frequency. In the zero span mode, the left boundary of the diagram constitutes the reference. Relative scaling is always suitable if masks for bursts are to be defined in zero span or if masks for modulated signals are required for span > 0 Hz.
Scale	- Linear - Logarithmic
Y-Axis:	
Scale unit	Unit of the y-axis
Scale mode	- Absolute: The limit values refer to absolute levels or voltages. - Relative: The limit values refer to the reference level (Ref Level). Limit values with the unit dB are always relative values.
Limit type	- Upper limit - Lower limit

In addition, the following functions are available for the limit line:

Defining a threshold

If the scaling of the y-axis is relative, you can define an absolute threshold value that works as a lower limit for the relative limit values (see figure below). Enter a value in the "Threshold" field of the "Edit Limit Line" dialog box.

The function is especially useful for mobile radio applications provided the limit values are defined in relation to the carrier power as long as they are above an absolute limit value.
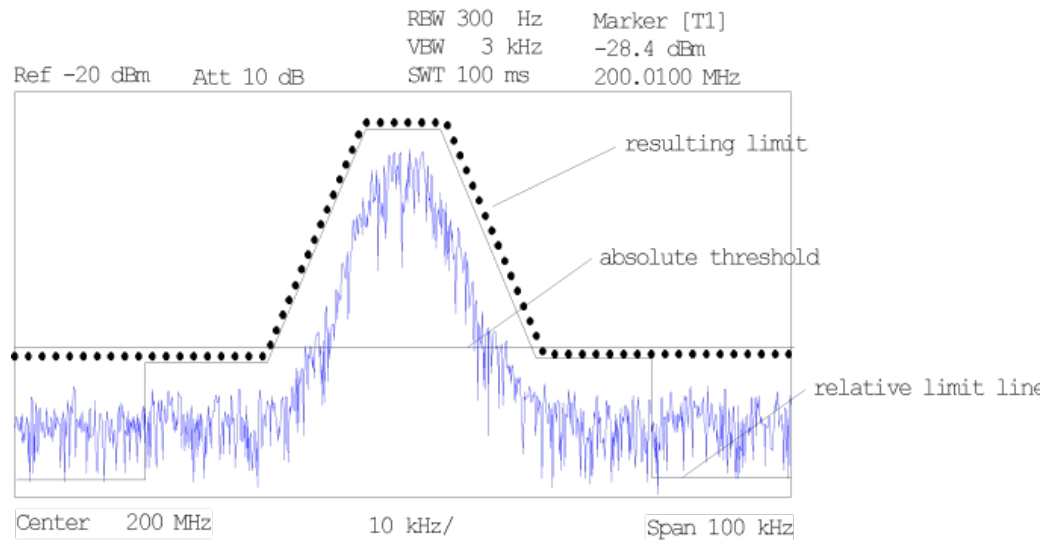
Defining a margin

To define a signal-level distance to the limit line, enter a value in the "Margin" field of the "Edit limit Line" dialog box.

If the limit line is defined as an upper limit, the margin means that the level is below the limit line. If the limit line is defined as a lower limit, the margin means that the level is above the limit line.

Entering a new data point

1. Press the "Insert value" button in the dialog, or select an existing data point in the table and press the Insert Value softkey.

2. Enter the new position (x) and value (y) in the edit dialog box.

Changing a data point

1. Press on the data point to be changed in the table.

2. Enter the new position (x) and value (y) in the edit dialog box.

Deleting a data point

1. Press on the data point to be deleted in the table.

2. Press the "Delete" button in the dialog.

Shifting a limit line horizontally

● Select the "Shift x" button and enter a shift width for the x value in the edit dialog box.

Shifting a limit line vertically

● Select the "Shift y" button and enter a shift width for the y value in the edit dialog box.

Saving the limit line settings

- Press the "Save" button in the dialog.
  If an existing name is used, a message box is displayed. You have to confirm before the limit line is overwritten.

3.3.7.7 Editing an Existing Limit Line

In the "Select Limit Line" dialog box, select the limit line you want to change. For details see also chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

1. Press the "Edit" on page 263 softkey.

2. Edit the data as described in chapter 3.3.7.6, "Creating a New Limit Line", on page 267.

3. Save the limit line ("Save Limit Line" on page 263 softkey).

3.3.7.8 Creating a New Limit Line Based upon an Existing Limit Line

1. In the "Select Limit Line" dialog box, select the limit line you want to use as a basis for a new limit line. For details see also chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

2. Press the Copy to softkey to transfer the data of the limit line into the "Edit Limit Line" dialog box.

3. Press the Edit Name softkey and enter a new name.

4. To shift the complete limit line parallel in the horizontal direction, select the "Shift x" button and enter an x shift value. In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally.

5. To shift the complete limit line parallel in the vertical direction, select the "Shift y" button and enter a y shift value. In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted vertically.

6. If required, edit the data as described in chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

7. Save the limit line (Save Limit Line softkey).

3.3.7.9 Activating/Deactivating a Limit Line

Prerequisites:

The x- and y-units of limit line and current measurement setting have to be compatible. For details refer to chapter 3.3.7.3, "Limit Lines (Frequency/Time Lines)", on page 265.

The limit line has to consist of 2 or more data points.

1. In the "Select Limit Line" dialog box, select the limit line you want to activate/deactivate. For details see also chapter 3.3.7.5, "Selecting a Limit Line", on page 266.

2. To activate or deactivate a limit line for a trace, press the "Select Traces to check" on page 262 softkey and select or deselect the trace(s) to which this limit line applies.

3. To deactivate the limit line for all traces, press the "Deselect All" on page 262 softkey.

3.3.8 Input/Output Configuration – INPUT/OUTPUT Key

The INPUT/OUTPUT key is used to configure input and output sources for measurement functions.

3.3.8.1 Softkeys of the Input/Output Menu

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

Input (AC/DC)
Toggles the RF input of the analyzer between AC and DC coupling.

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

SCPI command:
INPut:COUPling on page 562

Noise Source

Switches the supply voltage for an external noise source on or off. For details on connectors refer to the Quick Start Guide, chapter 1 "Front and Rear Panel".

SCPI command:

DIAGnostic<n>:SERVice:NSOurce on page 701

Video Output

Sends a video output signal according to the measured level to the connector on the rear panel of the analyzer.

Note: Video output does not return valid values in IQ or FFT mode.

SCPI command:

OUTP:IF VID , see OUTPut:IF[:SOURce] on page 729

Tracking Generator

This softkey is only available if the R&S FSV option Tracking Generator (R&S FSV-B9) or External Tracking Generator (R&S FSV-B10) or both are installed. It is not available in I/Q Analyzer mode.

For details see the base unit description.

Power Sensor

For precise power measurement a power sensor can be connected to the instrument via the front panel (USB connector) or the rear panel (power sensor, option R&S FSV-B5). The Power Sensor Support firmware option (R&S FSV-K9) provides the power measurement functions for this test setup.

This softkey is only available if the analyzer option Power Sensor (R&S FSV-K9) is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

For details see the chapter "Instrument Functions Power Sensor (K9)" in the base unit description.

Trigger Out

Sets the Trigger Out port in the Additional Interfaces (option R&S FSV-B5 only) to low or high. Thus, you can trigger an additional device via the external trigger port, for example.

SCPI command:

OUTPut:TRIGger on page 729

External Mixer

Opens the submenu for the external mixer.

For details see the base unit description.

Signal Source

Opens a dialog box to select the signal source. For "Digital Baseband (I/Q)", the source can also be configured here.

Input Path ← Signal Source

Defines whether the "RF Radio Frequency" or the "Baseband Digital" input path is used for measurements. "Baseband Digital" is only available if option R&S FSV-B17 (Digital Baseband interface) is installed.

Note: Note that the input path defines the characteristics of the signal, which differ significantly between the RF input and digital input.

SCPI command:

INPut:SELect on page 567

Connected Device ← Signal Source

Displays the name of the device connected to the optional Digital Baseband interface (R&S FSV-B17) to provide Baseband Digital input. The device name cannot be changed here.

The device name is unknown.

SCPI command:

INPut:DIQ:CDEVice on page 562

Input Sample Rate ← Signal Source

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.

SCPI command:

INPut:DIQ:SRATe on page 564

Full Scale Level ← Signal Source

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

The level can be defined either in dBm or Volt.

SCPI command:

INPut:DIQ:RANGe[:UPPer] on page 564

Level Unit ← Signal Source

Defines the unit used for the full scale level.

SCPI command:

INPut:DIQ:RANGe[:UPPer]:UNIT on page 564

Adjust Reference Level to Full Scale Level ← Signal Source

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

(See the Auto Level softkey).

SCPI command:

INPut:DIQ:RANGe:COUPling on page 563

EXIQ

Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

If the optional R&S DigIConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DigIConf requires a USB connection (not LAN!) from the analyzer to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface connection. R&S DigIConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the Digital Baseband Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

TX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital output to a connected device ("Transmitter" Type).

RX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital input from a connected device ("Receiver" Type).

Send To ← EXIQ
The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

Firmware Update ← EXIQ
If a firmware update for the R&S EX-IQ-BOX is delivered with the analyzer firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

R&S Support ← EXIQ
Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

DigIConf ← EXIQ
Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the analyzer application, press any key on the front panel. The application is displayed with the "EXIQ" 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 mini-mized, 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 analyzer once again.

SCPI command:
Remote commands for the R&S DigIConf software always begin with SOURce:EBOX. Such commands are passed on from the analyzer 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.

Digital Output
Opens a dialog box to enable a digital output stream to the optional Digital Baseband interface (R&S FSV-B17), if available.

The displayed sample rate is identical to the sample rate defined under Data Acquisition (I/Q Analyzer) and is not editable here.

For details see "Digital Output" in the description of the Digital Baseband Interface for the base unit.

SCPI command:
OUTPut:DIQ on page 573

Digital Baseband Info
Displays a dialog box with information on the digital I/Q input and output connection via the optional Digital Baseband interface (R&S FSV-B17), if available. The information includes:

* Device identification
* Used port
* (Maximum) digital input/output sample rates and maximum digital input/output transfer rates
* Status of the connection protocol
* Status of the PRBS descewing test

For details see "Interface Status Information" in "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)" in the description of the base unit.

SCPI command:
INPut:DIQ:CDEVice on page 562

3.3.9 Performing Measurements – RUN SINGLE/RUN CONT Keys

The RUN SINGLE and RUN CONT keys are used to start measurement tasks.

- RUN SINGLE switches to single sweep mode and performs a single sweep, just as the Single Sweep softkey in the "Sweep" menu does.
- RUN CONT switches to continuous sweep mode and starts sweeping, just as the Continuous Sweep softkey in the "Sweep" menu does.

3.4 Measurement Modes

This section describes the provided measurement modes, the change of measurement modes and the access to the menus of all active measurement modes. For details refer to the following sections:

3.4.1 Measurement Mode Selection – MODE Key

The MODE key provides a quick access to the menu of the current measurement mode and a fast change of the measurement mode. You can choose from the following measurement modes:

- chapter 3.4.1.13, "CDMA2000 BTS and MS Mode (R&S FSVOptions K82 / K83)", on page 280

- chapter 3.4.1.14, "1xEV-DO BTS and MS Mode (Options R&S FSV-K84/-K85)", on page 280

- chapter 3.4.1.15, "WLAN Mode (WLAN TX Measurements Option, R&S FSV-K91)", on page 280 (not available for analyzer 40 model 1307.9002K39)

- chapter 3.4.1.16, "WiMAX Mode (WiMAX IEEE 802.16 OFDM, OFDMA Measurements Option, R&S FSV-K93)", on page 280 (not available for analyzer 40 model 1307.9002K39)

- chapter 3.4.1.17, "LTE Mode", on page 281
  (not available for analyzer 40 model 1307.9002K39)

The "Power Sensor" mode can be accessed via the INPUT/OUTPUT key. This mode provides measurement functions for Power Sensors. The "Power Sensor" mode requires an instrument equipped with the corresponding optional software.

Spectrogram mode

Equipped with the firmware option R&S FSV-K14, the analyzer provides a graphical overview of changes in frequency and amplitude over a specified period of time. Spectrogram mode can be accessed viat the TRACE key.

For details see the description of R&S FSV-K14 in the base unit document.

To change the measurement mode

1. Press the MODE key.

   A menu with the currently available measurement modes is displayed.

2. To activate a different mode, press the corresponding softkey.

Storing application-specific settings when switching modes

To store application-specific settings when you switch modes, activate the "Application Setup Recovery" softkey in the "Setup" menu before starting a new mode (see "Application Setup Recovery" on page 76).

3.4.1.1 Spectrum Mode

In the "Spectrum" mode the provided functions correspond to those of a conventional spectrum analyzer. The analyzer measures the frequency spectrum of the test signal over the selected frequency range with the selected resolution and sweep time, or, for a fixed frequency, displays the waveform of the video signal. This mode is set in the initial configuration.

You can use up to four spectrum displays simultaneously. The additional spectrum displays are independent of each other. You can set up each display as you like without

affecting measurement configurations in another one. Each additional spectrum display opens in an extra tab labelled "Spectrum 1" to "Spectrum 4".

► To add a new spectrum display, press the "New Spectrum" softkey.
  The analyzer opens an additional "Spectrum" tab each time you press the softkey up to a maximum of four.

SCPI Command:

INSTrument[:SELect] on page 567

INSTrument:NSELect on page 570

INSTrument:CREate[:NEW] on page 569

3.4.1.2 I/Q Analyzer Mode

The "I/Q Analyzer" mode provides measurement and display functions for digital baseband signals. For details refer to chapter 3.5, "Instrument Functions - I/Q Analyzer", on page 281.

3.4.1.3 Analog Demodulation Mode (Analog Demodulation Option, R&S FSV-K7)

The "Analog Demodulation" mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for demodulating AM, FM, or PM signals.

For details see the R&S FSV-K7 document.

3.4.1.4 FM Stereo Mode (Option R&S FSV-K7S)

The "FM Stereo" mode provides measurement functions for demodulating FM Stereo signals. This mode requires an instrument equipped with the corresponding optional software, as well as the Analog Demodulation option (R&S FSV-K7).

For details see the R&S FSV-K7 document.

3.4.1.5 Bluetooth Mode (Option R&S FSV-K8)

The "Bluetooth" mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for performing Bluetooth measurements.

For details see the R&S FSV-K8 document.

3.4.1.6 GSM/EDGE Analyzer Mode (GSM/EDGE Option, R&S FSV-K10)

The "GSM/EDGE Analyzer" mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for downlink or uplink

signals according to the Third Generation Partnership Project (3GPP) standards for GSM/ EDGE in different domains (Time, Frequency, I/Q).

For details see the R&S FSV-K10 document.

3.4.1.7   Noise Figure Mode (Noise Figure Measurements Option, R&S FSV-K30)

The "Noise Figure" mode requires an instrument equipped with the corresponding optional software. This mode provides noise figure measurements.

For details see the R&S FSV-K30 document.

3.4.1.8   Phase Noise Mode (Phase Noise Measurements Option, R&S FSV-K40)

The "Phase Noise" mode requires an instrument equipped with the corresponding optional software. This mode provides measurements for phase noise tests.

For details see the R&S FSV-K40 document.

3.4.1.9   Vector Signal Analysis mode (VSA Option, R&S FSV-K70)

The "Vector Signal Analysis" (VSA) mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for vector signal analysis.

For details refer to the R&S FSV-K70 document.

3.4.1.10   3G FDD BTS Mode (3GPP Base Station Measurements Option, R&S FSV-K72)

The "3G FDD BTS" mode requires an instrument equipped with the corresponding optional software. This mode provides test measurements for WCDMA downlink signals (base station signals) according to the test specification.

For details see the R&S FSV-K72 document.

3.4.1.11   3G FDD UE Mode (3GPP User Equipment Measurements Option, R&S FSV-K73)

The "3G FDD UE" mode requires an instrument equipped with the corresponding optional software. This mode provides test measurements for WCDMA uplink signals (mobile signals) according to the test specification.

For details see the R&S FSV-K73 document.

3.4.1.12   TDS BTS and TDS UE Mode (Option R&S FSV-K76/-K77)

Equipped with the firmware application R&S FSV-K76, the analyzer performs code domain measurements on forward link signals according to the 3GPP standard (Third Generation Partnership Project). TD-SCDMA BTS Analysis is performed in "TDS BTS" mode.

Equipped with the firmware application R&S FSV-K77, the R&S FSV performs code domain measurements on downlink signals according to the 3GPP standard. TD-SCDMA ue Analysis is performed in "TDS ue" mode.

For details see the R&S FSV-K76/-K77 document.

3.4.1.13 CDMA2000 BTS and MS Mode (R&S FSVOptions K82 / K83)

The "CDMA2000 BTS" mode requires an instrument equipped with the optional softwareR&S FSV-K82. This mode provides test measurements for basic CDMA2000 base station tests.

The "CDMA2000 MS" mode requires an instrument equipped with the optional softwareR&S FSV-K83. This mode provides test measurements for basic CDMA2000 mobile station tests.

For details see the R&S FSV-K82/-K83 document.

3.4.1.14 1xEV-DO BTS and MS Mode (Options R&S FSV-K84/-K85)

The "1xEV-DO BTS" mode requires an instrument equipped with the optional software R&S FSV-K84. This mode provides Code Domain measurements on forward link signals according to the 3GPP2 Standard (Third Generation Partnership Project 2) High Rate Packet Data, generally referred to as "1xEV-DO".

The "1xEV-DO MS" mode requires an instrument equipped with the optional software R&S FSV-K85. This mode provides Code Domain measurements on reverse link signals according to the 3GPP2 Standard (Third Generation Partnership Project 2) High Rate Packet Data, generally referred to as "1xEV-DO".

For details see the R&S FSV-K84/-K85 document.

3.4.1.15 WLAN Mode (WLAN TX Measurements Option, R&S FSV-K91)

The "WLAN" mode requires an instrument equipped with the corresponding optional software. This mode provides Wireless LAN TX measurement functions according to IEEE 802.11 a, b, g and j standards.

This option is not available for analyzer 40 model 1307.9002K39.

For details see the R&S FSV-K91 document.

3.4.1.16 WiMAX Mode (WiMAX IEEE 802.16 OFDM, OFDMA Measurements Option, R&S FSV-K93)

The "WiMAX" mode requires an instrument equipped with the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93). This mode provides WiMAX and WiBro measurement functions according to IEEE standards 802.16-2004 OFDM and 802.16e-2005 OFDMA/WiBro. It includes the WiMAX 802.16 OFDM Measurements option.

This option is not available for analyzer 40 model 1307.9002K39.

For details see the R&S FSV-K93 document.

3.4.1.17 LTE Mode

The LTE mode requires an instrument equipped with one of the EUTRA/LTE DL measurement applications that are available for the analyzer.

- R&S FSV-K100 LTE FDD DL
- R&S FSV-K101 LTE FDD UL
- R&S FSV-K104 LTE TDD DL
- R&S FSV-K105 LTE TDD UL

The application provides EUTRA/LTE measurement functions according to the 3GPP standard.

This option is not available for analyzer 40 model 1307.9002K39.

For details see the R&S FSV-K100/K104 document.

3.4.2 Measurement Mode Menus – HOME Key

The HOME key provides a quick access to the root menu of the current measurement mode.

For the basic "Spectrum" mode (except for tracking generator measurements, see chapter 3.6, "Instrument Functions – Tracking Generator (Options R&S FSV-B9/ R&S FSV-B10)", on page 301), the softkeys of this menu are identical to the chapter 3.2.2.1, "Softkeys of the Frequency Menu", on page 98.

For details on changing the mode refer to chapter 3.4.1, "Measurement Mode Selection – MODE Key", on page 276.

3.5 Instrument Functions - I/Q Analyzer

The I/Q Analyzer provides functions to capture, visualize and evaluate I/Q data. These functions include:

- capturing data from the RF input or a Digital Baseband interface (with R&S FSV-B17 option)
- displaying I/Q data in various result types, e.g. separate Real/Imag diagrams or as an I/Q-vector
- providing I/Q data to a digital output for further processing in other devices (with R&S FSV-B17 option)

Menu and softkey description

The "I/Q Analyzer" menu is displayed when you select the "I/Q Analyzer" softkey in the MODE menu. The same menu is displayed when you press the MEAS or MEAS CON-FIG keys in "I/Q Analyzer" mode. For details see chapter 3.5.1, "Softkeys and Parameters of the I/Q Analyzer Menu", on page 283.

The "Amplitude" menu, which is displayed when you select the AMPT key, is described in see chapter 3.5.2, "Softkeys of the Amplitude Menu in I/Q Analyzer Mode", on page 290.

The "Input/Output" menu, which is displayed when you select the INPUT/OUTPUT key, contains the same functions in I/Q Analyzer mode as in "Spectrum" mode (see chapter 3.3.8.1, "Softkeys of the Input/Output Menu", on page 271).

The "Marker" menu is identical to the one in Spectrum mode for display modes "Magnitude","Real/Imag" and "Spectrum" (except for "Marker Zoom"), see "Display Config" on page 287. For the other display modes this menu is not available.

The "Marker To" menu is identical to the one in Spectrum mode. For the "I/Q" display mode, an additional function is available, see chapter 3.5.3, "Softkeys of the Marker To Menu in I/Q Analyzer Mode", on page 294.

The "Trace" menu is identical to the one in Spectrum mode, except in "I/Q Vector" display mode. In this case, only 1 trace is available and no detector can be selected (see chapter 3.2.8.1, "Softkeys of the Trace Menu", on page 130).

The "Trigger" menu, which is displayed when you select the TRIG key, is described in see chapter 3.5.4, "Softkeys of the Trigger Menu in I/Q Analyzer Mode", on page 294.

The "Span", "BW", and "Lines" menus are not available in this mode. For digital input, the "Frequency" menu is also not available. All other menus are identical to those described for "Spectrum" mode (see chapter 3.2, "Measurement Parameters", on page 93 and chapter 3.3, "Measurement Functions", on page 157.

Remote Control

Measurements with the I/Q Analyzer can also be performed via remote control. The required commands are contained in the following subsystems:

- chapter 4.2.3.9, "INPut Subsystem", on page 561
- "TRACe:IQ Subsystem", on page 678
- chapter 4.2.3.12, "OUTPut Subsystem", on page 572

Further information

- Some general information on working with I/Q data can be found in chapter 3.2.10, "Working with I/Q Data", on page 153.
- When measuring I/Q data, you may make use of the optional Digital Baseband interface (R&S FSV-B17); for details see chapter 3.7, "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)", on page 326.

3.5.1 Softkeys and Parameters of the I/Q Analyzer Menu

This section describes the softkeys and parameters of the "I/Q Analyzer" submenu which is displayed when you select the "I/Q Analyzer" softkey in the MODE menu. The same menu is displayed when you press the MEAS or MEAS CONFIG keys in "I/Q Analyzer" mode.

I/Q Analyzer

Starts the I/Q Analyzer evaluation mode and opens the submenu for the I/Q analyzer, which allows you to configure and display measurements of I/Q data, e.g. digital baseband signals.

SCPI command:

TRACe<n>:IQ[:STATe] on page 679

TRAC:IQ:EVAL ON

Activates I/Q Analyzer evaluation mode, see TRACe<n>:IQ:EVAL on page 685

or

CALCulate<n>:FORMat on page 545

Activates I/Q Analyzer evaluation mode and selects the display configuration.

Signal Source ← I/Q Analyzer

Opens a dialog box to select the signal source. For "Digital Baseband (I/Q)", the source can also be configured here.

Input Path ← Signal Source ← I/Q Analyzer

Defines whether the "RF Radio Frequency" or the "Baseband Digital" input path is used for measurements. "Baseband Digital" is only available if option R&S FSV-B17 (Digital Baseband interface) is installed.

Note: Note that the input path defines the characteristics of the signal, which differ significantly between the RF input and digital input.

SCPI command:

INPut:SELect on page 567

Connected Device ← Signal Source ← I/Q Analyzer

Displays the name of the device connected to the optional Digital Baseband interface (R&S FSV-B17) to provide Baseband Digital input. The device name cannot be changed here.

The device name is unknown.

SCPI command:

INPut:DIQ:CDEVice on page 562

Input Sample Rate ← Signal Source ← I/Q Analyzer

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.

SCPI command:

INPut:DIQ:SRATe on page 564

Full Scale Level ← Signal Source ← I/Q Analyzer

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

The level can be defined either in dBm or Volt.

SCPI command:

INPut:DIQ:RANGe[:UPPer] on page 564

Level Unit ← Signal Source ← I/Q Analyzer

Defines the unit used for the full scale level.

SCPI command:

INPut:DIQ:RANGe[:UPPer]:UNIT on page 564

Adjust Reference Level to Full Scale Level ← Signal Source ← I/Q Analyzer

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

(See the Auto Level softkey).

SCPI command:

INPut:DIQ:RANGe:COUPling on page 563

EXIQ ← I/Q Analyzer

Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

If the optional R&S DigIConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DigIConf requires a USB connection (not LAN!) from the analyzer to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface connection. R&S DigIConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the Digital Baseband Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

TX Settings ← EXIQ ← I/Q Analyzer
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital output to a connected device ("Transmitter" Type).

RX Settings ← EXIQ ← I/Q Analyzer
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital input from a connected device ("Receiver" Type).

Send To ← EXIQ ← I/Q Analyzer
The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

Firmware Update ← EXIQ ← I/Q Analyzer
If a firmware update for the R&S EX-IQ-BOX is delivered with the analyzer firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

R&S Support ← EXIQ ← I/Q Analyzer
Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

DigIConf ← EXIQ ← I/Q Analyzer
Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the analyzer application, press any key on the front panel. The application is displayed with the "EXIQ" 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 mini-mized, 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 analyzer once again.

SCPI command:
Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the analyzer 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.

Level ← I/Q Analyzer
Opens a dialog box to define the level settings.

Reference Level ← Level ← I/Q Analyzer
Specifies the reference level for the I/Q measurement.

SCPI command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue` on page 552

Auto Level ← Level ← I/Q Analyzer
If enabled, the reference level is adjusted to the full scale level automatically if the full scale level changes.

SCPI command:
`INPut:DIQ:RANGe:COUPling` on page 563

Preamp On/Off (option RF Preamplifier, B22/B24) ← Level ← I/Q Analyzer
Switches the preamplifier on or off.

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

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

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

In Spurious Emission Measurement mode, clicking this softkey will automatically open the "Sweep List" dialog, see "Sweep List dialog box" on page 233.

SCPI command:
`INPut:GAIN:STATe`   on page 566

Data Acquisition ← I/Q Analyzer
Opens a dialog box to configure data acquisition in I/Q Analyzer mode.

Sample Rate ← Data Acquisition ← I/Q Analyzer
Defines the I/Q data sample rate of the analyzer. This rate may differ from the sample rate of the connected device (see "Input Sample Rate" on page 273).

If the Digital Baseband Interface (R&S FSV-B17) is active, restrictions to the sample rate apply, see table 3-12.

For analyzer 40 model 1307.9002K39, the maximum sample rate is 12.5 MHz.

SCPI command:
TRACe<n>:IQ:SRATe on page 688

Filter BW ← Data Acquisition ← I/Q Analyzer
Displays the flat, usable bandwidth of the final I/Q data. This value is dependent on the defined Data Acquisition and the defined Signal Source and cannot be edited manually.

SCPI command:
TRACe<n>:IQ:BWIDth on page 680

Meas Time ← Data Acquisition ← I/Q Analyzer
Defines the I/Q acquisition time. By default, the measurement time is calculated as the number of I/Q samples ("Record Length") divided by the sample rate. If you change the measurement time, the Record Length is automatically changed, as well.

For details on the maximum number of samples see also chapter 3.2.10, "Working with I/Q Data", on page 153.

SCPI command:
[SENSe:]SWEep:TIME on page 648

Record Length ← Data Acquisition ← I/Q Analyzer
Defines the number of I/Q samples to record. By default, the number of sweep points is used. The record length is calculated as the measurement time multiplied by the sample rate. If you change the record length, the Meas Time is automatically changed, as well.

SCPI command:
TRACe<n>:IQ:RLENgth on page 686
TRACe<n>:IQ:SET on page 686

Display Config ← I/Q Analyzer
Opens a selection list to specify the result display configuration. The following displays are available:

"Magnitude"   Shows the values in time domain
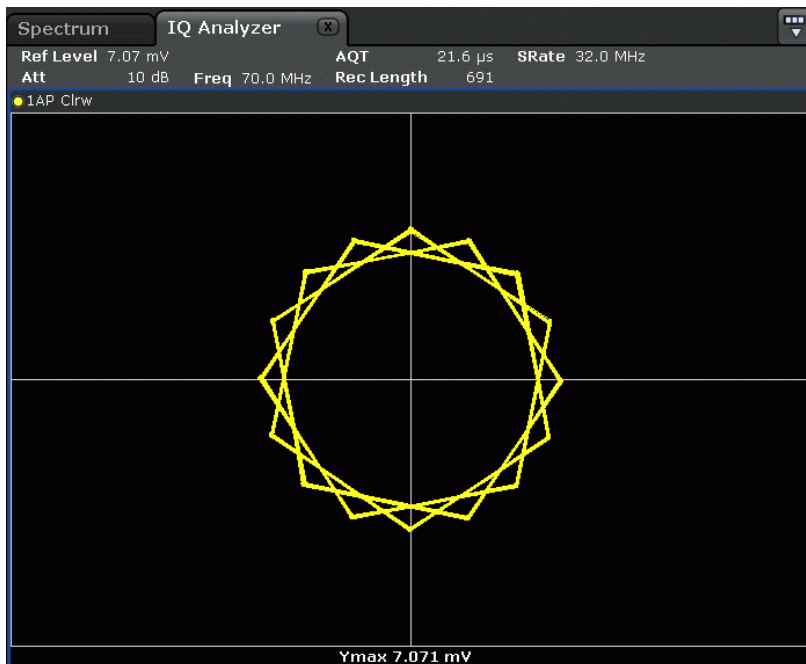
"Spectrum"   Displays the frequency spectrum of the captured I/Q samples.
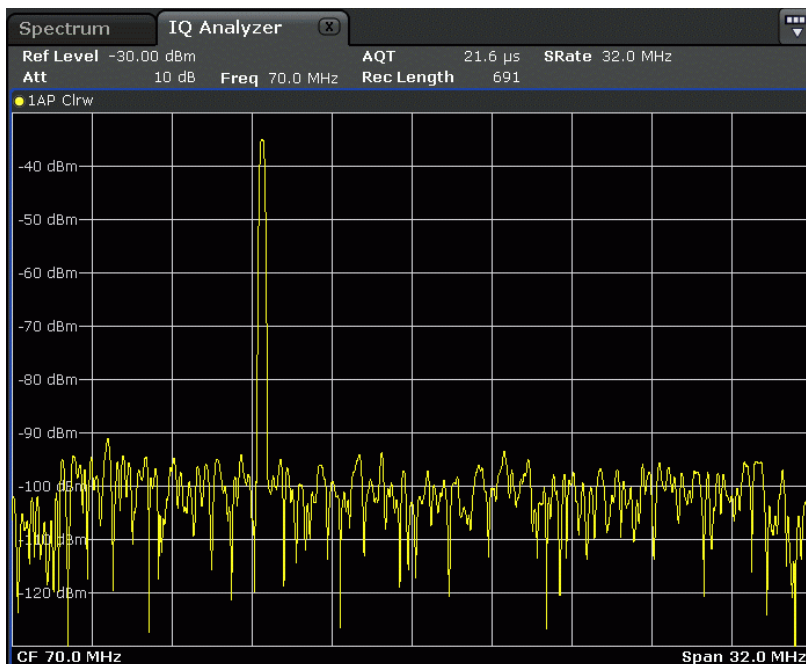
"I/Q-Vector"   Displays the captured samples in an I/Q-plot. The samples are connected by a line.
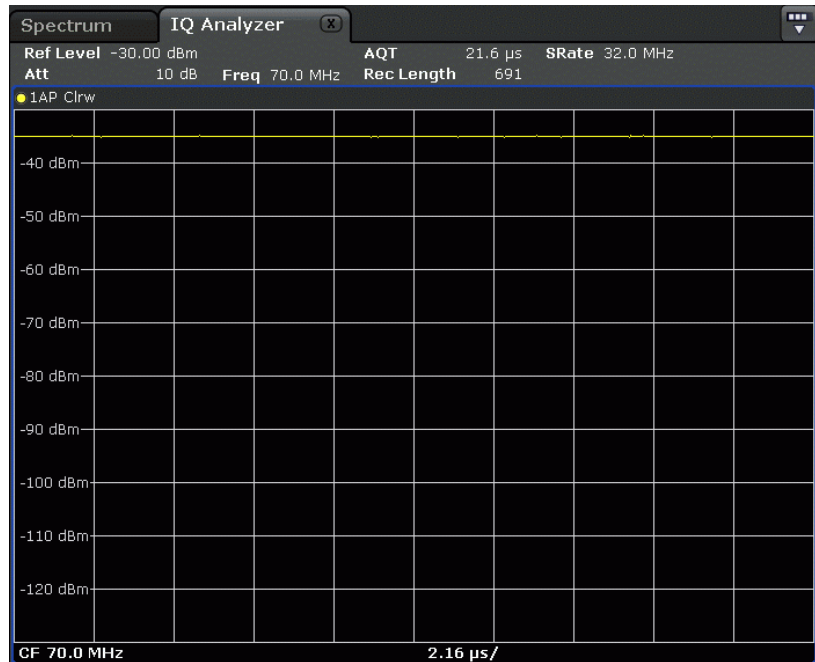
"Real/Imag (I/Q)"   Displays the I and Q values in separate diagrams.
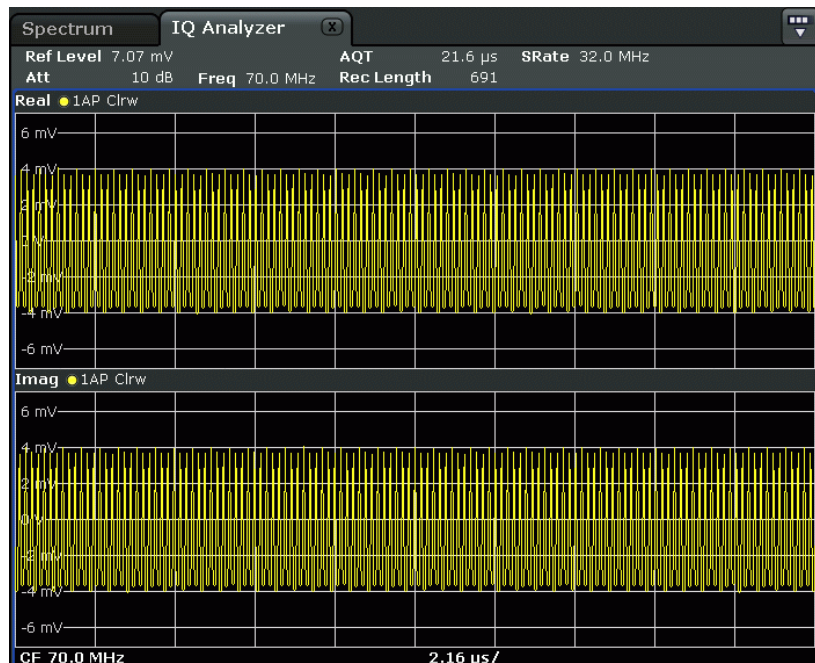
SCPI command:
CALCulate<n>:FORMat on page 545

Digital Output ← I/Q Analyzer
Opens a dialog box to enable a digital output stream to the optional Digital Baseband interface (R&S FSV-B17), if available.

The displayed sample rate is identical to the sample rate defined under Data Acquisition (I/Q Analyzer) and is not editable here.

For details see "Digital Output" in the description of the Digital Baseband Interface for the base unit.

SCPI command:
OUTPut:DIQ on page 573

Digital Baseband Info ← I/Q Analyzer
Displays a dialog box with information on the digital I/Q input and output connection via the optional Digital Baseband interface (R&S FSV-B17), if available. The information includes:

● Device identification
● Used port
● (Maximum) digital input/output sample rates and maximum digital input/output transfer rates
● Status of the connection protocol
● Status of the PRBS descewing test

For details see "Interface Status Information" in "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)" in the description of the base unit.

SCPI command:
INPut:DIQ:CDEVice on page 562

3.5.2 Softkeys of the Amplitude Menu in I/Q Analyzer Mode

In I/Q Analyzer mode, the "Amplitude" menu, which is displayed when you select the AMPT key, contains the following functions.

If the display configuration for the I/Q Analyzer is set to "I/Q Vector" or "Real/Imag (I/Q)", the Range and Unit functions are not available.

Ref Level

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

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel on page 551

Range

Opens a submenu to define the level display range.

Range Log 100 dB ← Range

Sets the level display range to 100 dB.

SCPI command:

DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 100DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 50 dB ← Range

Sets the level display range to 50 dB.

SCPI command:

DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 50DB

Sets the level display range to 50 dB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[: SCALe] on page 551).

Range Log 10 dB ← Range

Sets the level display range to 10 dB.

SCPI command:

DISP:WIND:TRAC:Y:SPAC LOG

(To define logarithmic scaling, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 550.)

DISP:WIND:TRAC:Y 10DB (see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 551).

Range Log 5 dB ← Range
Sets the level display range to 5 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISP:WIND:TRAC:Y 5DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log 1 dB ← Range
Sets the level display range to 1 dB.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISP:WIND:TRAC:Y 1DB` (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551).

Range Log Manual ← Range
Opens an edit dialog box to enter a value for logarithmic scaling for the level display range.

SCPI command:
`DISP:WIND:TRAC:Y:SPAC LOG`

(To define logarithmic scaling, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550.)

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 551

Range Linear % ← Range
Selects linear scaling in % for the level display range, i.e. the horizontal grid lines are labeled in %. The grid is divided in decadal steps.

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

SCPI command:
`DISP:TRAC:Y:SPAC LIN,`see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

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

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

SCPI command:
`DISP:TRAC:Y:SPAC LDB,` see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550

Unit

Opens the "Unit" submenu to select the unit for the level axis. The default setting is dBm. If a transducer is switched on, the softkey is not available.

In general, the signal analyzer measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. 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), conversion to other units is possible. The following units are available and directly convertible:

- dBm
- dBmV
- dBμV
- dBμA
- dBpW
- Volt
- Ampere
- Watt

SCPI command:

CALCulate<n>:UNIT:POWer on page 545

Y-Axis Max

Opens an edit dialog box to specify the maximum value of the y-axis in either direction (in Volts). Thus, the y-axis scale starts at -<Y-AxisMax> and ends at +<Y-AxisMax>.

This command is only available if the display configuration for the I/Q Analyzer is set to "I/Q Vector" or "Real/Imag (I/Q)", see "Display Config" on page 287.

Ref Level Offset

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 552

Ref Level Position

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

Grid Abs/Rel

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

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

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

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE on page 551

3.5.3 Softkeys of the Marker To Menu in I/Q Analyzer Mode

In I/Q Analyzer mode, The "Marker To" menu is identical to the one in Spectrum mode (see chapter 3.3.4.1, "Softkeys of the Marker To Menu", on page 179). For the "Real/Imag (I/Q)" display mode, however, an additional function is available.

Search Settings
Opens a dialog box to define which data is used for marker search functions.

Note: The search settings apply to all markers, not only the currently selected one.

"Search Real"   Marker search functions are performed on the real trace of the I/Q measurement.

"Search Imag"   Marker search functions are performed on the imaginary trace of the I/Q measurement.

"Search Magnitude"   Marker search functions are performed on the magnitude of the I and Q data.

SCPI command:
CALCulate<screen>:MARKer<m>:SEARch on page 479

3.5.4 Softkeys of the Trigger Menu in I/Q Analyzer Mode

In I/Q Analyzer mode, the "Trigger" menu, which is displayed when you select the TRIG key, contains the following functions:

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

As gate modes, all modes are available. For details see also chapter 3.2.9.3, "Using Gated Sweep Operation", on page 151.

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

SCPI command:
TRIGger<n>[:SEQuence]:SOURce on page 692
[SENSe:]SWEep:EGATe:SOURce on page 645

Free Run ← Trg/Gate Source

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

SCPI command:

TRIG:SOUR IMM, see TRIGger<n>[:SEQuence]:SOURce on page 692

External ← Trg/Gate Source

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

SCPI command:

TRIG:SOUR EXT, see TRIGger<n>[:SEQuence]:SOURce on page 692

SWE:EGAT:SOUR EXT for gated triggering, see [SENSe:]SWEep:EGATe:SOURce on page 645

Video ← Trg/Gate Source

Defines triggering by the displayed voltage.

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

Video mode is only available in the time domain.

SCPI command:

TRIG:SOUR VID, see TRIGger<n>[:SEQuence]:SOURce on page 692

SWE:EGAT:SOUR VID for gated triggering, see [SENSe:]SWEep:EGATe:SOURce on page 645

IF Power/BB Power ← Trg/Gate Source

Defines triggering of the measurement using the second intermediate frequency.

For this purpose, the analyzer uses a level detector at the second intermediate frequency. Its threshold can be set in a range between -50 dBm and -10 dBm at the input mixer. The resulting trigger level at the RF input is calculated via the following formula:

"$mixerlevel_{min}$ + RFAtt – PreampGain ≤ Input Signal ≤ $mixerlevel_{max}$ + RFAtt – PreampGain"

The bandwidth at the intermediate frequency is 40 MHz. The analyzer is triggered as soon as the trigger threshold is exceeded within a 6 MHz range around the selected frequency (= start frequency in the frequency sweep).

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

For digital input via the Digital Baseband Interface (R&S FSV-B17), the baseband power ("BB Power") is used as the trigger source.

SCPI command:

TRIG:SOUR IFP, see TRIGger<n>[:SEQuence]:SOURce on page 692

TRIG:SOUR BBP for digital input

SWE:EGAT:SOUR IFP for gated triggering, see [SENSe:]SWEep:EGATe:SOURce on page 645

Time ← Trg/Gate Source

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

SCPI command:

TRIG:SOUR TIMETRIGger<n>[:SEQuence]:SOURce on page 692

Trigger Level

Defines the trigger level as a numeric value.

In the trigger mode "Time", this softkey is not available.

SCPI command:

TRIGger<n>[:SEQuence]:LEVel:IFPower on page 691

TRIGger<n>[:SEQuence]:LEVel:VIDeo on page 691

For digital input via the Digital Baseband Interface, R&S FSV-B17:

TRIGger<n>[:SEQuence]:LEVel:BBPower on page 690

Trigger Polarity

Sets the polarity of the trigger source.

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

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

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

SCPI command:

TRIGger<n>[:SEQuence]:SLOPe on page 692

[SENSe:]SWEep:EGATe:POLarity on page 644

Trigger Offset

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

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)
	Only possible for span = 0 (e.g. I/Q Analyzer mode) and gated trigger switched off
	Maximum allowed range limited by the sweep time:
	pretrigger$_{max}$ = sweep time
	When using digital baseband interface (R&S FSV-B17) with I/Q Analyzer mode, the maximum range is limited by the number of pretrigger samples. See table 3-13.

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

Tip: To determine the trigger point in the sample (for "External" or "IF Power" trigger mode), use the `TRACe<n>:IQ:TPISample` command.

In the "Time" trigger mode, this softkey is not available.

SCPI command:

`TRIGger<n>[:SEQuence]:HOLDoff[:TIME]` on page 689

Repetition Interval

Opens an edit dialog box to define a repetition interval in which the measurement is triggered. The shortest interval is 2 ms. This softkey is only available if the trigger source "Time" is selected (see "Time" on page 147).

SCPI command:

`TRIGger<n>[:SEQuence]:TIME:RINTerval` on page 693

Trigger Hysteresis

Defines the value for the trigger hysteresis. 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. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

This softkey is only available if IF Power is the selected trigger source.

SCPI command:

`TRIGger<n>[:SEQuence]:IFPower:HYSTeresis` on page 690

Trigger Holdoff

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

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

SCPI command:

`TRIGger<n>[:SEQuence]:IFPower:HOLDoff` on page 690

For digital input via the Digital Baseband Interface, R&S FSV-B17:

`TRIGger<n>[:SEQuence]:BBPower:HOLDoff` on page 689

3.5.5 Working with I/Q Data

I/Q data can be captured either from RF input, or via the optional Digital Baseband Interface (R&S FSV-B17). The captured I/Q data can then be processed further, e.g. using the I/Q Analyzer, or in the applications that support the Digital Baseband Interface.

Working with digital input is described in chapter 3.7, "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)", on page 326 and in the applications that support that interface.

This section describes I/Q data processing of RF input, e.g. in the I/Q Analyzer.

The block diagram in figure 3-8 shows the analyzer hardware for active RF input from the IF section to the processor.

The A/D converter samples the IF signal at a rate of 128 MHz. The digital signal is down-converted to the complex baseband, lowpass-filtered, and the sample rate is reduced.

The continuously adjustable sample rates are realized using an optimal decimation filter and subsequent resampling on the set sample rate.

The I/Q data is written to a single memory, the data acquisition is hardware-triggered.

Fig. 3-14: Block diagram illustrating the analyzer signal processing

Maximum number of samples

The maximum number of samples for RF input is 200 MS.

For digital input using the Digital Baseband Interface (R&S FSV-B17), see table 3-13.

3.5.5.1 Sample Rate and Maximum Usable Bandwidth (RF Input)

Information on sample rates and maximum usable bandwidths for Digital Baseband (I/Q) input is described in table 3-12.

Within the usable bandwidth range, the analog IF filter of the analyzer is equalized in regard to amplitude characteristic and group delay (provided that the analyzer is aligned; for details see "Alignment" on page 63). In consequence, signals within this bandwidth range are hardly distorted at all (provided the analyzer is not overloaded).

For the I/Q data acquisition, digital decimation filters are used internally. The passband of these digital filters corresponds to the maximum usable bandwidth. In consequence, signals within the usable bandwidth (passband) remain unchanged, while signals outside the usable bandwidth (passband) are suppressed. Usually, the suppressed signals are noise, artifacts, and the second IF side band. If frequencies of interest to you are also suppressed, you should try to increase the sample rate, since this increases the maximum usable I/Q bandwidth.

As a rule, the usable bandwidth is proportional to the output sample. Yet, when the I/Q bandwidth reaches the bandwidth of the analog IF filter (at very high sample rates), the curve breaks.

analyzer with option R&S FSV-B70 (I/Q Bandwidth Extension):

This option is not available for analyzer 40 model 1307.9002K39.

maximum sample rate: 128 MHz

maximum bandwidth: 40 MHz

analyzer without option R&S FSV-B70 (I/Q Bandwidth Extension):

maximum sample rate: 45 MHz (analyzer40 model 1307.9002K39: 12.5 MHz)

maximum bandwidth: 28 MHz (analyzer40 model 1307.9002K39: 10 MHz)

Relationship between sample rate and usable bandwidth

The following diagram shows the maximum usable I/Q bandwidths depending on the user sample rates.

Fig. 3-15: Relation between maximum usable bandwidth and sample rate (RF input)

3.5.5.2 I/Q Gating

Sometimes in spectrum analysis, measurements are based on a certain length of time called the gate area. With I/Q gating, you can define the gate area using the gate length,

the distance between the periods and the number of periods. This value is specified in samples.

Using I/Q gating, the gate area can be defined using the following methods:

● Edge triggered recording
After a trigger signal, the gate period is defined by a gate length and a gate distance. All data in the gate period is recorded until the required number of samples has been recorded.

SCPI command: `TRACE:IQ:EGATE:TYPE EDGE`, see `TRACe<n>:IQ:EGATe:TYPE` on page 684

● Level triggered recording
After a trigger signal, all data is recorded in which the gate signal is set to 1, which means it has exceeded a level. In this case, the gate signal can be generated by the IFP trigger, for example: each time the IFP level is exceeded, the IFP trigger signal is set to 1 and the samples in this area are recorded as gate samples.

SCPI command: `TRACE:IQ:EGATE:TYPE LEV`, see `TRACe<n>:IQ:EGATe:TYPE` on page 684

3.5.6 STATus:QUEStionable:DIQ Register

This register comprises information about the connection state of the digital baseband input and the digital baseband output with option R&S FSV-B17. It can be queried with the following commands:

● `STATus:QUEStionable:DIQ:CONDition` on page 661

● `STATus:QUEStionable:DIQ[:EVENt]` on page 662

Bit No.	Meaning
0	**Digital I/Q Input Device connected** This bit is set if a device is recognized and connected to the Digital Baseband Input of the analyzer.
1	**Digital I/Q Input Connection Protocol in progress** This bit is set while the connection between analyzer and digital baseband data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
2	**Digital I/Q Input Connection Protocol error** This bit is set if an error occurred during establishing of the connect between analyzer and digital baseband data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
3-5	not used
6	**Digital I/Q Input FIFO Overload** This bit is set if the input transfer rate is too high. The analyzer can process a maximum transfer rate of 128MHz.
7	not used
8	**Digital I/Q Output Device connected** This bit is set if a device is recognized and connected to the Digital Baseband Output.
9	**Digital I/Q Output Connection Protocol in progress** This bit is set while the connection between analyzer and digital baseband data signal sink (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
10	**Digital I/Q Output Connection Protocol error** This bit is set if an error occurred while the connection between analyzer and digital baseband data signal sink (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
11-14	not used
15	This bit is always set to 0.

3.6 Instrument Functions – Tracking Generator (Options R&S FSV-B9/ R&S FSV-B10)

If the analyzer Tracking Generator option (R&S FSV-B9) is installed, an internal tracking generator emits a signal at the exact input frequency of the analyzer during operation. The generated signal is sent to the DUT, thus allowing the analyzer to control the input frequency of the device directly.

Using the analyzer External Tracking Generator option (B10), you can operate various commercially available generators as a tracking generator on the analyzer. Thus, scalar network analysis with the analyzer is also possible outside the frequency range of the internal tracking generator, when the appropriate generators are used.

The analyzer also allows you to set a frequency offset for frequency-converting measurements. For harmonics measurements or frequency-converting measurements, when external generators are used you can also enter a factor by which the generator frequency is increased or reduced, compared to the receive frequency of the analyzer. Make sure,

however, that the resulting generator frequencies do not exceed the allowed setting range of the generator.

Both the internal and external tracking generator options can be installed simultaneously. However, only one tracking generator (internal or one of two possible external generators) can be used at any time. Which tracking generator is currently active, if any, is indicated by the "Source RF Internal (On/ Off)" on page 303 softkey. It can be changed using the "Source Config" on page 307 softkey. For details see chapter 3.6.3, "Configuring Tracking Generators", on page 310.

Tracking generator control (both internal and external) is only available in the "Spectrum" mode for frequency, time (zero span) or I/Q measurements, as well as in "Analog Demodulation" mode. Special measurement functions are not available with tracking generator control. The corresponding softkeys in the "Measurement" menu are deactivated in this case.

If you switch to a mode other than "Spectrum" or "Analog Demodulation", any currently active tracking generator is deactivated.

Menu and softkey description

- chapter 3.6.1, "Softkeys of the Tracking Generator Menu", on page 302

Further information

- chapter 3.6.2, "Connecting External Tracking Generators", on page 307
- chapter 3.6.3, "Configuring Tracking Generators", on page 310
- chapter 3.6.4, "Tracking Generator Functions", on page 317
- chapter 3.6.5, "Displayed Information and Errors", on page 325

3.6.1 Softkeys of the Tracking Generator Menu

The "Tracking Generator" menu is displayed when you press the INPUT/OUPUT key and then "Tracking Generator".

This softkey is only available if the R&S FSV option Tracking Generator (B9) or External Tracking Generator (B10) or both are installed. The following table shows all softkeys available in the "Tracking Generator" menu.

As long as a tracking generator is active, the HOME key also displays the "Tracking Generator" menu.

Source RF Internal (On/ Off)

Switches the selected tracking generator on or off. Default setting is off. The currently selected generator is indicated on the softkey.

SCPI command:

OUTPut[:STATe] on page 574

Activates the internal tracking generator (B9).

SOURce<n>:EXTernal<generator>[:STATe] on page 651

Activates the external tracking generator 1 (B10).

Source Power

Opens an edit dialog box to quickly change the output power of the currently selected tracking generator, alternatively to the "Tracking Generator configuration" dialog box (see "Source Config" on page 307 softkey).

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

SCPI command:

SOURce<n>:POWer[:LEVel][:IMMediate][:AMPLitude] on page 658

Source Cal

Opens a submenu to configure calibration for transmission and reflection measurement for tracking generators. For details on the test setups see chapter 3.6.4.2, "Calibrating for transmission and reflection measurement", on page 318.

Calibrate Transmission ← Source Cal

Starts a sweep that records a reference trace. This trace is used to calculate the difference for the normalized values.

SCPI command:

[SENSe:]CORRection:METHod on page 588

Selects the transmission method and starts the sweep to record a reference trace.

Calibrate Reflection Short ← Source Cal

Starts a sweep as a reference trace for short-circuit calibration.

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

SCPI command:

[SENSe:]CORRection:METHod on page 588

Selects the reflection method.

[SENSe:]CORRection:COLLect[:ACQuire] on page 584

Starts the sweep for short-circuit calibration.

Calibrate Reflection Open ← Source Cal

Starts a sweep as a reference trace for the open-circuit calibration.

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

SCPI command:

[SENSe:]CORRection:METHod on page 588

Selects the reflection method.

[SENSe:]CORRection:COLLect[:ACQuire] on page 584

Starts the sweep for open-circuit calibration.

Normalize ← Source Cal

Switches the normalization on or off. The softkey is only available if the memory contains a reference trace. For details on normalization see chapter 3.6.4.5, "Normalization", on page 320.

SCPI command:

[SENSe:]CORRection[:STATe] on page 583

Reference Value Position ← Source Cal

Switches the reference line on or off. The reference line marks the reference position at which the normalization result (calculated difference to a reference trace) is displayed. For details on the reference line see chapter 3.6.4.5, "Normalization", on page 320.

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition on page 552

Reference Value ← Source Cal

Opens an edit dialog box to enter a position value that shifts the reference line vertically. By default, the reference line corresponds to a difference of 0 dB between the currently measured trace and the reference trace.

If a 10 dB attenuation is inserted into the signal path between DUT and analyzer input, for example after a source calibration, the measurement trace is moved down by 10 dB. Entering a reference value of -10 dB will also shift the reference line down by 10 dB and place the measurement trace on the reference line. The deviation from the nominal power level can be displayed with higher resolution (e.g. 1 dB/div). The power is still displayed in absolute values.

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue on page 552

Recall ← Source Cal

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).

SCPI command:

[SENSe:]CORRection:RECall on page 588

Save As Trd Factor ← Source Cal

"Transducer" on page 60Uses the normalized measurement data to generate a transducer factor with up to 625 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 "Transducer" softkey in the "SETUP" menu.

The "Save As Trd Factor" softkey is only available if normalization is switched on.

SCPI command:

[SENSe:]CORRection:TRANsducer:GENerator on page 589

Modulation

Opens a submenu to define modulation settings. This submenu contains the following commands:

● "External AM" on page 305
● "External FM" on page 305
● "External I/Q" on page 306
● "Modulation OFF" on page 306

External AM ← Modulation

Activates an AM modulation of the tracking generator output signal.

The modulation signal is applied to the TG IN I/AM connector. An input voltage of 1 V corresponds to 100 % amplitude modulation.

Switching on an external AM disables the active I/Q modulation.

SCPI command:

SOURce<n>:AM:STATe on page 651

External FM ← Modulation

Activates the FM modulation of the tracking generator output signal. The modulation signal is applied to the TG IN Q/FM connector. Switching on an external FM disables the active I/Q modulation.

SCPI command:

SOURce<n>:FM:STATe on page 656
SOURce<n>:FM:DEViation on page 656

External I/Q ← Modulation

Activates the external I/Q modulation of the tracking generator output signal. The signals for modulation are applied to the two input connectors TG IN I and TG IN Q at the rear panel of the unit. The input voltage range is ±1 V into 50 Ω. Switching on an external I/Q modulation disables the active AM or FM modulation.

SCPI command:

SOURce<n>:DM:STATe on page 651

Modulation OFF ← Modulation

Deactivates external modulation of the tracking generator output signal.

SCPI command:

SOURce<n>:AM:STATe on page 651

SOURce<n>:FM:STATe on page 656

SOURce<n>:DM:STATe on page 651

Power Sweep

Opens a submenu to define power sweep settings. This softkey is only available if the (internal) Tracking Generator option (B9) is installed.

This submenu contains the following commands:

*   "Power Sweep (On /Off)" on page 306
*   "Power Sweep Start" on page 306
*   "Power Sweep Stop" on page 307

Power Sweep (On /Off) ← Power Sweep

Activates or deactivates the power sweep. If the power sweep is on, the analyzer is set to zero span mode (span = 0Hz). During the sweep time of the zero span, the power at the internal tracking generator is changed linearly from start power to stop power. The start and stop power for the power sweep are displayed in the diagram header ("INT TG <start power>… <stop power>", see also chapter 3.6.5, "Displayed Information and Errors", on page 325.

The start power can be set between -30 dBm and +0 dBm.

The stop value can also be be set between -30 dBm and +0 dBm and may be smaller than the start value.

The difference between the start and stop values may not exceed 10 dB.

This softkey is only available if the (internal) Tracking Generator option (B9) is installed.

SCPI command:

SOURce<n>:POWer:MODE on page 658

SOURce<n>:POWer:MODE on page 658

Power Sweep Start ← Power Sweep

Defines the start power of the power sweep.

The start power can be set between -30 dBm and +0 dBm. If the start power is set above 7 GHz, it is automatically limited to 7 GHz.

The difference between the start and stop values may not exceed 10 dB.

This softkey is only available if the (internal) Tracking Generator option (B9) is installed.

SCPI command:

SOURce<n>:POWer:STARt on page 659

Power Sweep Stop ← Power Sweep
Defines the stop power of the power sweep.

The stop power can be set between -30 dBm and +0 dBm. It can be smaller than the start value. If the stop power is set above 7 GHz, it is automatically limited to 7 GHz.

The difference between the start and stop values may not exceed 10 dB.

This softkey is only available if the (internal) Tracking Generator option (B9) is installed.

SCPI command:

SOURce<n>:POWer:STOP on page 659

Source Config
Opens the "Tracking Generator Configuration" dialog, see chapter 3.6.3, "Configuring Tracking Generators", on page 310.

3.6.2 Connecting External Tracking Generators

The external tracking generator is controlled either via a LAN connection or via the – optional – second GPIB interface of the analyzer (= IEC2, supplied with the option).

Using GPIB, with some Rohde & Schwarz generators, additionally the TTL synchronization interface included in the AUX interface of the analyzer can be used.

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

Therefore, the frequency sweep differs according to the capabilities of the employed generator:

- For generators without a TTL interface, the generator frequency is set for each frequency point via GPIB first, then the setting procedure has to be completed before recording of measured values is possible.

- For generators with a TTL interface, a list of the frequencies to be set is entered into the generator before the beginning of the first sweep. Then the sweep is started and the next frequency point is selected using the TTL handshake line TRIGGER. Recording measured values is only enabled when the generator signals the end of the setting procedure via the BLANK signal. This method is considerably faster than pure GPIB control.

The "Tracking Generator Configuration" dialog provides a list of the supported generators with the frequency and level range, as well as the capabilities used. The interface settings are defined using the "Source Config" on page 307 softkey. For details see chapter 3.6.3.2, "External Tracking Generator", on page 313.

In order to use the functions of the external tracking generator, an appropriate generator must be connected and configured correctly. If no external generator is selected, if the GPIB or TCP/IP address is not correct, or the generator is not ready for operation, an error message is displayed ("Ext. Generator GPIB Handshake Error!" or "Ext. Generator TCPIP Handshake Error!".

figure 3-16 illustrates the TTL connection using an SMU generator, for example.
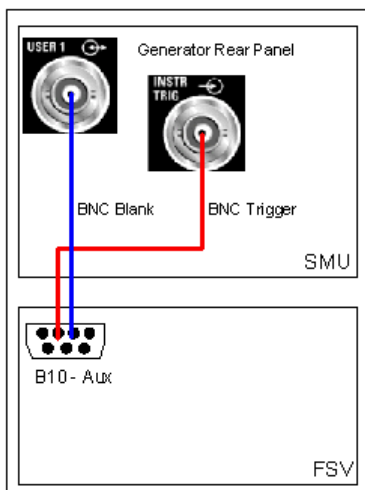
Fig. 3-16: TTL connection for an SMU generator

In order to enhance measurement accuracy, a common reference frequency should be used for both the analyzer 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 analyzer and that you enable usage of the external reference on the analyzer via "SETUP" >"Reference EXT".

3.6.2.1 Overview of Generators Supported by the analyzer

The R&S SMA and R&S SMU require the following firmware versions:

R&S SMA: V2.10.x or higher

R&S SMU: V1.10 or higher

Generator	Interface Type	Generator Min Freq	Generator Max Freq	Generator Min Power dBm	Generator Max Power dBm
SMA01A	TTL	9 kHz	3.0 GHz	-145	+30
SMBV100A3	TTL	9 kHz	3.2 GHz	-145	+30
SMBV100A6	TTL	9 kHz	6.0 GHz	-145	+30
SMC100A1	TTL	9 kHz	1.1 GHz	-120	+30

Generator	Interface Type	Generator Min Freq	Generator Max Freq	Generator Min Power dBm	Generator Max Power dBm
SMC100A3	TTL	9 kHz	3.2 GHz	-145	+30
SME02	TTL	5 kHz	1.5 GHz	-144	+16
SME03	TTL	5 kHz	3.0 GHz	-144	+16
SME06	TTL	5 kHz	6.0 GHz	-144	+16
SMG	GPIB	100 kHz	1.0 GHz	-137	+13
SMGL	GPIB	9 kHz	1.0 GHz	-118	+30
SMGU	GPIB	100 kHz	2.16 GHz	-140	+13
SMH	GPIB	100 kHz	2.0 GHz	-140	+13
SMHU	GPIB	100 kHz	4.32 GHz	-140	+13
SMIQ02B	TTL	300 kHz	2.2 GHz	-144	+13
SMIQ02E	GPIB	300 kHz	2.2 GHz	-144	+13
SMIQ03B	TTL	300 kHz	3.3 GHz	-144	+13
SMIQ03E	GPIB	300 kHz	3.3 GHz	-144	+13
SMIQ04B	TTL	300 kHz	4.4 GHz	-144	+10
SMIQ06B	TTL	300 kHz	6.4 GHz	-144	+10
SML01	GPIB	9 kHz	1.1 GHz	-140	+13
SML02	GPIB	9 kHz	2.2 GHz	-140	+13
SML03	GPIB	9 kHz	3.3 GHz	-140	+13
SMR20	TTL	1 GHz	20 GHz	-130 [2]	+11 [2]
SMR20B11[1]	TTL	10 MHz	20 GHz	-130 [2]	+13 [2]
SMR27	TTL	1 GHz	27 GHz	-130 [2]	+11 [2]
SMR27B11 [1]	TTL	10 MHz	27 GHz	-130 [2]	+12 [2]
SMR30	TTL	1 GHz	30 GHz	-130 [2]	+11 [2]
SMR30B11 [1]	TTL	10 MHz	30 GHz	-130 [2]	+12 [2]
SMR40	TTL	1 GHz	40 GHz	-130 [2]	+9 [2]
SMR40B11 [1]	TTL	10 MHz	40 GHz	-130 [2]	+12 [2]
SMR50	TTL	1 GHz	50 GHz	-130 [2]	+9 [2]
SMR50B11 [1]	TTL	10 MHz	50 GHz	-130 [2]	+12 [2]
SMR60	TTL	1 GHz	60 GHz	-130 [2]	+9 [2]
SMR60B11 [1]	TTL	10 MHz	60 GHz	-130 [2]	+12 [2]
SMP02	TTL	10 MHz	20 GHz	-130 [3]	+17 [3]
SMP03	TTL	10 MHz	27 GHz	-130 [3]	+13 [3]

Generator	Interface Type	Generator Min Freq	Generator Max Freq	Generator Min Power dBm	Generator Max Power dBm
SMP04	TTL	10 MHz	40 GHz	-130 [3]	+12 [3]
SMP22	TTL	10 MHz	20 GHz	-130 [3]	+20 [3]
SMT02	GPIB	5.0 kHz	1.5 GHz	-144	+13
SMT03	GPIB	5.0 kHz	3.0 GHz	-144	+13
SMT06	GPIB	5.0 kHz	6.0 GHz	-144	+13
SMV03	GPIB	9 kHz	3.3 GHz	-140	+13
SMU200A	TTL	100 kHz	2.2 GHz	-145	+13
SMU02B31	TTL	100 kHz	2.2 GHz	-145	+19
SMU03	TTL	100 kHz	3 GHz	-145	+13
SMU03B31	TTL	100 kHz	3 GHz	-145	+19
SMU04	TTL	100 kHz	4 GHz	-145	+13
SMU04B31	TTL	100 kHz	4 GHz	-145	+19
SMU06	TTL	100 kHz	6 GHz	-145	+13
SMU06B31	TTL	100 kHz	6 GHz	-145	+19
SMX	GPIB	100 kHz	1.0 GHz	-137	+13
SMY01	GPIB	9 kHz	1.04 GHz	-140	+13
SMY02	GPIB	9 kHz	2.08 GHz	-140	+13
HP8340A	GPIB	10 MHz	26.5 GHz	-110	10
HP8648	GPIB	9 kHz	4 GHz	-136	10
HP ESG-A Series 1000A, 2000A, 3000A, 4000A	GPIB	250 kHz	4 GHz	-136	20
HP ESG-D SERIES E4432B	GPIB	250 kHz	3 GHz	-136	+10

1) Requires the option SMR-B11 to be fitted.

2) Maximum/minimum power depends on presence of Option SMR-B15/-B17 and set frequency range. For more details see SMR data sheet.

3) Maximum/minimum power depends on presence of Option SMP-B15/-B17 and set frequency range. For more details see SMP data sheet.

3.6.3 Configuring Tracking Generators

The "Tracking Generator Configuration" dialog box is opened via the "Source Config" softkey in the "Tracking Generator" menu.

This dialox box allows you to define measurement settings, as well as connection settings for external generators (option B10 only). Depending on which options are installed, the corresponding tabs for internal or external generators, or both, are displayed.

- chapter 3.6.3.1, "Internal Tracking Generator", on page 311
- chapter 3.6.3.2, "External Tracking Generator", on page 313

3.6.3.1 Internal Tracking Generator

The internal tracking generator is configured in the "Internal" tab of the "tracking Generator Configuration" dialog box.

In the top half of the dialog box, the measurement configurations can be defined. In the lower half of the dialog box, the capabilities of the internal tracking generator are displayed for reference only.
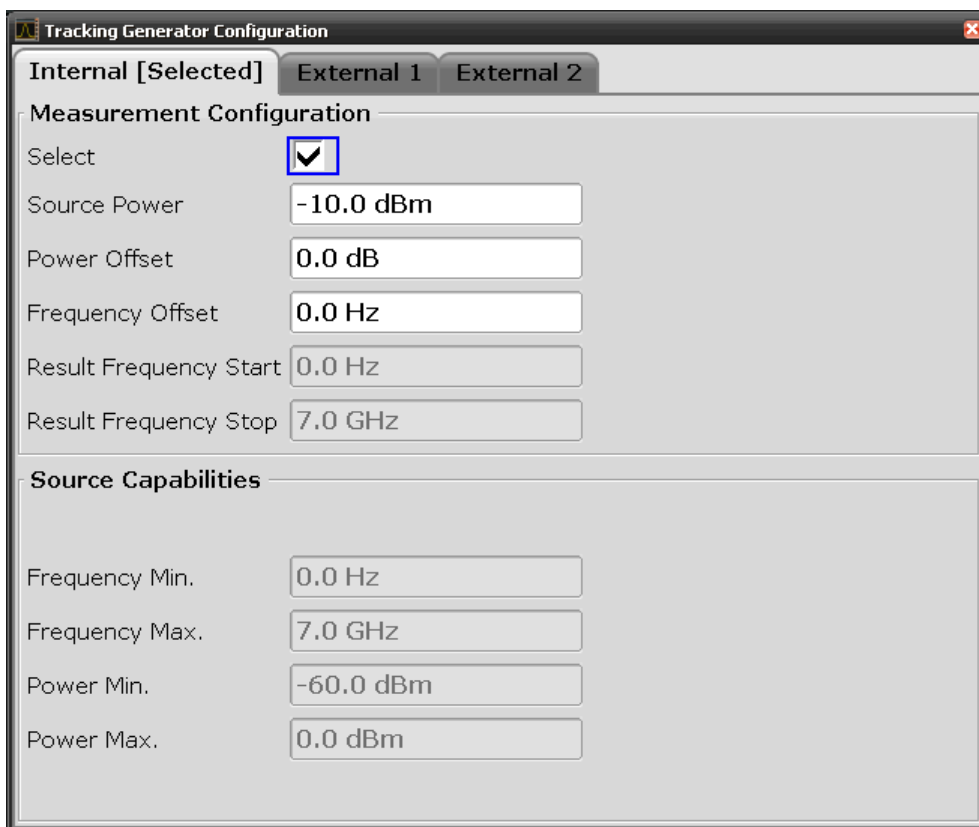
The configuration dialog box contains the following fields:

Select
Selects the internal tracking generator as the current tracking generator source. "Internal" is displayed as the source on the "Source RF" softkey. All tracking generator functions are performed with the currently selected source.

Note: Note that the generator is not automatically activated when it is selected. To activate the currently selected generator, click the "Source RF On" softkey.

Source Power

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

SCPI command:

SOURce<n>:POWer[:LEVel][:IMMediate][:AMPLitude] on page 658

Power Offset

Constant level offset for the tracking 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 enhancement label "LVL" in the diagram header (see also chapter 3.6.5, "Displayed Information and Errors", on page 325).

With this offset, attenuators or amplifiers at the output connector of the tracking 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 tracking generator.

SCPI command:

SOURce<n>:POWer[:LEVel][:IMMediate]:OFFSet on page 658

Frequency Offset

Constant frequency offset between the output signal of the tracking generator and the input frequency of the analyzer. Possible offsets are in a range of ±1 GHz in 0.1 Hz steps.

The default setting is 0 Hz. Offsets <> 0 Hz are marked with the enhancement label "FRQ" in the diagram header (see also chapter 3.6.5, "Displayed Information and Errors", on page 325).

If a positive frequency offset is entered, the tracking generator generates an output signal above the receive frequency of the analyzer. In case of a negative frequency offset it generates a signal below the receive frequency of the analyzer. The output frequency of the tracking generator is calculated as follows:

Tracking generator frequency = receive frequency + frequency offset.

SCPI command:

SOURce<n>:FREQuency:OFFSet on page 657

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 analyzer.

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 analyzer.

Frequency Min.

For reference only: Lower frequency limit for the generator.

Frequency Max.

For reference only: Upper frequency limit for the generator.

Power Min.
For reference only: Lower power limit for the generator.

Power Max.
For reference only: Upper power limit for the generator.

3.6.3.2 External Tracking Generator

The external tracking generators are configured in the "External" tabs of the "Tracking Generator Configuration" dialog box.

In the top section of the dialog box, the measurement configurations can be defined. In the middle section, interface settings for the connection to the external generator are defined. In the lower section of the dialog box, the capabilities of the external tracking generator are displayed for reference only.

The configuration dialog box contains the following fields:

Select
Selects the specified external tracking generator as the current tracking generator source. "External 1" or "External 2" is displayed as the source on the "Source RF" softkey. All tracking generator functions are performed with the currently selected source.

Note: Note that the generator is not automatically activated when it is selected. To activate the currently selected generator, click the "Source RF On" softkey.

Source Frequency Coupling

Enables or disables frequency coupling between the analyzer and the generator.

"Auto"   Default setting: the frequencies are coupled (see "Generator Frequency (Numerator/Denominator/Offset)" on page 314).

"Manual"   The generator uses a fixed frequency, defined in the (Fixed) Generator Frequency field which is displayed when you select "Manual" coupling.

SCPI command:

SOURce<n>:EXTernal<m>:FREQuency:COUPling[:STATe] on page 652

(Fixed) Generator Frequency

Defines the fixed frequency to be used by the generator.

SCPI command:

SOURce<n>:EXTernal<m>:FREQuency on page 652

Source Power

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

SCPI command:

SOURce<n>:EXTernal<generator>:POWer[:LEVel] on page 655

Power Offset

Constant level offset for the tracking 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 enhancement label "LVL" in the diagram header (see also chapter 3.6.5, "Displayed Information and Errors", on page 325).

With this offset, attenuators or amplifiers at the output connector of the tracking 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 tracking generator.

SCPI command:

SOURce<n>:POWer[:LEVel][:IMMediate]:OFFSet on page 658

Generator Frequency (Numerator/Denominator/Offset)

The frequency used by the generator may differ from the input from the analyzer. 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 analyzer screen and the values for Start and 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 <> 0 Hz are marked with the enhancement label "FRQ" in the diagram header (see also chapter 3.6.5, "Displayed Information and Errors", on page 325).

If a positive frequency offset is entered, the tracking generator generates an output signal above the receive frequency of the analyzer. For a negative frequency offset it generates a signal below the receive frequency of the analyzer.

The output frequency of the generator is calculated as follows:

$$F_{Generator} = \left| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

Fig. 3-17: Output frequency of the generator

Note: Make sure that the frequencies resulting from the start and stop frequency of the analyzer do not exceed the allowed generator range:

● If the start frequency lies below F MIN, the generator is only switched on when F MIN is reached.
● If the stop frequency lies above F MAX, the generator is switched off. When the generator is subsequently switched on using the "Source RF Internal (On/ Off)" on page 303 softkey, the stop frequency is limited to F MAX.
● If the stop frequency lies below F MIN, the generator is switched off and an error message is displayed.

SCPI command:

SOURce<n>:EXTernal<generator>:FREQuency[:FACTor]:NUMerator
on page 653
SOURce<n>:EXTernal<generator>:FREQuency[:FACTor]:DENominator
on page 653
SOURce<n>:EXTernal<generator>:FREQuency:OFFSet<m> on page 654

Reverse sweep
The "Offset" setting can be used to sweep in the reverse direction. You can do this by setting a "negative" offset in the tracking generator configuration.
Example for reverse sweep:
$F_{AnalyzerStart}$ = 100 MHz
$F_{AnalyzerStop}$ = 200 MHz
F_{Offset} = -300 MHz
Numerator = Denominator = 1
→$F_{GeneratorStart}$ = 200 MHz
→$F_{GeneratorStop}$ = 100 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 for reverse sweep via minimum frequency:
$F_{AnalyzerStart}$ = 100 MHz
$F_{AnalyzerStop}$ = 200 MHz
F_{Offset} = -150 MHz
F_{min} = 20 MHz
Numerator = Denominator = 1
→$F_{GeneratorStart}$ = 50 MHz
→$F_{GeneratorStop}$ = 50 MHz via Fmin

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 analyzer.

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 analyzer.

Type
Generator type. See also chapter 3.6.2.1, "Overview of Generators Supported by the analyzer", on page 308.
SCPI command:
SYSTem:COMMunicate:RDEVice:GENerator<generator>:TYPE on page 672

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

● TCP/IP
● GPIB

For details on interfaces see the "Interfaces and Protocols" section in the *R&S FSV Quick Start Guide*.
SCPI command:
SYSTem:COMMunicate:RDEVice:GENerator<generator>:INTerface
on page 670

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

See also chapter 3.6.2, "Connecting External Tracking Generators", on page 307.

For Noise Figure measurements (K30) this setting currently has no effect.
SCPI command:
SYSTem:COMMunicate:RDEVice:GENerator<generator>:LINK on page 671

Address
For LAN connections: TCP/IP address.

For GPIB connections: GPIB address.

For more information on configuring interfaces see the "Interfaces and Protocols" section in the *R&S FSV Quick Start Guide* on the CD-ROM.
SCPI command:
SYSTem:COMMunicate:RDEVice:GENerator<generator>:LINK on page 671

Reference
Selects internal or external reference for the generator (default: internal).

Note: Using the TTL interface allows for considerably higher measurement rates than pure GPIB control, because the frequency stepping of the analyzer is directly coupled with the frequency stepping of the generator.
SCPI command:
SOURce<n>:EXTernal<generator>:ROSCillator[:SOURce] on page 655

Edit Generator Setup File

Displays the setup file for the currently selected generator (see Type field) in read-only mode in an editor.

Adding new generator types

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"). To add a new generator type to the selection list in the Type field, edit the setup file for an existing generator as required, then save the file with the extension ".gen". After you close the configuration dialog and re-open it, a new generator is available in the Type list with the name of the saved setup file.

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 3.6.5, "Displayed Information and Errors", on page 325).

Frequency Min.

For reference only: Lower frequency limit for the generator.

Frequency Max.

For reference only: Upper frequency limit for the generator.

Power Min.

For reference only: Lower power limit for the generator.

Power Max.

For reference only: Upper power limit for the generator.

3.6.4 Tracking Generator Functions

The following functions are available if the analyzer Tracking Generator (R&S FSV-B9) or External Tracking Generator (R&S FSV-B10) options are installed.

- chapter 3.6.4.1, "Calibration mechanism", on page 317
- chapter 3.6.4.2, "Calibrating for transmission and reflection measurement", on page 318
- chapter 3.6.4.3, "Transmission measurement", on page 319
- chapter 3.6.4.4, "Reflection measurement", on page 319
- chapter 3.6.4.5, "Normalization", on page 320
- chapter 3.6.4.6, "Modulation (internal Tracking Generator only)", on page 323

3.6.4.1 Calibration mechanism

Calibration means calculating the difference between the currently measured power and a reference curve, independent of the selected type of measurement (transmission/ reflection). The hardware settings used for measuring the reference curve are included in the reference dataset.

Instrument Functions – Tracking Generator (Options R&S FSV-B9/ R&S FSV-B10)

Even with normalization switched on, the instrument settings can be changed in a wide area without stopping the normalization. This reduces the necessity to carry out a new normalization to a minimum.

Therefore, the reference dataset (trace with n measured values, where n is the number of Sweep Points) is stored internally as a table of n points (frequency/level).

Differences in level settings between the reference curve 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.

An enhancement label is used to mark the different levels of measurement accuracy. This enhancement label is displayed at the right diagram border if normalization is switched on and a deviation from the reference setting occurs. Three accuracy levels are defined:

Table 3-10: Measurement accuracy levels

Accuracy	Enhancement label	Reason/Limitation
high	NOR	No difference between reference setting and measurement
medium	APX (approximation)	Change of the following settings: ● coupling (RBW, VBW, SWT) ● reference level, RF attenuation ● start or stop frequency ● output level of tracking generator ● detector (max. peak, min. peak, sample, etc.) ● change of frequency: max. 691 points within the set sweep limits (corresponds to a doubling of the span)
–	Aborted normalization	More than 500 extrapolated points within the current sweep limits (in case of span doubling)

ⓘ At a reference level of -10 dBm and at a tracking generator output level of the same value, the analyzer operates without overrange reserve. That means the analyzer is in danger of being overloaded if a signal is applied whose amplitude is higher than the reference line. In this case, either the message "OVLD" for overload or "IFOVL" 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 tracking generator ("Source Config" on page 307 softkey in the Tracking Generator menu)

● Increasing the reference level (Ref Level softkey in the "Amplitude" menu)

3.6.4.2 Calibrating for transmission and reflection measurement

Prerequisite: The instrument is in tracking generator measurement mode.

1. To enter the generator output level, press the "Source Power" on page 303 softkey.

2. To enter a constant level offset for the tracking generator, press the "Source Config" on page 307 softkey and enter a "Power Offset".

3. To open the submenu for calibration, press the "Source Cal" on page 303 softkey.

4. To record a reference trace for transmission measurement, press the "Calibrate Transmission" on page 303 softkey.
    The recording of the reference trace and the completion of the calibration sweep are indicated by message bo XE s.

5. To record a reference trace for reflection measurement, press the "Calibrate Reflection Short" on page 303 or "Calibrate Reflection Open" on page 304 softkey.
    The recording of the reference trace and the completion of the calibration sweep are indicated by message bo XE s.

6. To switch on the normalization, press the "Normalize" on page 304 softkey.

7. To display the reference line, press the "Reference Value Position" on page 304 softkey.

8. To enter a value to shift the reference line, press the "Reference Value" on page 304 softkey.

9. To restore the settings used for source calibration, press the "Recall" on page 305 softkey.

3.6.4.3   Transmission measurement

This measurement yields the transmission characteristics of a two-port network. The internal or external tracking generator serves as a signal source. It is connected to the input connector of the DUT. The input of the analyzer 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).
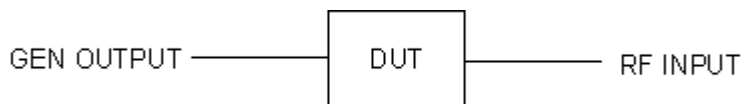
Fig. 3-18: Test setup for transmission measurement

3.6.4.4   Reflection measurement

Scalar reflection measurements can be carried out by means of a reflection-coefficient measurement bridge.
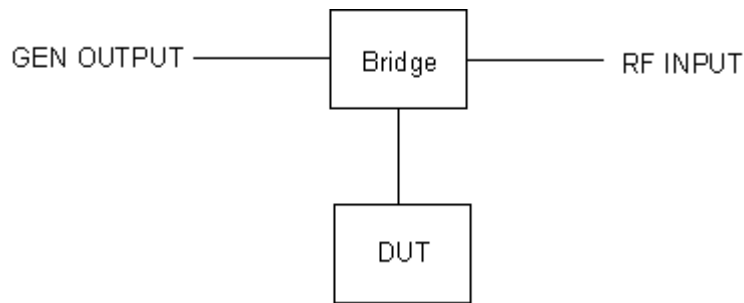
Fig. 3-19: Test setup for reflection measurement

3.6.4.5   Normalization

The "NORMALIZE" softkey switches normalization on or off. The softkey is only available if the memory contains a correction trace.

You can shift the relative reference point within the grid using the "Reference Value Position" on page 304 softkey. Thus, the trace can be shifted from the top grid margin to the middle of the grid:
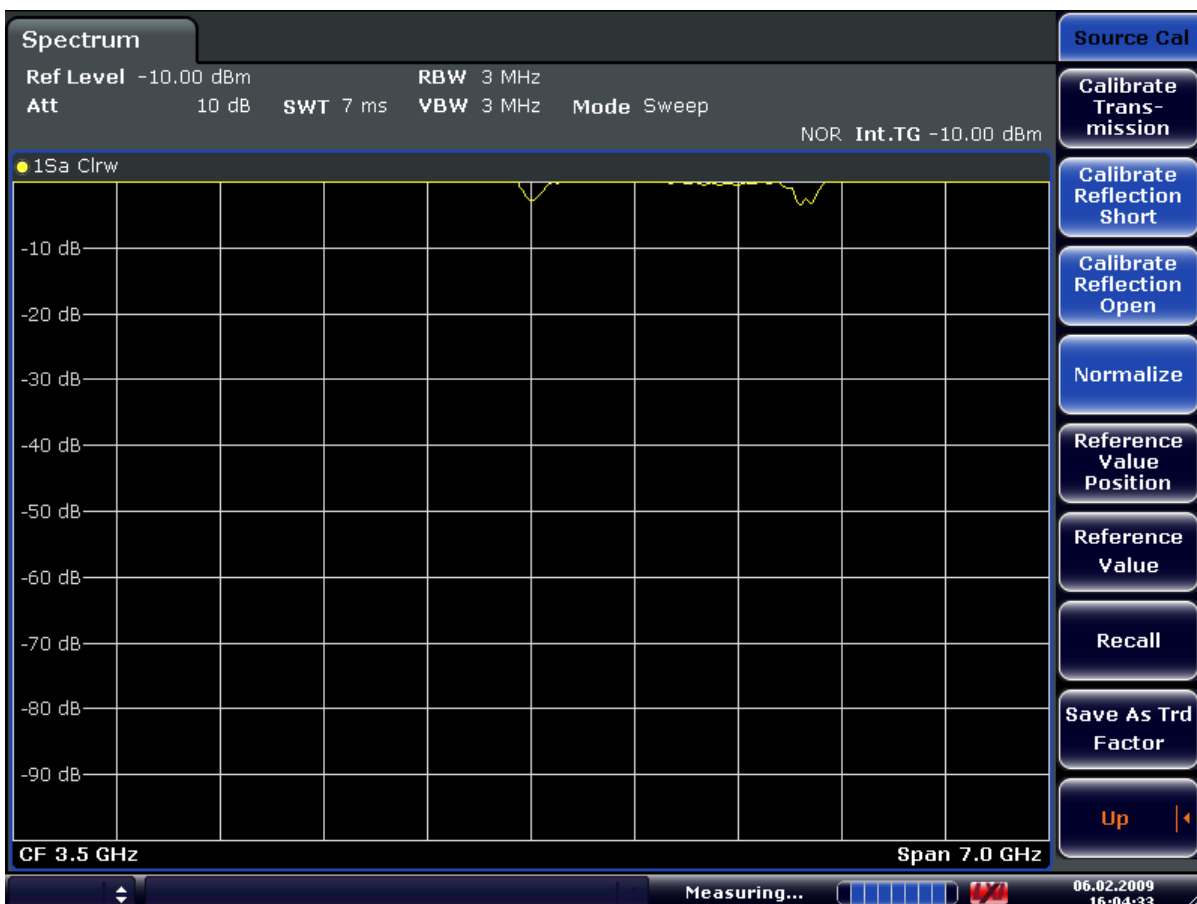
Fig. 3-20: Normalized display

Fig. 3-21: Normalized measurement, shifted with Reference Value Position= 50%

DISP:WIND:TRAC:Y:RPOS 10PCT, see DISPlay[:WINDow<n>]:TRACe<t>:Y[:
SCALe]:RPOSition on page 552
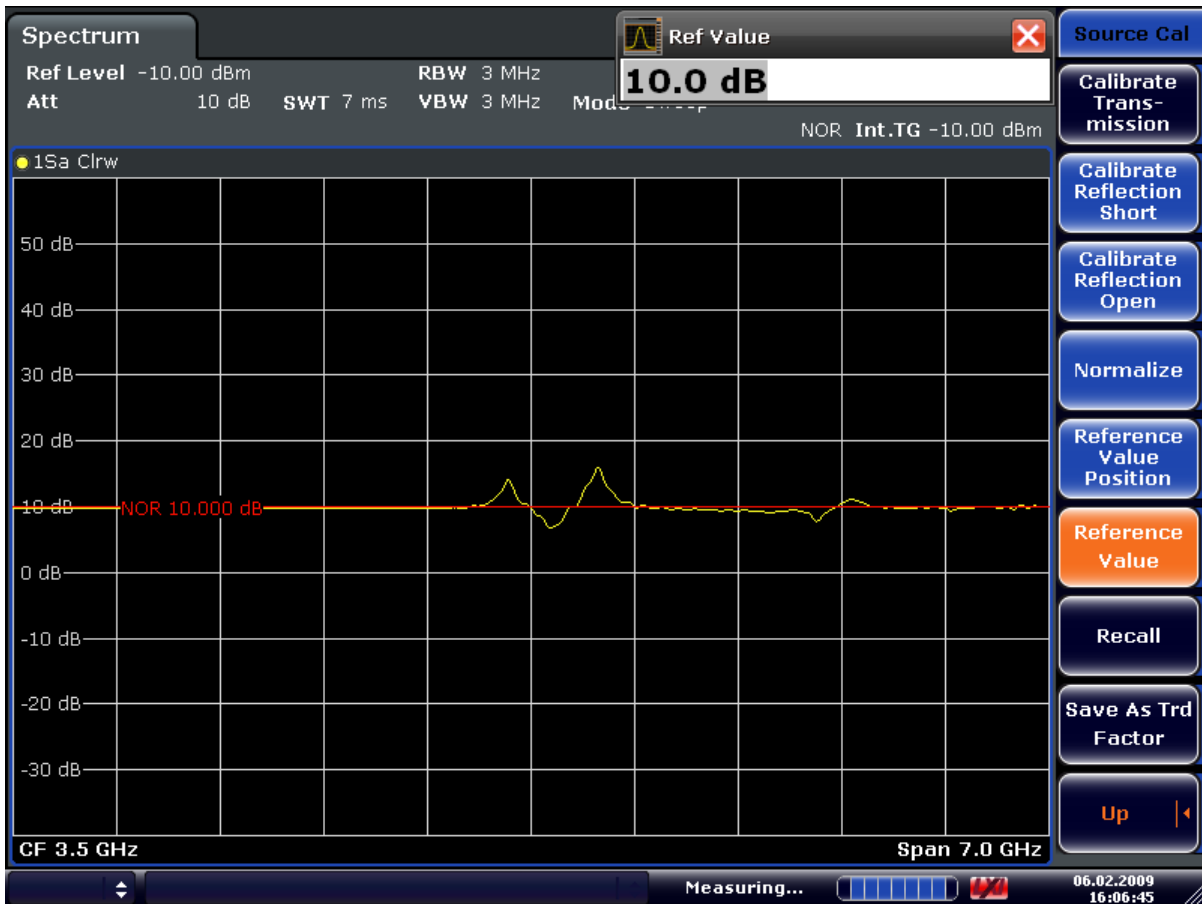
Fig. 3-22: Measurement with Reference Value: +10dB and Reference Value Position = 50%

After the reference line has been shifted by entering *+10 dB* as the "Reference Value" on page 304, deviations from the nominal value can be displayed with high resolution (e.g. 2 dB/Div.). The absolute measured values are still displayed; in the above example, 2 dB below nominal value (reference line) = 8 dB attenuation.
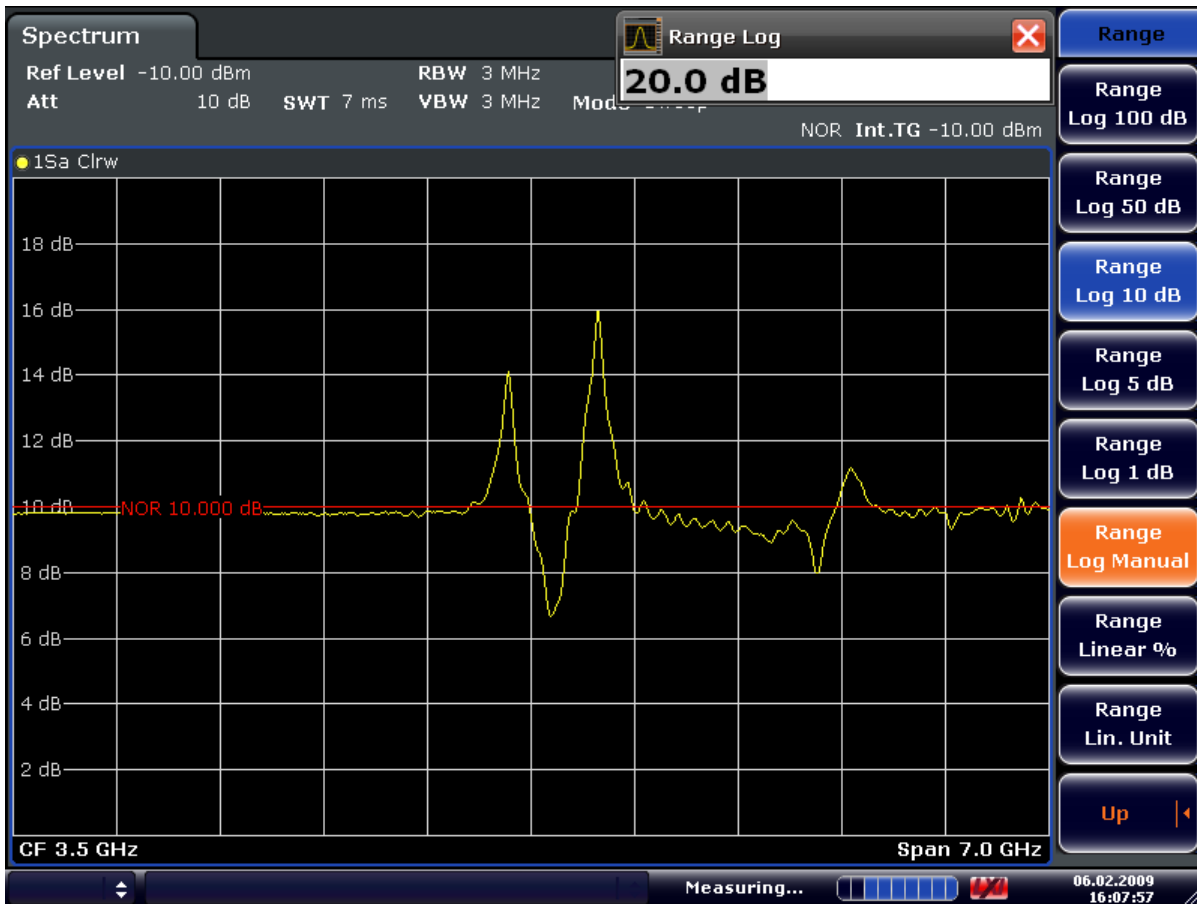
Fig. 3-23: Measurement of a 10-dB attenuator pad with 2dB/Div

`DISP:WIND:TRAC:Y:RVAL +10dB`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue` on page 552

3.6.4.6 Modulation (internal Tracking Generator only)

The time characteristics of the tracking generator output signal can be influenced by means of external signals (input voltage range -1 V to +1 V).

Two BNC connectors at the rear panel are available as signal inputs. Their function changes depending on the selected modulation:

- **TG IN I/AM**and
- TG IN Q/FM

The modulation modes can be combined with each other and with the frequency offset function up to a certain degree. The following table shows which modulation modes are possible at the same time and which ones can be combined with the frequency offset function.

Table 3-11: Simultaneous modes of modulation (tracking generator)

Modulation	Frequency offset	EXT AM	EXT FM	EXT I/Q
Frequency offset		●	●	●
EXT AM	●		●	
EXT FM	●	●		
EXT I/Q	●			

● = can be combined

External AM

The "External AM" on page 305 softkey activates an AM modulation of the tracking generator output signal.

The modulation signal is applied to the TG IN I/AM connector. An input voltage of 1 V corresponds to 100% amplitude modulation.

Switching on an external AM disables the active I/Q modulation.

External FM

The "External FM" on page 305 softkey activates the FM modulation of the tracking generator output signal.

The modulation frequency range is 1 kHz to 100 kHz, the deviation can be set in 1-decade steps in the range of 100 Hz to 10 MHz at an input voltage of 1 V. The phase deviation h should not exceed the value 100.

Phase deviation h = deviation/modulation frequency

The modulation signal is applied to the TG IN Q/FM connector.

Switching on an external FM disables the active I/Q modulation.

External IQ

The "External I/Q" on page 306 softkey activates the external I/Q modulation of the tracking generator.

The signals for modulation are applied to the two input connectors TG IN I and TG IN Q at the rear panel of the unit. The input voltage range is ±1 V into 50 Ω.

Switching on an external I/Q modulation disables the active external AM or FM.

Functional description of the quadrature modulator:
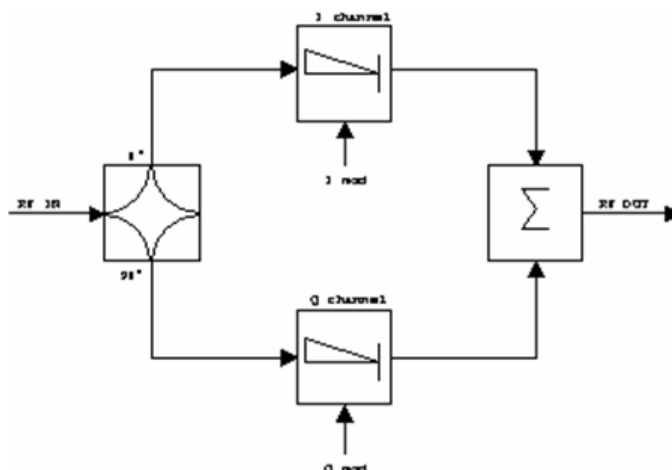
Fig. 3-24: I/Q modulation

I/Q modulation is performed by means of the built-in quadrature modulator. The RF signal is divided into two orthogonal I and Q components (in phase and quadrature phase). Amplitude and phase are controlled in each path by the I and Q modulation signal. By adding the two components an RF output signal is generated that can be controlled in amplitude and phase.

SCPI command:

SOURce<n>:DM:STATe on page 651

3.6.5   Displayed Information and Errors

Diagram header

In Tracking Generator measurement mode, some additional information is displayed in the diagram header.

Label	Description
INT TG: <source power>	Internal tracking generator active
INT TG: <start power>… <stop power>	Internal tracking generator with power sweep active
EXT TG <1|2>: <source power>	External tracking generator (1 or 2) active
LVL	Power Offset (see chapter 3.6.3, "Configuring Tracking Generators", on page 310
FRQ	Frequency Offset (see chapter 3.6.3, "Configuring Tracking Generators", on page 310
Measurement accuracy levels	
NOR	Normalization on; No difference between reference setting and measurement

Label	Description
APX (approximation)	Normalization on; Deviation from the reference setting occurs
-	Aborted normalization

For details on measurement accuracy levels, see chapter 3.6.4.5, "Normalization", on page 320.

Error and status messages

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 figure 3-17
"Ext. Generator File Syntax Error!"	Syntax error in the generator setup file (see "Edit Generator Setup File" on page 317
"Ext. Generator Command Error!"	Missing or wrong command in the generator setup file (see "Edit Generator Setup File" on page 317
"Ext. Generator Visa Error!!"	Error with Visa driver provided with installation (very unlikely)

3.7 Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)

In the standard configuration, the analyzer provides an internal I/Q memory in order to capture and evaluate I/Q data, which can be output via GPIB or the LAN interface. If the analyzer Digital Baseband Interface option (R&S FSV-B17) is installed, an online digital I/Q data interface is provided on the rear panel of the instrument for input and output.

This option is not available for analyzer 40 model 1307.9002K39.

Using the Digital Baseband interface for input, the digital baseband signal from the digital interface is used for measurement, rather than the digitalized IF signal. If the digital output is enabled, the I/Q data is continuously output at the connector at the rear of the instrument. In the base unit, the input and output I/Q data can be evaluated using the I/Q Analyzer, for example (see chapter 3.5, "Instrument Functions - I/Q Analyzer",

on page 281). Other applications (e.g. VSA, R&S FSV-K70) also support digital input, see the descriptions of the individual firmware options for details.

The digital input and output can be enabled in the base unit or in one of the applications (where available). Alternatively, I/Q data can also be captured via remote control. The required commands are contained in the following subsystems:

● chapter 4.2.3.9, "INPut Subsystem", on page 561

● "TRACe:IQ Subsystem", on page 678

● chapter 4.2.3.12, "OUTPut Subsystem", on page 572

Information on the `STATus:QUEStionable:DIQ` register can be found in chapter 3.5.6, "STATus:QUEStionable:DIQ Register", on page 300.

3.7.1 Typical Applications for the Digital Baseband Interface

The following typical applications use the Digital Baseband interface:

● Capturing and evaluating digital I/Q data in the I/Q Analyzer mode of the analyzer base unit or other (optional) applications, e.g. R&S FSV-K70 (VSA). See chapter 3.5, "Instrument Functions - I/Q Analyzer", on page 281 or the description of the individual firmware options.
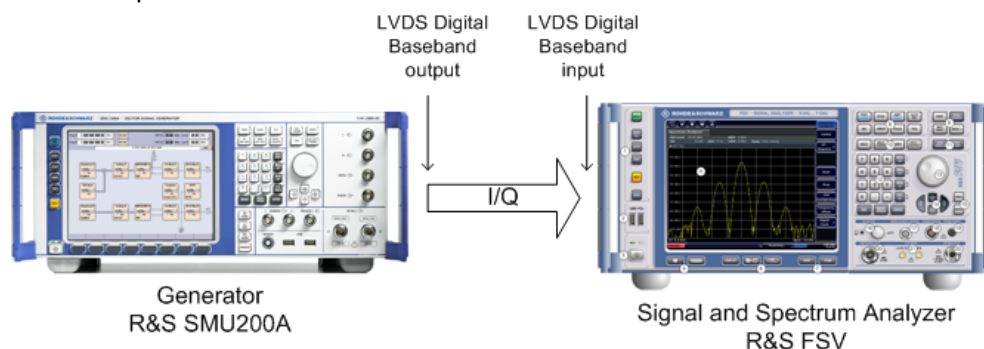
● Output of digital I/Q data to a selected receiver, e.g. to implement fading (simulating mobile radio communication participants) using a generator.
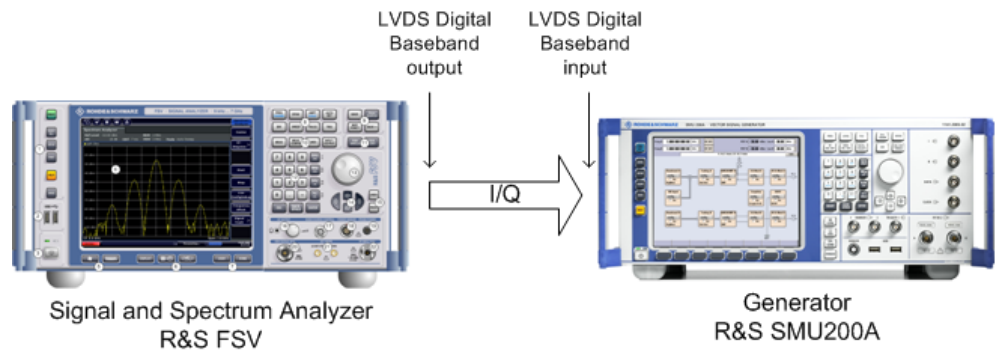
- Output of digital I/Q data to a device with a user-specific interface using an R&S EX-IQ-BOX (see the "R&S®EX-IQ-BOX - External Signal Interface Module Manual").
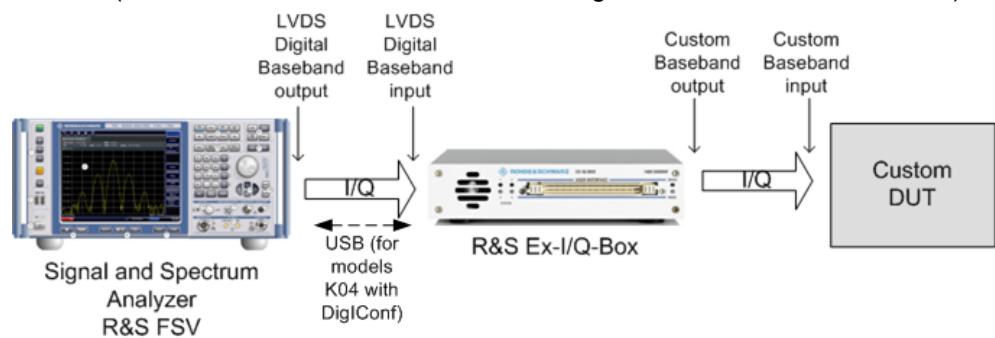
- Capturing and evaluating digital I/Q data from a device with a user-specific interface using an R&S EX-IQ-BOX (see the "R&S®EX-IQ-BOX - External Signal Interface Module Manual").
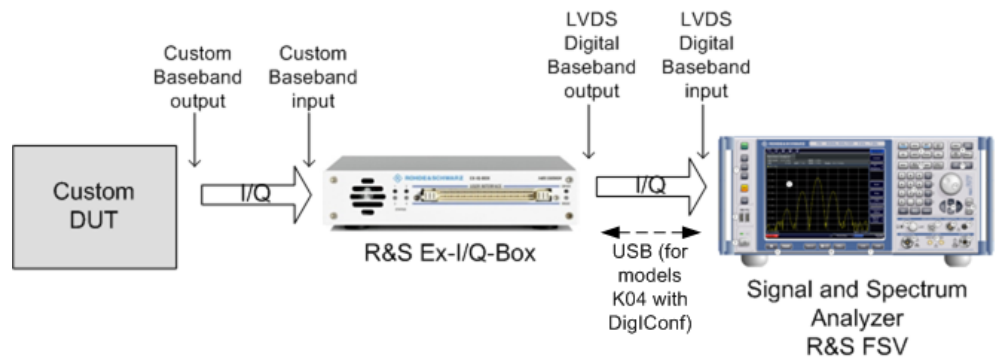
R&S EX-IQ-BOX and R&S DigIConf

The R&S EX-IQ-BOX is a configurable interface module that converts signal properties and the transmission protocol of the R&S instruments into user-defined or standardized signal formats and vice versa.

The latest R&S EX-IQ-BOX (model 1409.5505K04) provides the configuration software R&S DigIConf which can be installed directly on the analyzer. The software R&S DigIConf (Digital Interface Configurator for the R&S EX-IQ-BOX, version 2.10 or higher) controls the protocol, data and clock settings of the R&S EX-IQ-BOX independently from the connected R&S instrument. Besides basic functions of the user-defined protocols, this software utility supports the settings for standardized protocols, as e.g. CPRI, OBSAI or DigRF. **Note that R&S DigIConf requires a USB connection (not LAN!) to the analyzer in addition to the Digital Baseband Interface connection.**

Remote control is possible and very simple. Remote commands for the R&S DigIConf software always begin with SOURce:EBOX. Such commands are passed on from the analyzer to the R&S EX-IQ-BOX automatically via the USB connection.

A setup file, included in delivery, consists of an installation wizard, the executable program and all necessary program and data files. The latest software versions can be downloaded free of charge from the R&S website: www.rohde-schwarz.com/en/products/ test_and_measurement/signal_generation/EX-IQ-Box. Simply execute the Setup file and follow the instructions in the installation wizard.

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

3.7.2   Digital Input

Digital input is enabled by selecting the "Baseband Digital" input path in the "Signal Source" dialog box (available either in the "Measurement" menu of the "I/Q Analyzer" mode, or in the "Input/Output" menu of the base unit and some applications, see "Signal Source" on page 272).

The digital input and output cannot be used simultaneously.

Signal Source

The device that provides digital input must be connected to the Digital Baseband interface at the rear of the analyzer. The signal source is then configured in the "Signal Source" dialog box.

In the "Signal Source" dialog box the detected input device is indicated. For "Digital Baseband (I/Q)" sources, you can configure the basic connection settings, e.g. the input sample rate. Each time the device is disconnected or the configuration is changed, a connection protocol is executed, and before the first measurement, a PRBS descewing test is performed. Information on the connection status and the results of the connection tests are provided in the "Digital Baseband Info" dialog box, see chapter 3.7.5, "Interface Status Information", on page 338.

Measurement Settings

The "Full Scale Level" defines the level that should correspond to an I/Q sample with the magnitude "1" and can be defined either in dBm or Volt (see "Full Scale Level" on page 273). When converting the measured power into dBm, an impedance of 50 Ω is assumed.

Processing digital input

The digital input signal is brought to the desired sample rate using a downsampling filter and fractional resampling. The word length of the data is 18 bits fixed point for each I and Q. The resulting data can be processed by the selected application (see chapter 3.7.1, "Typical Applications for the Digital Baseband Interface", on page 327). As illustrated in figure 3-25, the sample rate is dependant on the input sample rate.
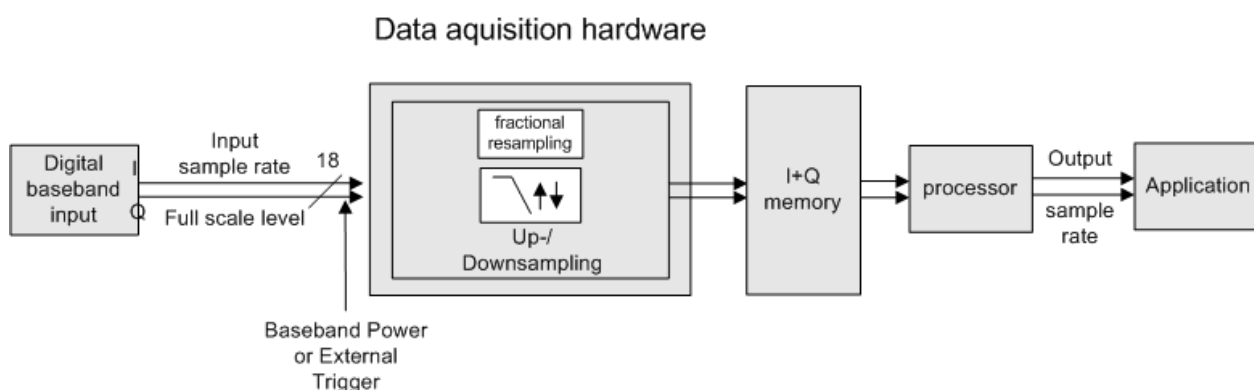
Fig. 3-25: Signal path using digital input

Sample rates, bandwidths and other limitations

The calculation of the usable I/Q bandwidth for active digital input is described in table 3-12.

Abbreviations

The following abbreviations are used in this section:

- **SR**: sample rate: the sample rate that is defined by the user (e.g. in the "Data Aquisition" dialog box in the "I/Q Analyzer" mode, see "Sample Rate" on page 287)
- **ISR**: Input sample rate: the sample rate of the data provided by the connected device to the digital input
- **Ms**: 1 Ms = 1024 * 1024 samples

Table 3-12: Calculation of the usable I/Q bandwidth for active digital input

Precondition	Bandwith
$\dfrac{SR}{ISR} < 0.5$	0.8 * SR
$0.5 \leq \dfrac{SR}{ISR} < 1.216$	0.625 * SR
$\dfrac{SR}{ISR} \geq 1.216$	0.76 * ISR

The following table describes the dependencies for digital in- and output:

Table 3-13: Dependencies for digital in- and output

Type of Limit	Precondition	Range / Value
Input sample rate		100 Hz … 10 GHz (*)
Minimum sample rate		100 Hz (*)
Maximum sample rate	Digital input active	45 MHz (without R&S FSV-B70) (*)
		254 * ISR, max. 10 GHz (with R&S FSV-B70) (*)
	Digital output active	45 MHz (without R&S FSV-B70)
		100 MHz (with R&S FSV-B70)
(*) Note the relationship between the sample rate and the input sample rate, which may restrict the value ranges further: ISR_{min}= SR/254 ISR_{max}= SR*2*1048576		

Type of Limit	Precondition	Range / Value
Maximum number of samples		$Min\left(100Ms, 100Ms \bullet \dfrac{SR}{ISR}\right)$ - **Note**: the internal filter settling time depends on the relation: $\dfrac{SR}{ISR}$ Some analyzer applications limit the maximum number of samples to reasonable values. In I/Q Analyzer mode (Eval mode, see `TRACe<n>:IQ:EVAL` on page 685), the maximum number of samples is restricted to: $Min\left(10Mio, 100Ms \bullet \dfrac{SR}{ISR}\right)$ - g
Maximum number of I/Q pretrigger samples		-(MaxNoOfSamples-1) to + (MaxNoOf-Samples-1)
(*) Note the relationship between the sample rate and the input sample rate, which may restrict the value ranges further: $ISR_{min} = SR/254$ $ISR_{max} = SR*2*1048576$		

Table 3-14: Typical values for the maximum number of samples depending on the SR/ISR relation

SR/ISR	Max number of samples
100	104857600
10	104857600
1	52428760
1/10	6553579
1/100	819174

SlowIQ measurements

"SlowIQ" measurements are measurements where the sample rate exceeds the rate used to transfer valid samples. In the analyzer, the sample rate may exceed 100 MHz for "SlowIQ" measurements. This happens, for example, when an analog signal is sampled by external hardware, e.g. an oscilloscope, with a sample rate > 100 MHz, is stored there in a memory temporarily and then read from the memory and transmitted to the analyzer. In this case, make sure the source sample rate is defined corrrespondingly for the connected device (see "Input Sample Rate" on page 273).

Bandwidths

Depending on the sample rate, the following bandwidths are available:
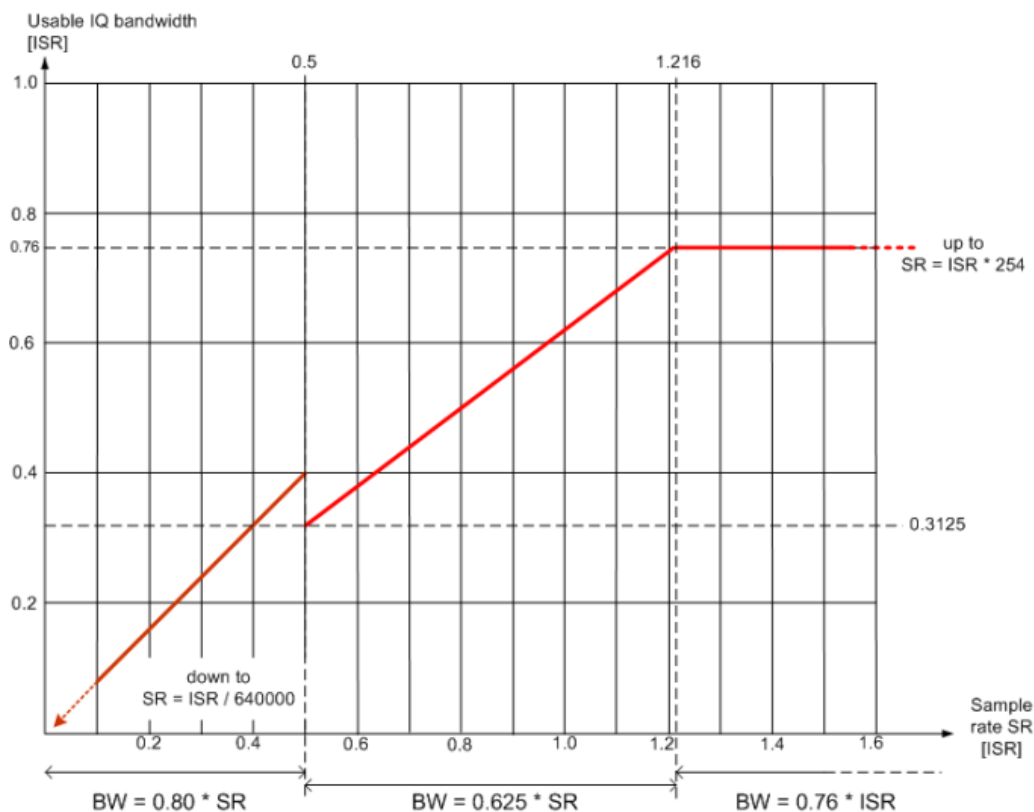
Fig. 3-26: Bandwidths depending on sample rate for active digital input

Triggering

The following trigger modes are supported:

- External (see "External" on page 147)
- BB Power (see "IF Power/BB Power" on page 147)
- Time (see "Time" on page 147)

If external triggering is used, the external trigger must be applied via the connector on the rear panel of the instrument (as for analog input).

> **Gating**
>
> Gating is not supported for digital input.

3.7.3 Digital Output

Digital output is enabled in the I/Q Analyzer mode (see chapter 3.5, "Instrument Functions - I/Q Analyzer", on page 281).

The digital input and output cannot be used simultaneously.

Processing digital output

Digital output is processed almost identically to RF input in I/Q mode (see chapter 3.2.10, "Working with I/Q Data", on page 153). I/Q data is sampled blockwise, according to the defined sample rate, and stored in the I/Q memory. From the memory, the I/Q data is processed in the I/Q Analyzer mode. Simultaneously, the data is written to the digital baseband interface continuously. Using this interface, the I/Q data can be processed in an external device as an alternative to internal processing in the analyzer.

The sample rate at the digital output corresponds to the user-defined sample rate (maximum 100 MHz, see "Sample Rate" on page 287). The current sample rate is displayed in the "Digital Output" dialog box (read-only) when the digital output is enabled (see "Digital Output" on page 275).

For digital output, the full scale level corresponds to the defined reference level (without the reference level offset and transducer; see also "Full Scale Level" on page 273 and "Reference Level" on page 286.

The data rate for digital output via the Digital Baseband interface is 100 MHz, i.e. any connected device must be capable of processing digital input at a data rate of 100 MHz.
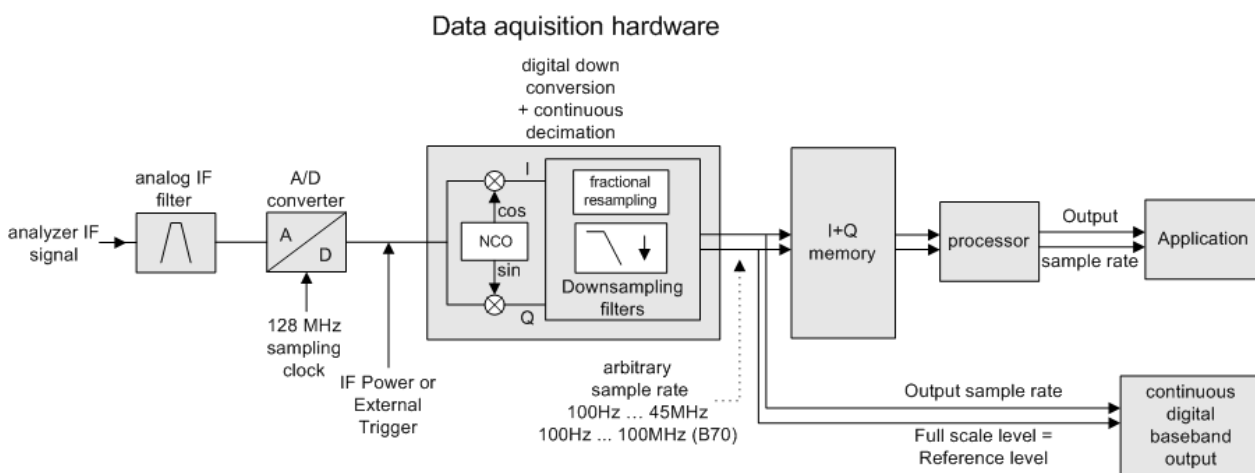
Fig. 3-27: Signal path using the digital output

3.7.4 Softkeys and Parameters of the Digital Baseband Interface

The following softkeys and parameters are available for the Digital Baseband interface in the applications that support it.

Signal Source

Opens a dialog box to select the signal source. For "Digital Baseband (I/Q)", the source can also be configured here.

Input Path ← Signal Source

Defines whether the "RF Radio Frequency" or the "Baseband Digital" input path is used for measurements. "Baseband Digital" is only available if option R&S FSV-B17 (Digital Baseband interface) is installed.

Note: Note that the input path defines the characteristics of the signal, which differ significantly between the RF input and digital input.

SCPI command:
INPut:SELect on page 567

Connected Device ← Signal Source

Displays the name of the device connected to the optional Digital Baseband interface (R&S FSV-B17) to provide Baseband Digital input. The device name cannot be changed here.

The device name is unknown.

SCPI command:
INPut:DIQ:CDEVice on page 562

Input Sample Rate ← Signal Source

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.

SCPI command:
INPut:DIQ:SRATe on page 564

Full Scale Level ← Signal Source

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

The level can be defined either in dBm or Volt.

SCPI command:
INPut:DIQ:RANGe[:UPPer] on page 564

Level Unit ← Signal Source
Defines the unit used for the full scale level.

SCPI command:
INPut:DIQ:RANGe[:UPPer]:UNIT on page 564

Adjust Reference Level to Full Scale Level ← Signal Source
If enabled, the reference level is adjusted to the full scale level automatically if any change occurs.

(See the Auto Level softkey).

SCPI command:
INPut:DIQ:RANGe:COUPling on page 563

Digital Output
Opens a dialog box to enable a digital output stream to the optional Digital Baseband interface (R&S FSV-B17), if available.

The displayed sample rate is identical to the sample rate defined under Data Acquisition (I/Q Analyzer) and is not editable here.

For details see "Digital Output" in the description of the Digital Baseband Interface for the base unit.

SCPI command:
OUTPut:DIQ on page 573

Digital Baseband Info
Displays a dialog box with information on the digital I/Q input and output connection via the optional Digital Baseband interface (R&S FSV-B17), if available. The information includes:

● Device identification
● Used port
● (Maximum) digital input/output sample rates and maximum digital input/output transfer rates
● Status of the connection protocol
● Status of the PRBS descewing test

For details see "Interface Status Information" in "Instrument Functions - Digital Baseband Interface (Option R&S FSV-B17)" in the description of the base unit.

SCPI command:
INPut:DIQ:CDEVice on page 562

EXIQ
Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

If the optional R&S DigIConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DigIConf requires a USB connection (not LAN!) from the analyzer to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface connection. R&S DigIConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the Digital Baseband Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

TX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital output to a connected device ("Transmitter" Type).

RX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital input from a connected device ("Receiver" Type).

Send To ← EXIQ
The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

Firmware Update ← EXIQ
If a firmware update for the R&S EX-IQ-BOX is delivered with the analyzer firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

R&S Support ← EXIQ
Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

DigIConf ← EXIQ
Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the analyzer application, press any key on the front panel. The application is displayed with the "EXIQ" 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 analyzer once again.

SCPI command:
Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the analyzer 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.

3.7.5   Interface Status Information

When a digitial input or output device is connected to the Digital Baseband Interface, a dialog box and status icons in the status bar provide information on the status of the connection. To display the dialog box, select the "Digital Baseband Info" softkey in the "Input/Output" menu (see "Digital Baseband Info" on page 275).
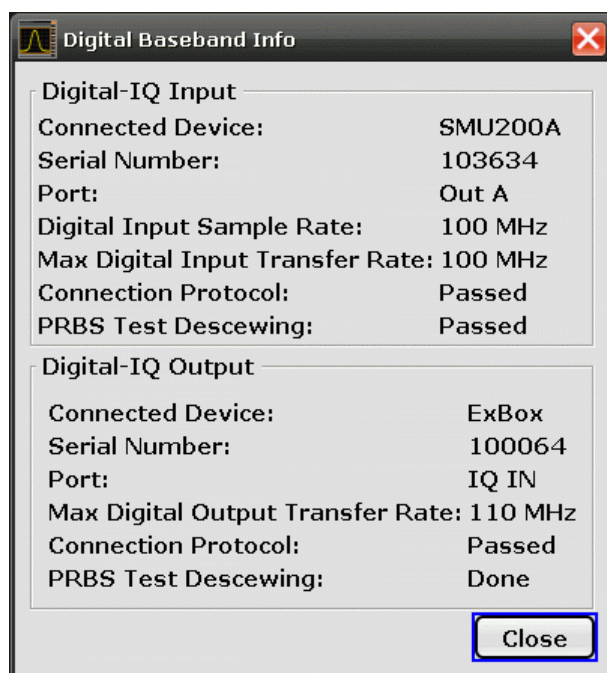
The following information is displayed:

Table 3-15: Displayed Information for Digital Baseband Connections

Label	Description
Digital I/Q input connection	
Digital-I/Q Input	Device connected to analyzer input interface
Serial Number	Serial number of the connected device
Port	Port name used by the connected device
(Max.) Digital Output Sample Rate	Maximum possible or currently used sample rate of the connected device; depends on the used connection protocol version (see "<SampleRate-Type>" parameter described in `INPut:DIQ:CDEVice` on page 562)
Max. Digital Output Transfer Rate	Maximum data transfer rate of the connected device in Hz
Connection Protocol	State of the connection protocol which is used to identify the connected device
PRBS Test Descewing	State of the PRBS test
Digital I/Q output connection	
Digital-I/Q Output	Device connected to analyzer output interface
Serial Number	Serial number of the connected device
Port	Port name used by the connected device
Max. Digital Input Transfer Rate	Maximum input data transfer rate that can be processed by the connected device
Connection Protocol	State of the connection protocol which is used to identify the connected device
PRBS Test Descewing	State of the PRBS test

You can query the information in this dialog box using remote commands, see `INPut:DIQ:CDEVice` on page 562.

Connection tests

Each time a device is (re-)connected to the analyzer, a connection protocol is executed. This test identifies the connected device. This test may take 2 seconds to complete. If a connection cannot be established within 30 seconds, the test is aborted and an error is indicated in the dialog box and the status bar.

Before the first measurement is started after a device has been (re-)connected to the analyzer, a PRBS Descewing test is performed to identify the properties of the used cable. The state of this test is also indicated in the dialog box and the status bar.

If either of the tests fail, check the cable to the connected device as a first step. Also make sure the data rate of the analyzer and the connected device comply with the specification.

Status icons

The status of the connection tests are indicated in the "Digital Baseband Info" dialog box and as icons in the status bar. The status icons have the following meaning:

Table 3-16: Status information for digital baseband connections

Icon	Status
Digital input	
IQ IN	Connection established, protocol not yet started
IQ IN	Connection protocol in progress
IQ IN	Connection protocol passed
IQ IN	PRBS test in progress
IQ IN	PRBS test passed
IQ IN	Connection protocol failed
IQ IN	PRBS test failed
IQ IN	No cable connected although "Signal Source" = "DigIQ"
Digital output	
IQ OUT	Connection established, protocol not yet started
IQ OUT	Connection protocol in progress
IQ OUT	Connection protocol passed
IQ OUT	Connection protocol failed
IQ OUT	No cable connected although "Digital Output" enabled.

Error messages

If errors occur, a message is displayed in the status bar. The following table describes the most common errors and possible solutions.

Message	Possible solutions
"Dig. Input Sample Rate too high!"	● Increase the sample rate ● Reduce the input sample rate
"Dig. Input Sample Rate too low!"	● Reduce the sample rate ● Increase the input sample rate
"Output Sample Rate too high!"	● Reduce the sample rate ● Increase the input sample rate

Message	Possible solutions
"Number of I/Q Capture Samples too high!"	• Reduce the number of I/Q samples • Reduce the ratio input sample rate / sample rate by increasing the sample rate or descreasing the input sample rate
Keyword: "FIFO OVL"	Reduce the input sample rate

3.7.6 Description of the LVDS Connector

The Digital Baseband interface is a proprietary LVDS serial interface. For adaption to industrial standard interfaces use the R&S EX-IQ-BOX (see the "R&S EX-IQ-BOX - External Signal Interface Module Manual").

The LVDS Connector is a 26 pin female 0.050" Mini D Ribbon connector (e.g.: 3M 102XX-1210VE series).

For the connection, use the cables provided with the R&S EX-IQ-BOX or an R&S®SMU-Z6 cable (order no.: 1415.0201.02).
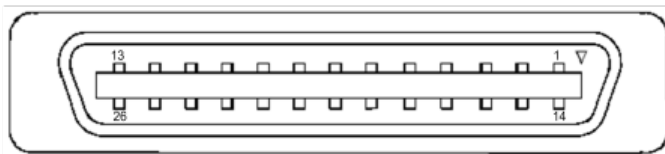
Fig. 3-28: LVDS connector on the analyzer rear panel, connector front view

The table 3-17 shows the multiplexed data at the output of the LVDS transmitter.

Table 3-17: LVDS connector pin description

Pin	Signal	Level	
1			reserved for future use
2	GND	0V	Ground, shield of pair 1-14, for future use
3	SDAT0_P	LVDS	Serial data channel 0 positive pin; carries the bits VALID, ENABLE, MARKER_1, Reserve_1, RE_0, RE_1
4	SDAT1_P	LVDS	Serial data channel 1 positive pin; carries the bits RE_2, RE_3, RE_4, RE_5, RE_6, RE_7
5	SDAT2_P	LVDS	Serial data channel 2 positive pin; carries the bits RE_8, RE_9, RE_10, RE_11, RE_12, RE_13
6	CLK1_P	LVDS	Clock 1 positive pin; clock for transmission on LVDS link
7	S_CLK	TTL	(for future use)
8	+5VD	+5.0V	Supply voltage (for future use)
9	SDAT3_P	LVDS	Serial data channel 3 positive pin; carries the bits RE_14, RE_15, RE_16, RE_17, RE_18, RE_19

Pin	Signal	Level	
10	SDAT4_P	LVDS	Serial data channel 4 positive pin; carries the bits TRIGGER_1, TRIGGER_2, MARKER_2, Reserve_2, IM_0, IM_1
11	SDAT5_P	LVDS	Serial data channel 5 positive pin; carries the bits IM_2, IM_3, IM_4, IM_5, IM_6, IM_7
12	SDAT6_P	LVDS	Serial data channel 6 positive pin; carries the bits IM_8, IM_9, IM_10, IM_11, IM_12, IM_13
	SDAT7_P	LVDS	Serial data channel 7 positive pin; carries the bits IM_14, IM_15, IM_16, IM_17, IM_18, IM_19
14			reserved for future use
15	SDAT0_M	LVDS	Serial data channel 0 negative pin
16	SDAT1_M	LVDS	Serial data channel 1 negative pin
17	SDAT2_M	LVDS	Serial data channel 2 negative pin
18	CLK1_M	LVDS	Clock 1 negative pin
19	DGND	0V	Power ground; ground return for 5V supply voltage (for future use)
20	S_DATA	TTL	(for future use)
21	SDAT3_M	LVDS	Serial data channel 3 negative pin
22	SDAT4_M	LVDS	Serial data channel 4 negative pin
23	SDAT5_M	LVDS	Serial data channel 5 negative pin
24	SDAT6_M	LVDS	Serial data channel 6 negative pin
25	SDAT7_M	LVDS	Serial data channel 7 negative pin
26	GND	0V	LVDS ground; shielding of transmission lines and shielding of cable

3.8 Instrument Functions – External Mixer (Option R&S FSV-B21)

If the analyzer External Mixer option (R&S FSV-B21) is installed, an external mixer can be connected to the analyzer to increase the available frequency range.

External mixers - once activated - are available for all instrument applications. (De-)Activation is only possible in the base unit, i.e. in "Spectrum" mode.

Connecting External Mixers

How to connect external mixers is described in the analyzer Quick Start Guide, "Optional Front Panel Connectors".

Menu and softkey description

The "External Mixer" menu is displayed when you select the "External Mixer" softkey in the "Home" menu of the "Spectrum" mode.

For details see chapter 3.8.1, "Softkeys of the External Mixer (Option B21)", on page 343.

Further information

Some general information on working with external mixers can be found in chapter 3.8.2, "General Information on External Mixers", on page 353.

3.8.1 Softkeys of the External Mixer (Option B21)

External Mixer

Opens the submenu for the external mixer.

External Mixer (On/Off) ← External Mixer

Switches the external mixer on or off. Once activated, the external mixer is available for all applications on the instrument.

SCPI command:

[SENSe:]MIXer[:STATe] on page 617

External Mixer Config ← External Mixer

Opens the "External Mixer Configuration" dialog box that contains two tabs:

● "External Mixer Setup" on page 344
● "Conversion Loss Table Setup" on page 347
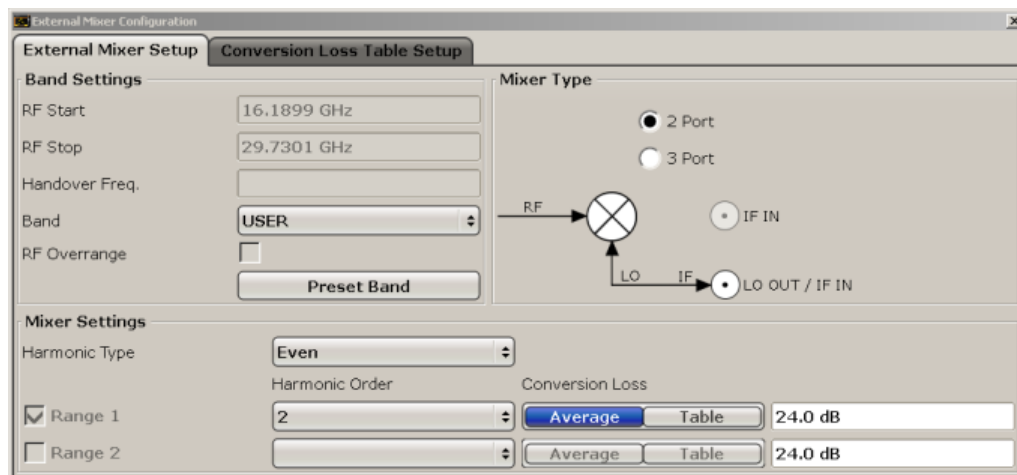
External Mixer Setup ← External Mixer Config ← External Mixer

In this tab you configure the band and mixer settings.

RF Start ← External Mixer Setup ← External Mixer Config ← External Mixer

Displays the start frequency of the selected band. For details on how the frequency range is defined see the information at the beginning of this chapter (chapter 3.8, "Instrument Functions – External Mixer (Option R&S FSV-B21)", on page 342).

SCPI command:

[SENSe:]MIXer:FREQuency:STARt on page 619

RF Stop ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
Displays the stop frequency of the selected band.For details on how the frequency range is defined see the information at the beginning of this chapter (chapter 3.8, "Instrument Functions – External Mixer (Option R&S FSV-B21)", on page 342).

SCPI command:
[SENSe:]MIXer:FREQuency:STOP on page 619

Handover Freq. ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
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.

SCPI command:
[SENSe:]MIXer:FREQuency:HANDover on page 619

Band ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
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.

The mixer settings for the user-defined band can be selected freely. The frequency range for the user band is defined via the harmonics configuration (see "Range 1/2" on page 346).

SCPI command:
[SENSe:]MIXer:HARMonic:BAND on page 619

RF Overrange ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
Specifies whether the band limits are extended beyond "RF Start" and "RF Stop" due to the capabilities of the used harmonics.

SCPI command:
[SENSe:]MIXer:RFOVerrange[:STATe] on page 618

Preset Band ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
Restores the presettings for the selected band.

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

SCPI command:
[SENSe:]MIXer:HARMonic:BAND:PRESet on page 620

Mixer Type ← **External Mixer Setup** ← **External Mixer Config** ← **External Mixer**
The analyzer option B21 allows for the following external mixer types:

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

"3 Port"   LO and IF data uses separate ports

SCPI command:
[SENSe:]MIXer:PORTs on page 622

Harmonic Type ← External Mixer Setup ← External Mixer Config ← External Mixer
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 346).

SCPI command:
[SENSe:]MIXer:HARMonic:TYPE on page 621

Range 1/2 ← External Mixer Setup ← External Mixer Config ← External Mixer
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.

SCPI command:
[SENSe:]MIXer:HARMonic:HIGH:STATe on page 620

Harmonic Order ← Range 1/2 ← External Mixer Setup ← External Mixer Config ← External Mixer
Defines which of the available harmonic orders are 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 splitted.

For the band "USER", the order of harmonic is defined by the user. The order of harmonic can be between 2 and 100, the lowest usable frequency being 26,5 GHz.

SCPI command:
[SENSe:]MIXer:HARMonic[:LOW] on page 620
[SENSe:]MIXer:HARMonic:HIGH[:VALue] on page 620

Conversion Loss ← Range 1/2 ← External Mixer Setup ← External Mixer Config ← External Mixer
Defines how the conversion loss is handled. The following possibilities 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. Prede-
fined conversion loss tables are often provided with the external mixer
and can be imported to the analyzer. Alternatively, you can define your
own conversion loss tables. Conversion loss tables are configured and
managed in the Conversion Loss Table Setup tab.

For details on conversion loss tables, see chapter 3.8.2.3, "Conversion
Loss Tables", on page 354. For details on importing tables, see "Import
Table" on page 351.

All tables stored on the instrument in the `C:\r_s\instr\user\cvl\`
directory are offered for selection. A validation check is then performed
on the selected table to ensure that it complies with the settings. In par-
ticular, the following is checked:

- the assigned band name

- the harmonic order

- the mixer type

- the table must contain at least one frequency that lies within the fre-
  quency range for the band

SCPI command:

`[SENSe:]MIXer:LOSS[:LOW]` on page 622

Average for range 1

`[SENSe:]MIXer:LOSS:TABLe[:LOW]` on page 622

Table for range 1

`[SENSe:]MIXer:LOSS:HIGH` on page 621

Average for range 2

`[SENSe:]MIXer:LOSS:TABLe:HIGH` on page 621

Table for range 2

Conversion Loss Table Setup ← External Mixer Config ← External Mixer

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.
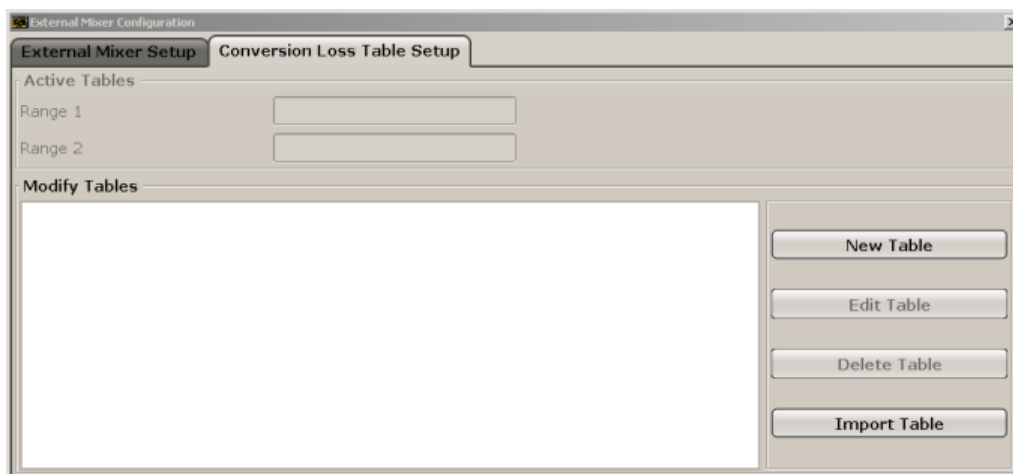
New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

Opens the "Edit Conversion Loss Table" dialog box to configure a new conversion loss table.

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

SCPI command:

[SENSe:]CORRection:CVL:SELect on page 585

File Name ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

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. The entry in this field is mandatory. The `.ACL` extension is automatically appended during storage.

SCPI command:

[SENSe:]CORRection:CVL:SELect on page 585

Comment ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

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

SCPI command:

[SENSe:]CORRection:CVL:COMMent on page 587

Band ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

The waveguide or user-defined band for which the table is to be applied.

SCPI command:

[SENSe:]CORRection:CVL:BAND on page 585

Harmonic Order ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

The harmonic order for which the table is to be applied.

SCPI command:

[SENSe:]CORRection:CVL:HARMonic on page 586

Bias ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

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 351.

SCPI command:

[SENSe:]CORRection:CVL:BIAS on page 586

Mixer Name ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

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

SCPI command:

[SENSe:]CORRection:CVL:MIXer on page 585

Mixer S/N ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

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

SCPI command:

[SENSe:]CORRection:CVL:SNUMber on page 585

Mixer Type ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

Specifies whether the external mixer for which the table is to be applied is a two-port or three-port type.

SCPI command:

[SENSe:]CORRection:CVL:PORTs on page 586

Position/Value ← **New Table** ← **Conversion Loss Table Setup** ← **External Mixer Config** ← **External Mixer**

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.

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 (see figure 3-31) as that for the first and last reference value.

Fig. 3-29: Conversion loss outside the band's frequency range

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.

The following functions are available to define the table:

● Insert an entry
● Delete an entry
● Shift all positions by a specific value (shift x)
● Shift all conversion loss values by a specific value (shift y)

SCPI command:
[SENSe:]CORRection:CVL:DATA on page 587

Insert ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer
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 ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer
Deletes the currently selected position/value entry.

Shift x ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer
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 ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer
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 ← New Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

The conversion loss table is stored under the specified name in the `C:\r_s\instr\user\cvl\` directory of the instrument.

Edit Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

Opens the "Edit Conversion Loss Table" dialog box to edit the selected conversion loss table. For details on table configuration see "New Table" on page 348.

SCPI command:

[SENSe:]CORRection:CVL:SELect on page 585

Delete Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

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

SCPI command:

[SENSe:]CORRection:CVL:CLEar on page 587

Import Table ← Conversion Loss Table Setup ← External Mixer Config ← External Mixer

Imports a stored conversion loss table from any directory to the instrument's `C:\r_s\instr\user\cvl\` directory.

Bias Settings ← External Mixer

Opens a dialog box to 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.

SCPI command:

[SENSe:]MIXer:BIAS:LOW on page 618

[SENSe:]MIXer:BIAS:HIGH on page 618

Write to <CVL table name> ← Bias Settings ← External Mixer

Stores the bias setting in the currently selected "Conversion Loss Table" for the range (see "Conversion Loss Table Setup" on page 347).

SCPI command:

[SENSe:]CORRection:CVL:BIAS on page 586

LO Level ← External Mixer

Opens an edit dialog box to change the LO level of the external mixer's LO port from 13.0 dBm to 17.0 dBm in 0.1 dB steps. Default value is 15.5 dB.

SCPI command:

[SENSe:]MIXer:LOPower on page 621

Signal ID (On/Off) ← **External Mixer**

The SIGNAL ID softkey 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. (See also chapter 3.8.2.5, "Remarks on Signal Identification with Auto ID", on page 355).

The reference sweep is performed using a LO setting shifted downwards by 2*IF/<Harmonic order>. Input signals in the wanted sideband that are converted using the specified harmonic are displayed in both traces at the same position on the frequency axis. Image signals and mixer products caused by other harmonics are displayed in both traces at different positions. The user identifies the signals visually by comparing the two traces.

Since the LO frequency is displaced downwards in the reference sweep, the conversion loss of the mixer may differ from the test sweep. Therefore the level should only be measured in the test sweep (trace 1).

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

SCPI command:

[SENSe:]MIXer:SIGNal on page 622

Auto ID (On/Off) ← **External Mixer**

Activates or deactivates automatic signal identification.

Auto ID basically functions like Signal ID (On/Off). 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. (See also chapter 3.8.2.5, "Remarks on Signal Identification with Auto ID", on page 355).

Real input signals are displayed at the same frequency in the test and reference sweeps, i.e. theoretically identical signal levels are expected in the two sweeps at the frequency of the real mixer product. If the level difference is lower than the tolerance set with Auto ID Threshold, the signal obtained in the test sweep is displayed. If a signal occurs only in the test sweep or reference sweep, it is an unwanted mixer product. The level of this signal is compared to the noise floor in the other sweep. If the S/N ratio is sufficiently large, the tolerance limit for the maximum permissible level difference is exceeded. This means that the signal with the lower level, i.e. noise in this case, is displayed.

Note that "Auto ID" functions according to the fail-safe principle, i.e. unwanted mixer products may not be detected as such but signals which are in fact real input signals are not blanked out. See also chapter 3.8.2.5, "Remarks on Signal Identification with Auto ID", on page 355.

SCPI command:

[SENSe:]MIXer:SIGNal on page 622

Auto ID Threshold ← External Mixer

Allows the maximum permissible level difference between test sweep and reference sweep to be corrected during automatic comparison (Auto ID 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. See also chapter 3.8.2.5, "Remarks on Signal Identification with Auto ID", on page 355.

SCPI command:

[SENSe:]MIXer:THReshold on page 623

3.8.2 General Information on External Mixers

This section contains some general information on external mixers and their application.

3.8.2.1 Frequency Range

The frequency of the input signal can be expressed as a function of the LO frequency and the selected harmonic of the 1st LO as follows:

$f_{in} = n * f_{LO} + f_{IF}$

where:

f_{in}: frequency of input signal

n: order of harmonic used for conversion

f_{LO}: frequency of first LO: 7.73 GHz to 15.23 GHz

f_{IF}: intermediate frequency 729.9 MHz

3.8.2.2 Bias Current

Single-diode mixers generally require a DC voltage which is applied via the LO line. This DC voltage is to be tuned to the minimum conversion loss versus frequency. Such a DC voltage can be set via the "BIAS" function using the D/A converter of the analyzer. The value to be entered is not the voltage but the short-circuit current. The current is defined in the "Bias Settings" or set to the value of the conversion loss table (see "Bias Settings" on page 351 and "Bias" on page 349.
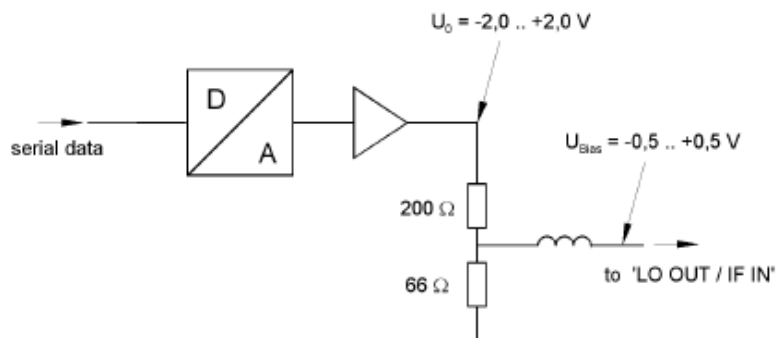
Fig. 3-30: Bias circuit of the analyzer

The voltage U0 at the output of the operational amplifier can be set in the range –2.0 to +2.0 V An open-circuit voltage Vbias of –0.5 to +0.5 V is obtained accordingly at the output of the voltage divider. A short-circuit current of Ishort = V0 / 200 Ω = 10 mA to + 10 mA is obtained for a short circuit at the output of the voltage divider. For using biasing it is not important to know exactly the current flowing through the diode since the conversion loss must be set to minimum with the frequency. It therefore makes no difference whether the setting is performed by an open-circuit voltage or by a short-circuit current. A DC return path is ensured via the 66 Ω resistor, which is an advantage in some mixers.

3.8.2.3 Conversion Loss Tables

Conversion loss tables consist of value pairs that describe the correction values for conversion loss at certain frequencies. 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 (see figure 3-31) as that for the first and last reference value.
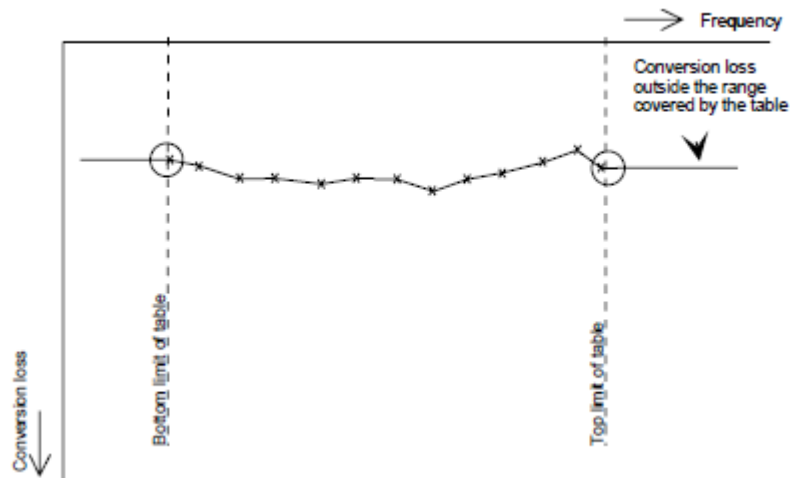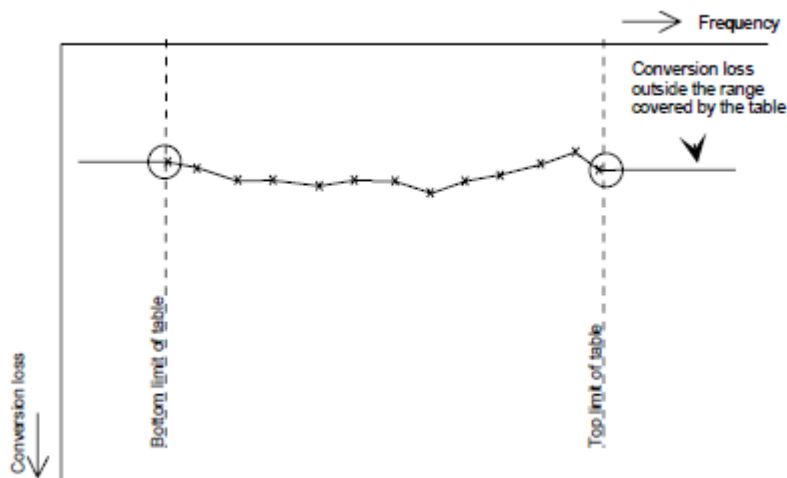

Fig. 3-31: Conversion loss outside the band's frequency range

Predefined conversion loss tables are often provided with the external mixer and can be imported to the analyzer. Alternatively, you can define your own conversion loss tables. Conversion loss tables are configured and managed in the "Conversion Loss Table Setup" tab of the "External Mixer Configuration" dialog box (see "Conversion Loss Table Setup" on page 347).

The conversion loss table to be used for a particular range is defined in the "External Mixer Configuration" dialog box. All tables stored on the instrument in the `C:\r_s\instr \user\cvl\` directory are offered for selection. A validation check is then performed on the selected table to ensure that it complies with the settings. In particular, the following is checked:

- the assigned band name
- the harmonic order
- the mixer type
- the table must contain at least one frequency that lies within the frequency range for the band

3.8.2.4 Full Screen Level

The maximum possible reference level depends on the maximum used conversion loss value. Thus, the reference level can be adjusted for each range according to the used conversion loss table or average conversion loss value. If a conversion loss value is used which exceeds the maximum reference level, the reference level is adjusted to the maximum value permitted by the firmware.

3.8.2.5 Remarks on Signal Identification with Auto ID

Test sweep and reference sweep

Depending on which of the automatic signal identification functions are used, the traces are used to display either the test sweep (the upper side-band sweep) or the reference sweep (lower side-band sweep).

Function	Trace 1	Trace 2	Trace 3
Signal ID	Signal ID upper side-band	Signal ID lower side-band	-
Auto ID	Auto ID	-	-
Signal ID + Auto ID	Signal ID upper side-band	Signal ID lower side-band	Auto ID

Type of signal

The automatic comparison of the test sweep and reference sweep with the "Auto ID" function can only be usefully applied for signals with time-constant spectrum since the two sweeps are always required to determine the actual spectrum.

Tolerance for the comparison of test sweep and reference

Since the LO frequency is displaced downwards in the reference sweep, the conversion loss of the mixer may differ from that of the test sweep. The reasons for this are the LO output power of the R&S FSV varying with the frequency and the non-ideal characteristics of the mixer. A certain tolerance should therefore be permitted for the comparison of the signal levels in the test sweep and reference sweep. The user can set this tolerance using the "AUTO ID THRESHOLD" function. If the tolerance is defined too narrow, the signal collected with the reference sweep may be displayed even for the identification of real signals.

Example:

A signal with a frequency of 52.5 GHz is applied to the mixer input. Let the signal level be –30 dBm. The conversion loss of the mixer is 28 dB at this frequency in the test sweep and 35 dB in the reference sweep. The user has entered a tolerance of 5 dB and a conversion loss of 28 dB. Thus, the signal is recorded with the correct level of –30 dBm in the test sweep, a signal level of –37 dBm is obtained in the reference sweep. As the difference (7 dB) between the levels is >5 dB, the signal with the lower level is displayed, i.e. the signal of the reference sweep. Since the set conversion loss is adapted to the test sweep, the signal displayed on the R&S FSV has a level of –37 dBm yielding incorrect level display.

The tolerance entered corresponds to the minimum S/N ratio which signals should have to ensure correct identification. If the S/N ratio of a mixer product is less than the tolerance, the decision criterion is fulfilled even if only the noise floor is recorded in the reference sweep at the frequency of this mixer product. Unwanted mixer products are therefore not detected as such by "AUTO ID". They can only be identified by a visual comparison of the two traces using the function "SIGNAL ID".

In order to avoid the visual identification of such unwanted mixer products it is useful to perform the measurement test in two steps:

In the first step the tolerance is set to the minimum value (0.1 dB). This enables unwanted mixer products with low S/N ratio to be detected and blanked out.

"FREQ > EXTERNAL MIXER > AUTO ID"

" FREQ > EXTERNAL MIXER > AUTO ID THRESHOLD": *0.1" "dB*

To determine the signal levels of real input signals the tolerance is to be set to the minimum value, e.g. 10 dB, in the second step.

"FREQ > EXTERNAL MIXER > AUTO ID THRESHOLD": *10 dB*

The real input signals are then displayed with the correct level.

Mixer products with low S/N ratio

If the S/N ratio of a mixer product is less than the tolerance set with "AUTO ID THRESHOLD", the level difference between the test sweep and reference sweep at the frequency of this mixer product is always within limits, even if the signal occurs in one of the sweeps only. Such mixer products cannot be identified by "AUTO ID". It is therefore recommended to perform a visual comparison of the test sweep and reference sweep using the function "SIGNAL ID".

An unwanted signal having a S/N ratio corresponding approximately to the tolerance set with "AUTO ID THRESHOLD" may not be blanked out permanently. Due to the fact that

the noise display varies from one sweep to another, the S/N ratio changes and thus the level difference between the test sweep and reference sweep measured at a frequency too. As a result, the criterion for detecting unwanted signals is not fulfilled. To blank out unwanted signals permanently an almost constant noise indication is therefore required. This can be achieved by reducing the video bandwidth. Since the average noise indication lies well below the generated noise peak values, the minimum level diminishes. For identification using "AUTO ID" signals should have this minimum level.

Examining unwanted mixer products with small span

With large spans in which non-modulated sinewave signals are represented as single lines, unwanted mixer products are generally completely blanked out. If the user, however, examines closer the frequency range containing a blanked signal using a small span, e.g. an image-frequency response, the spectrum represented in is obtained.

Components of a mixer product blanked out with AUTO ID

There are components of a blanked signal the level difference of which is smaller than the tolerance predefined with "AUTO ID THRESHOLD" as compared with the noise floor. These components are therefore not blanked out. The tolerance chosen was 10 dB in this example which can be seen at the level difference between marker and delta marker (display 'Delta 2 [T1]').

Using AUTO ID with large spans

As already described, the comparison of maximum peak values of test and reference sweep is performed for each sweep point. A trace comprises yyy…10000 sweep values the number of which is reduced to build the 691 pixels. Each pixel contains the maximum value of the sweep points it consist of. Therefore a pixel can contain information of a number of frequency steps.

If unwanted mixer products represented at frequencies which slightly differ from each other occur in the test sweep and reference sweep, the two mixer products from the test sweep and the reference sweep are displayed by the same sweep point. They will not be detected as unwanted mixer products by "AUTO ID "and therefore not be blanked out.

Very small spans should therefore be selected to ensure correct signal identification by means of "AUTO ID".

Display of mixer products at the same frequency

If the input signal consists of a very large number of spectral components, it will become more and more probable that two different unwanted mixer products will be displayed at the same frequency in the test sweep and reference sweep. Such a case is shown in .

The external mixer has been working using 2nd order harmonic. The signal recorded in the test sweep is displayed by trace 1. The IF filter of the R&S FSV is represented at a 3 dB bandwidth of 20 kHz, the real IF bandwidth being 30 kHz. If, however, the 3 dB bandwidth (trace 2) of the signal recorded in the reference sweep is examined, it will be found to be larger exactly by a factor of 2. This shows that the two products were generated by mixing with LO harmonics of different orders The signal recorded in the test sweep was generated by mixing with 3rd order harmonic. Since the frequency axis scaling is based on the 2nd order, the mixer product or the resulting diagram of the IF filter is compressed

by a factor of 2/3. The signal recorded in the reference sweep was generated by mixing with the fundamental of the LO signal. Since the frequency axis scaling is based on the 2nd order, the mixer product or the resulting diagram of the IF filter is expanded by a factor of 2.

Automatic identification with a large span is not possible since the two mixer products are displayed at the same frequency. The diagram shown in is obtained when examining products with a narrow span using "AUTO ID". The user can easily recognize unwanted mixer products from the clear diagram obtained using "AUTO ID" or "SIGNAL ID".

3.8.3   Introductory Example of Operation

The following example gives an example of the operation of external mixers as well as the required settings: A sine wave signal with f = 14.5 GHz is applied to the input of a multiplier. The spectrum at the multiplier output is to be recorded in the range of 52 to 60 GHz using a 2-port mixer for the V band. The mixer used is a double-diode mixer. The example of operation is described in the following steps:

- Test Setup
- Activating the External Mixer and Selecting the Mode
- Default Settings
- Level Correction
- Frequency-dependant Level Correction
- Level Correction with an Average Value
- Taking into Account the Cable Loss in the IF Path
- Functions for Signal Identification

Test Setup
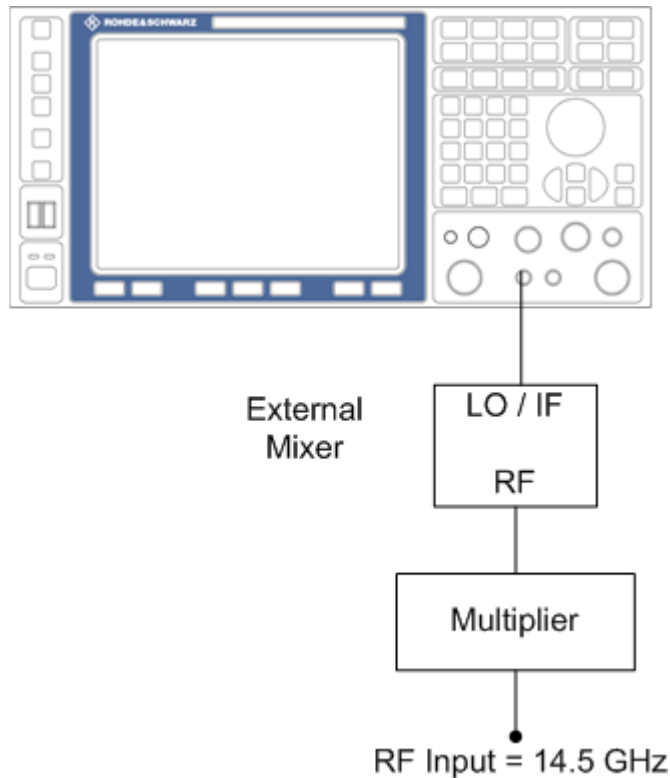
Fig. 3-32: External mixer test setup

1. 1. Connect the "LO OUT / IF IN" output of the analyzer to the LO/IF port of the external mixer.

2. Connect the multiplier to the external mixer.

3. Apply a sine wave signal with *f = 14.5 GHz* to the input of the multiplier.

Activating the External Mixer and Selecting the Mode

►   Activate the external mixing for all applications by selecting "FREQ > External Mixer > External Mixer ON" in Spectrum mode.

Default Settings

Prior to the measurement select the required band (in this case the V band).

1. Select "FREQ > External Mixer > External Mixer Config".

2. From the "Band" selection list, select the "V" band.

Level Correction

The conversion loss of the mixer can be taken into account either as a function of frequency (table with reference values) or using an average value. The frequency-dependent level correction is used in this example in order to obtain a higher precision. As an alternative, level correction based on average value can be used (see below).

1. Select "FREQ > External Mixer > External Mixer Config".

2. For Range 1, select "Table".

3. From the selection list, select a conversion loss table stored on the instrument.

   If the selected table is not valid for the selected band, an error message is displayed.

3.8.3.1 Frequency-dependent Level Correction

1. Open the external mixer configuration settings by selecting "FREQ > External Mixer > External Mixer Config".

2. Select the required "Band".

3. For "Range 1", select "Table".

4. From the selection list, select a conversion loss table stored on the instrument. No further settings are necessary since the selected file contains all required parameters. If the selected table is not valid for the selected band, an error message is displayed. If no conversion loss table is available yet, create a new table first (in the "Conversion Loss Table Setup" tab, see "New Table" on page 348).

5. A span is automatically set which covers the whole V band (50 to 75 GHz).

6. Set the frequency range to be examined by selecting "FREQ > Frequency Start"=*52 GHz* and "FREQ > Frequency Stop"=*60 GHz*.

7. Reduce the video bandwidth by selecting "BW > Video Bandwidth Manual"=*1 MHz*. This allows for correct signal identification using "AUTO ID" (see also chapter 3.8.2.5, "Remarks on Signal Identification with Auto ID", on page 355).

3.8.3.2 Level Correction with an Average Value

To take an average value into account instead of the frequency-dependent level correction, enter the following parameters for the selected band in the external mixer configuration settings:

1. Open the external mixer configuration settings by selecting "FREQ > External Mixer > External Mixer Config".

2. Select the required "Band".

3. For "Range 1", select "Average".

4. Enter the average of the conversion loss.

The entered average value is taken into account for the spectrum display irrespective of the frequency. The precision that can be obtained depends on the frequency response of the mixer. With this type of level correction, measurements can be easily performed at single frequencies.

3.8.3.3 Taking into Account the Cable Loss in the IF Path

On performing level correction, the conversion loss of the mixer and also the insertion loss a_0 of the cable used to tap off the IF signal are to be taken into account. This additional loss is frequency-dependent.

1. Determine the insertion of the cable at the intermediate frequency f_{IF} = *729.9 MHz*.

2. For level correction with average value, add the cable insertion loss to the average conversion loss.
    For frequency-dependent level correction, increase each reference value by the insertion loss to the same extent. To do so, you can enter the cable loss using a transducer table. Such a table should only contain two reference values (band start and end) for which a_0 is specified.

3.9 Instrument Functions - Power Sensor (R&S FSV-K9)

For precise power measurement up to 4 power sensors can be connected to the instrument via the front panel (USB connector) or the rear panel (power sensor, option R&S FSV-B5). The Power Sensor Support firmware option provides the power measurement functions for this test setup. Both manual operation and remote control are supported. The power sensor results are displayed in the marker table.
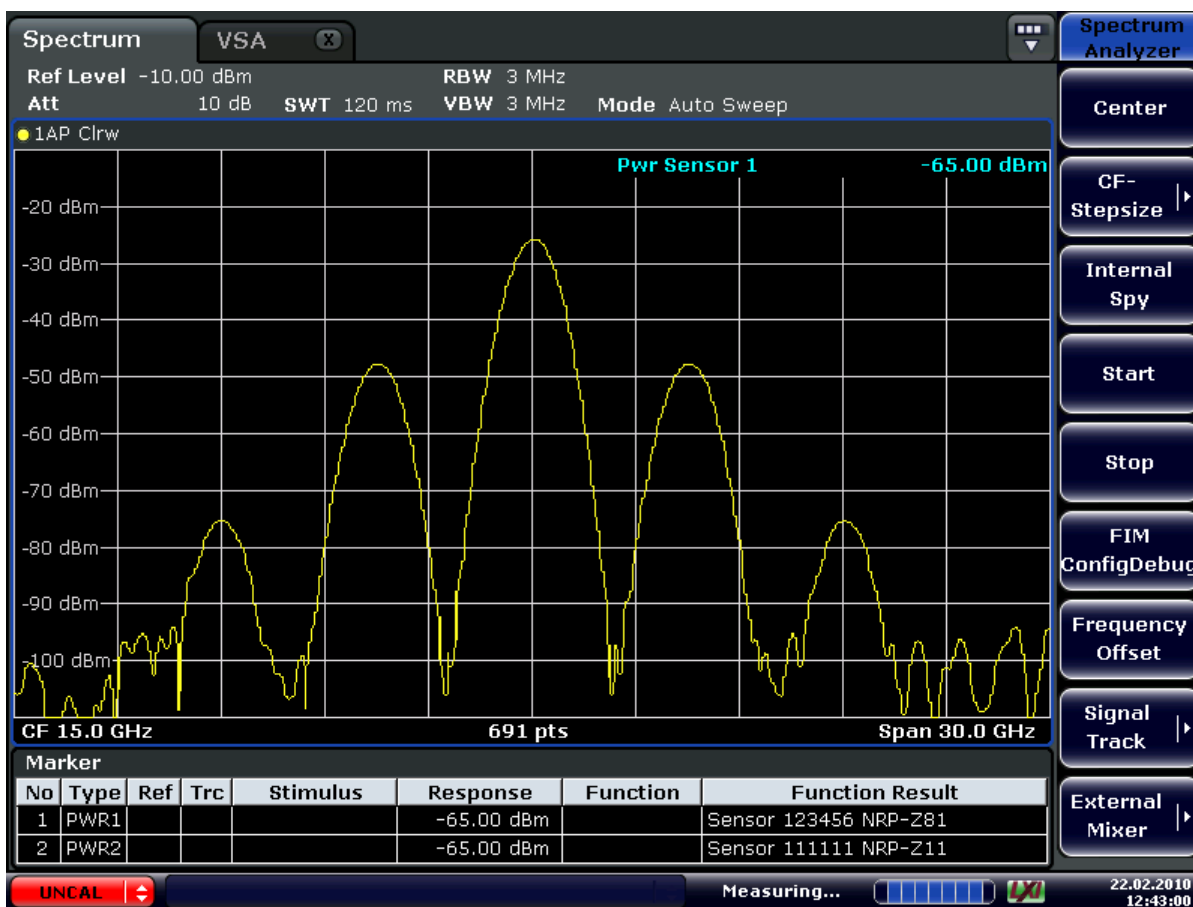
For details on the connectors and compatible power sensors refer to the Quick Start Guide, chapter 1, "Front and Rear Panel".
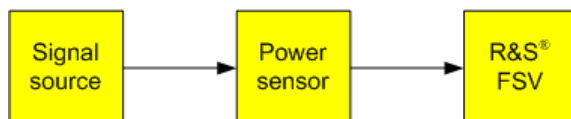
Fig. 3-33: Power sensor support – standard test setup

Using the power sensor with several applications

The power sensor cannot be used from the Analyzer firmware and the R&S Power Viewer (virtual power meter for displaying results of the R&S NRP power sensors) simultaneously. After using the Power Viewer, close the application, then unplug and replug the sensor. Afterwards the power sensor can be used by the Analyzer again.

To open the Power Sensor menu

The power sensor option R&S FSV–K9 is integrated within the "Input/Output" menu.

● Press the INPUT/OUTPUT key.
● Press the "Power Sensor" softkey.The "Power Sensor" menu is displayed.

Menu and softkey description

● chapter 3.9.3, "Softkeys of the Power Sensor Menu (R&S FSV-K9)", on page 365

Remote operation

Power sensors can be operated using the following remote command subsystems:

● "CALCulate:PMETer Subsystem (Power Sensor, R&S FSV-K9)", on page 531
● chapter 4.2.3.3, "CALibration:PMETer Subsystem (Power Sensor, R&S FSV-K9)", on page 545
● chapter 4.2.3.6, "FETCh:PMETer Subsystem (Power Sensor, R&S FSV-K9)", on page 557
● chapter 4.2.3.13, "READ:PMETer Subsystem", on page 575
● "SENSe:PMETer<p> Subsystem (Power Sensor, R&S FSV-K9)", on page 628
● chapter 4.2.3.20, "UNIT Subsystem", on page 694

Results display

The results of the power sensor measurements are displayed in the marker table. For each power sensor, a row is inserted. The sensor index is indicated in the "Function" column.

Marker						
No	Type	Trc	Stimulus	Response	Function	Function Result
1	PWR2			---	Sensor 2	Sensor ?
2	PWR3			---	Sensor 3	Sensor ?
3	PWR4			---	Sensor 4	Sensor ?

Alternatively, you can query the results using the remote command `FETCh<n>:PMETer<p>` on page 557.

Tasks

The following tasks with Power Sensors are described in this chapter:

● chapter 3.9.2, "Zeroing the Power Sensor", on page 365
● chapter 3.9.1, "Using Power Sensors", on page 364

Further information

Information on possible error messages when using the Power Sensor is provided in chapter 3.9.4, "Error Messages", on page 370.

3.9.1 Using Power Sensors

As of firmware version 1.50, up to 4 power sensors can be configured separately and used for precise power measurement (previously only one sensor was supported). All power sensors can be activated and deactivated individually.

The following procedure describes in detail how to configure and activate power sensors.

1. Press INPUT/OUTPUT > "Power Sensor" to display the "Power Sensor" menu.

2. Press "Power Sensor Config" to display the configuration dialog box.

3. Select the tab for the power sensor index you want to configure, e.g. "Sensor 1". Note: if automatic assignment is active (default) and a power sensor is already connected to the analyzer, the serial number of the sensor is indicated in one of the tabs. In this case, you configure that particular sensor in the corresponding tab. If no serial number is indicated, you can set up a configuration and assign a sensor manually later.

4. Press "Select" to evaluate the power sensor when power measurement is activated.

5. Define the frequency of the signal whose power you want to measure.
   a) To define the frequency manually, select "Frequency Manual" and enter a frequency.
   b) To determine the frequency automatically, select "Frequency Coupling" and then either "Center", to use the center frequency, or "Marker", to use the frequency defined by marker 1.

6. Select the unit for the power result display (see "Unit/Scale" on page 367).

7. Select the measurement time for which the average is calculated. To define the number of readings to be taken into account manually, select "Manual" and enter the number in the "Number of Readings" field (see also "Meas Time/Average" on page 367 and "Number of Readings" on page 368).

8. To activate the duty cycle correction, select "DutyCycle" and enter a percentage as the correction value (see "Duty Cycle" on page 368).

9. If you selected "dB" or "%" as units (relative display), define a reference value:
   a) To set the currently measured power as a reference value, press the Meas->Ref button.
   b) Alternatively, enter a value manually in the "Reference Value" field.
   c) Optionally, select the "Use Ref Level Offset" option to take the reference level offset set for the analyzer (Ref Level Offset softkey) into account for the measured power.

10. Optionally, define the usage of an external power trigger (see also "External Power Trigger" on page 369):
    a) Select the "External Power Trigger" option.
    b) Enter the "External Trigger Level".

11. If necessary, repeat steps 3-10 for another power sensor.

12. By default, automatic assignment is active. If a power sensor is already connected to the analyzer, it is automatically assigned to an index and the serial number of the sensor is indicated on the corresponding tab. In this case, you already configured the settings for the assigned power sensor.
Otherwise, assign the connected power sensors to the power sensor configurations manually:

   a) Press the "Power Sensor Assignment" softkey in the "Power Sensor" menu to display the assignment dialog box.

   b) For each configuration, define whether it is to be assigned automatically or manually by activating or deactivating the "Auto Assignment" option for the corresponding power sensor index.

   c) For manual assignment, select the serial number of one of the connected power sensors from the list.

13. Press the "Power Sensor On" softkey in the "Power Sensor" menu to activate power measurement for the selected power sensors.

   The results of the power measurement are displayed in the marker table (Function: "Sensor<1...4>") and can be queried via the remote command `FETC:PMET<p>?` (see `FETCh<n>:PMETer<p>` on page 557).

3.9.2 Zeroing the Power Sensor

You can reset each power sensor to zero. This can be done using the remote command `CALibration:PMETer<p>:ZERO:AUTO ONCE` on page 546 or manually, as desribed here.

1. In the "Power Sensor" menu (INPUT/OUTPUT > "Power Sensor"), press "Power Sensor Config" to display the configuration dialog box.

2. Select the tab that is assigned to the power sensor you want to zero.

3. Press the Zeroing Power Sensor button.
   A dialog box is displayed that prompts you to disconnect all signals from the input of the power sensor.

4. Disconnect all signals from the input of the power sensor and press ENTER to continue.

5. Wait until zeroing is complete.
   A corresponding message is displayed.

3.9.3 Softkeys of the Power Sensor Menu (R&S FSV-K9)

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

For details on how to configure and activate power sensors, see chapter 3.9.1, "Using Power Sensors", on page 364.

Power Sensor On/Off
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 in the "Power Sensor Configuration" dialog box (see "Power Sensor Config" on page 366). However, the general setting overrides the individual settings.

SCPI command:
`[SENSe:]PMETer<p>[:STATe]` on page 628

Power Sensor Config
Opens the "Power Sensor Configuration" dialog box to configure up to 4 different power sensors. Each sensor configuration is displayed on a separate tab. The serial number of the power sensor connected to the instrument and currently assigned to the displayed configuration is indicated on the tab.
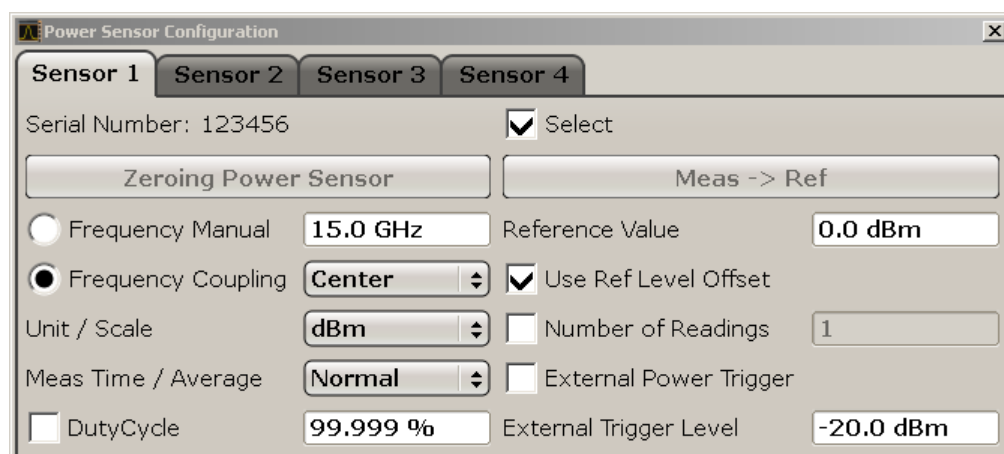
Select ← Power Sensor Config

Selects the individual power sensor for usage if power measurement is generally activated (Power Sensor On/Off function).

SCPI command:

[SENSe:]PMETer<p>[:STATe] on page 628

Zeroing Power Sensor ← Power Sensor Config

Starts zeroing of the power sensor. For details on the zeroing process refer to chapter 3.9.2, "Zeroing the Power Sensor", on page 365 .

SCPI command:

CALibration:PMETer<p>:ZERO:AUTO ONCE on page 546

Frequency Manual ← Power Sensor Config

Define 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.

SCPI command:

[SENSe:]PMETer<p>:FREQuency on page 629

Frequency Coupling ← Power Sensor Config

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

SCPI command:

[SENSe:]PMETer<p>:FREQuency:LINK on page 629

Unit/Scale ← Power Sensor Config

Select 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 softkey or the Reference Value softkey.

SCPI command:

UNIT<n>:PMETer<p>:POWer on page 694

UNIT<n>:PMETer<p>:POWer:RATio on page 695

Meas Time/Average ← Power Sensor Config

Select the measurement time or switch 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 of 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	Switches to manual averaging mode. The average count is set with the "Number of Readings" on page 368 softkey.

SCPI command:

[SENSe:]PMETer<p>:MTIMe on page 630

[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe] on page 630

Duty Cycle ← **Power Sensor Config**

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

SCPI command:

[SENSe:]PMETer<p>:DCYCle:STATe on page 628

[SENSe:]PMETer<p>:DCYCle:VALue on page 629

Meas->Ref ← **Power Sensor Config**

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.

SCPI command:

CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE on page 532

Reference Value ← **Power Sensor Config**

Enter a reference value for relative measurements in the unit dBm.

SCPI command:

CALCulate<n>:PMETer<p>:RELative[:MAGNitude] on page 532

Use Ref Lev Offset ← **Power Sensor Config**

If activated, takes the reference level offset set for the analyzer (Ref Level Offset softkey) into account for the measured power. If deactivated, takes no offset into account.

SCPI command:

[SENSe:]PMETer<p>:ROFFset[:STATe] on page 631

Number of Readings ← **Power Sensor Config**

Enter the number of readings (averagings) to be performed after a single sweep has been started. This softkey 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 averaging and sweep count of the "Trace" menu 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.

SCPI command:

[SENSe:]PMETer<p>:MTIMe:AVERage:COUNt on page 631

External Power Trigger ← Power Sensor Config

Activates the creation of a trigger signal in the power sensor. When you select this option, the following settings in the configuration dialog become unavailable:

- Unit/Scale
- Reference Value
- Use Ref Lev Offset
- Number of Readings

Selecting this option causes the transmission of the following remote commands to the power sensor:

```
*RST

SENS:AVER:STAT OFF

TRIG:MAST:STAT ON

TRIG:SOUR INT

TRIG:SLOP POS

TRIG:DTIM 100e-6

INIT:CONT ON
```

This softkey is only available in conjunction with a NRP-Z81 power sensor.

SCPI command:

[SENSe:]PMETer<p>:TRIGger[:STATe] on page 631

External Trigger Level ← Power Sensor Config

Enter the external trigger level.

This softkey is only available in conjunction with a NRP-Z81 power sensor.

SCPI command:

[SENSe:]PMETer<p>:TRIGger:LEVel on page 632

Power Sensor Assignment

Opens the "Power Sensor Assignment" dialog box to assign the connected power sensors to the configuration sets.
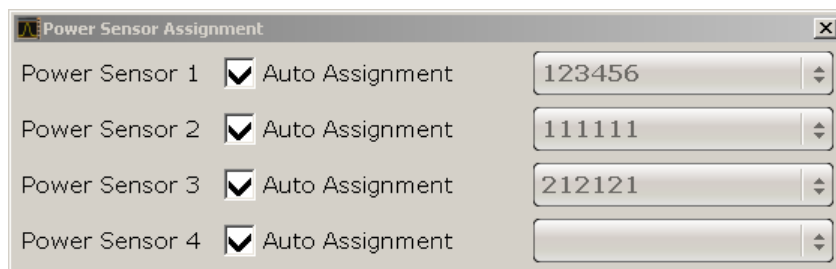
The detected serial numbers of the power sensors connected to the instrument are provided in a selection list. For each of the four available power sensor indexes ("Power Sensor 1"..."Power Sensor 4"), which correspond to the tabs in the configuration dialog, one of the detected serial numbers can be 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 Assignment" option and selecting a serial number from the list.

SCPI command:

SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine on page 672

SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe]
on page 673

SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt on page 673

3.9.4 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command SYSTem:ERRor?.

A short explanation of the device-specific error messages for analyzer-K9 is given below.

Status bar message	Description
Zeroing could not be performed	Zeroing could not be performed because the RF power applied is too high.
Power sensor zero failed	

3.10 Instrument Functions - Spectrogram Measurements

Equipped with the firmware option R&S FSV-K14, the analyzer provides a graphical overview of changes in frequency and amplitude over a specified period of time.

Not all measurement types available in spectrum mode can be displayed in the "Spectrogram" result display. If the "Spectrogram Measurement" option is active and a measurement cannot be displayed in form of a spectrogram, the softkey of the corresponding measurement is disabled.

All settings of the base unit are also valid for the spectrogram view and vice versa.

The following chapter describes the instrument functions specific to "Spectrogram" measurements.

To open the Spectrogram view

The "Spectrogram" result display and its softkey menu is part of the "Trace" menu of the base unit.

1. Press the TRACE key.

2. Press the "Spectrogram" softkey.

   The menu for the "Spectrogram" result display opens.

Menus and Softkeys

The main menu for the "Spectrogram" result display is part of the "Trace" menu of the base unit and is described in chapter 3.10.2, "Softkeys of the Spectrogram Menu", on page 374.

Furthermore, some special "Spectrogram" functions are included in the "Sweep" menu, see chapter 3.2.7.1, "Softkeys of the Sweep Menu", on page 124.

Marker functions

The functions in the "Marker" menu (MKR key) are the same as for the base unit (see chapter 3.3.1.1, "Softkeys of the Marker Menu", on page 159). However, note the slightly different behavior as described in chapter 3.10.1, "General Information", on page 371.

Remote Operation

Remote commands for "Spectrogram" measurements are included in the following sub-systems:

- "CALCulate:DELTamarker:SPECtrogram | SGRam subsystem", on page 435
- "CALCulate:MARKer:SPECtrogram | SGRam subsystem", on page 509
- "CALCulate:SPECtrogram subsystem", on page 534
- chapter 4.2.4.7, "MMEMory Subsystem", on page 717

3.10.1 General Information

This section provides some basic information about using the firmware application and about performing measurements with the firmware application.

Screen Layout

The Spectrogram view is divided into two screens: the spectrum analyzer result display (upper screen) and the spectrogram result display (lower screen).
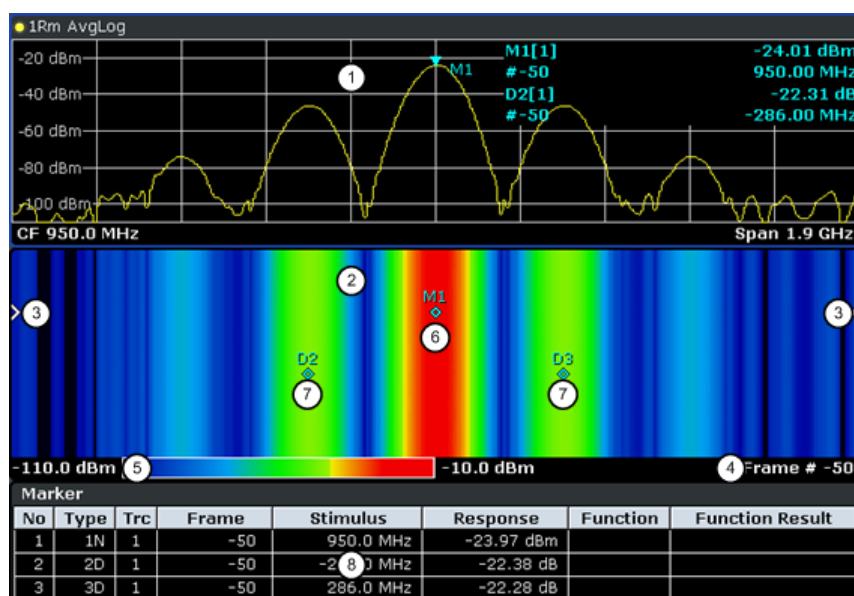
Fig. 3-34: Screen layout of the spectrogram result display

1 = Spectrum result display
2 = Spectrogram result display
3 = Frame indicator
4 = Time stamp / frame number
5 = Color map
6 = Marker
7 = Deltamarker
8 = Marker list

- Spectrum Analyzer result display (1 in figure 3-34)
  This result display is the same as the Spectrum Analyzer with the x-axis representing the frequency span or time (span = 0) and the y-axis the power level. Configure and use this display in the same way as you would in Spectrum Analyzer mode.
  All traces are available and you can view those traces just like in the base unit (see chapter 3.2.8.4, "Trace Mode Overview", on page 140). The trace modes View and Blank are not available for trace 1.
  While performing a measurement the trace is updated continuously. You can also restore the trace to a point that has already been recorded by selecting a specific frame (see "Select Frame" on page 128). This is possible in Single Sweep mode or if the sweep has been stopped.

- Spectrogram result display (2)
  The data displayed in the Spectrogram is always based on the data of trace 1 in the Spectrum Analyzer result display. The Spectrogram can handle measurements in the frequency domain (span > 0) as well as measurements in the time domain (span = 0)
  The Spectrogram is a cartesian diagram. The x-axis shows the power distribution of a measured signal over a specified frequency or time range. Different power levels are displayed in different colors. The y-axis represents the time with the top of the diagram being the current timeframe (the measurement runs from top to bottom). Each line (or trace) of the y-axis represents one captured frame. The frames are sorted in chronological order. One frame is equal to a certain number of sweep points, depending on the dimension of the x-axis. If there are more measurement values

than measurement points, several measured values are combined in one measurement point using the selected detector (see chapter 3.2.8.6, "Detector Overview", on page 143). Frames are sorted in chronological order, beginning with the most recently recorded frame or frame number 0 at the top of the diagram. After that and below frame 0 is the frame recorded before the current frame (frame -1) and so on until the maximum number of captured frames is reached. The maximum number of frames that you can capture is summarized in the table below (see table 3-18. A marker in the form of an arrow (3) on the left and right border of the Spectrogram indicates the currently selected frame.

The actual number of the currently selected frame is shown below the diagram (4). If the time stamp is active, the analyzer shows the time stamp instead of the frame number (see Time Stamp (On Off).

Below the diagram there is also a color map (5) that shows the power levels corresponding to the displayed colors. The minimum value of the y-axis is on the left of the color map. The maximum value is on the right of the map. You can also change the color scheme in use (see Color. The colors corresponding to the power levels, however, are always assigned automatically.

Markers and deltamarkers (6) (7) take the form of diamonds in the Spectrogram. They are only displayed in the Spectrogram, if the marker position is inside the visible area of the spectrogram. If more than two markers are active, it is possible to display a Marker Table at the bottom of the display (8).

Table 3-18: Correlation between number of sweep points and number of frames stored in the history buffer

Sweep Points	Max. History Depth
≤1250	20000
2001	12488
4001	6247
8.001	3124
16.001	1562
32.001	781

Markers and Marker Values

In the Spectrum Analyzer result display, the markers and their frequency and level values (1) are displayed in the marker field just like in the base unit (see chapter 3.3.1, "Using Markers and Delta Markers – MKR Key", on page 158). In addition to the base unit functionality, the frame number is displayed to indicate the position of the marker in time (2).
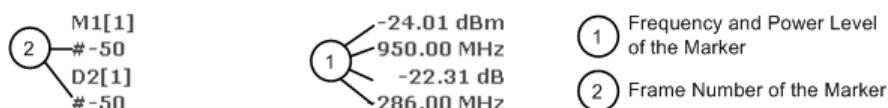
In the Spectrogram result display, you can activate up to 16 markers or deltamarkers at the same time. Any marker can be assigned to a different frame. Therefore, in addition to the frequency (1) you can set the frame number (2) when activating a new marker. If no frame number is specified, the marker is positioned on the currently selected frame.
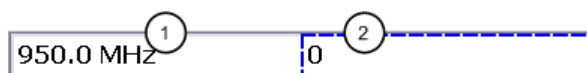
① Input Field for Marker Frequency

② Input Field for Marker Frame Number

In the Spectrogram result display all markers are visible that are positioned on a visible frame.

In the Spectrum Analyzer result display, only the markers positioned on the currently selected frame are visible. In Continuous Sweep mode this means that only markers positioned on frame 0 are visible. To view markers that are positioned on a frame other than frame 0 in the Spectrum Analyzer result display, it is necessary to stop the measurement and select the corresponding frame.

3.10.2 Softkeys of the Spectrogram Menu

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

To display the "Spectrogram" menu, press the TRACE key and then select the "Spectogram" softkey.

Spectrogram
Opens the submenu for the spectrogram view.

Spectrogram (On Off) ← **Spectrogram**
Activates and deactivates the Spectrogram result display

SCPI command:
CALCulate<n>:SPECtrogram|SGRam[:STATe] on page 537

History Depth ← **Spectrogram**
Sets the number of frames that the analyzer stores in its memory. The maximum number of frames depends on the Sweep Points (see chapter 3.10.1, "General Information", on page 371).

If the memory is full, the analyzer deletes the oldest frames stored in the memory and replaces them with the new data.

SCPI command:
CALCulate<n>:SPECtrogram|SGRam:HDEPth on page 537

Color ← Spectrogram

Sets the color scheme of the Spectrogram result display. Three color schemes are available:

- **Color**
  RGB colors

- **Radar**
  Black - green - white

- **Grayscale**
  Black and white

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:COLor on page 535

Time Stamp (On Off) ← Spectrogram

Activates and deactivates the time stamp. The time stamp shows the system time while the measurement is running. In single sweep mode or if the sweep is stopped, the time stamp shows the time and date of the end of the sweep.

When active, the time stamp replaces the display of the frame number.

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:TSTamp[:STATe] on page 537

Clear Spectrogram ← Spectrogram

Resets the Spectrogram result display and clears the history buffer.

SCPI command:

CALCulate<n>:SPECtrogram|SGRam:CLEar[:IMMediate] on page 535

4 Remote Control

This chapter describes how to control the analyzer via a remote computer. After an introduction to the basic principles of remote control, the individual commands are described in detail. At the end of this chapter, some helpful programming examples are provided.

4.1   Remote Control - Basics

This chapter provides basic information on operating an instrument via remote control.

The computer that is used for remote operation is called "controller" here.

4.1.1   Remote Control Interfaces and Protocols

The instrument supports different interfaces for remote control. The following table gives an overview.

Table 4-1: Remote control interfaces and protocols

Interface	Protocols, VISA*) address string	Remarks
Local Area Network (LAN)	Protocols: ● VXI-11 ● RSIB ● simple telnet (Raw Ethernet) VISA*) address string: TCPIP::host address[::LAN device name][::INSTR]	A LAN connector is located on the rear panel of the instrument. The interface is based on TCP/IP and supports various protocols. For a description of the protocols refer to: ● "VXI-11 Protocol", on page 381 ● "RSIB Protocol", on page 382 ● "Telnet Protocol", on page 383
GPIB (IEC/ IEEE Bus Interface)	VISA*) address string: GPIB::primary address[::INSTR] (no secondary address)	A GPIB bus interface (option R&S FSV-B10) according to the IEC 625.1/IEEE 488.1 standard is located on the rear panel of the instrument. For a description of the interface refer to chapter 4.1.1.4, "GPIB Interface (IEC 625/IEEE 418 Bus Interface)", on page 383.
*) VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control using the indicated interfaces (see also chapter 4.1.1.1, "VISA Libraries", on page 379).		

Within this interface description, the term GPIB is used as a synonym for the IEC/IEEE bus interface.

SCPI (Standard Commands for Programmable Instruments)

SCPI commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the

standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

4.1.1.1 VISA Libraries

VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel (LAN or TCP/IP, USB, GPIB,...) is selected at initialization time by means of the channel–specific address string ("VISA resource string") indicated in table 4-1, or by an appropriately defined VISA alias (short name). A VISA installation is a prerequisite for remote control using the VXI-11 and RSIB protocols. The necessary VISA library is available as a separate product. For details contact your local R&S sales representative.

For more information on VISA refer to the user documentation.

4.1.1.2 Messages

The messages transferred on the data lines are divided into the following categories:

- Interface messages
  Interface messages are transmitted to the instrument on the data lines, with the attention line being active (LOW). They are used to communicate between the controller and the instrument. Interface messages can only be sent by instruments that have GPIB bus functionality. For details see the sections for the required interface.

- Instrument messages
  Instrument messages are employed in the same way for all interfaces, if not indicated otherwise in the description. Structure and syntax of the instrument messages are described in chapter 4.1.4, "SCPI Command Structure", on page 387. A detailed description of all messages available for the instrument is provided in the chapter "Remote Control Commands".
  There are different types of instrument messages, depending on the direction they are sent:
  – Commands
  – Instrument responses

Commands

Commands (program messages) are messages the controller sends to the instrument. They operate the instrument functions and request information. The commands are subdivided according to two criteria:

- According to the effect they have on the instrument:
  – **Setting commands** cause instrument settings such as a reset of the instrument or setting the frequency.

- **Queries** cause data to be provided for remote control, e.g. for identification of the instrument or polling a parameter value. Queries are formed by directly appending a question mark to the command header.
- According to their definition in standards:
  - **Common commands**: their function and syntax are precisely defined in standard IEEE 488.2. They are employed identically on all instruments (if implemented). They refer to functions such as management of the standardized status registers, reset and self test.
  - **Instrument control commands** refer to functions depending on the features of the instrument such as frequency settings. Many of these commands have also been standardized by the SCPI committee. These commands are marked as "SCPI compliant" in the command reference chapters. Commands without this SCPI label are device-specific, however, their syntax follows SCPI rules as permitted by the standard.

Instrument responses

Instrument responses (response messages and service requests) are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status.

4.1.1.3 LAN Interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols. The network card can be operated with a 10 MHz Ethernet IEEE 802.3 or a 100 MHz Ethernet IEEE 802.3u interface. For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol. They are connected using a commercial RJ45 cable (shielded or unshielded twisted pair category 5). The TCP/IP network protocol and the associated network services are preconfigured on the instrument. Software for instrument control and the VISA program library must be installed on the controller.

VISA library

Instrument access via VXI-11 or RSIB protocols is usually achieved from high level programming platforms using VISA as an intermediate abstraction layer. VISA encapsulates the low level VXI, RSIB or even GPIB function calls and thus makes the transport interface transparent for the user. See chapter 4.1.1.1, "VISA Libraries", on page 379 for details.

IP address

Only the IP address or the computer name (LAN device name) is required to set up the connection. The IP address/computer name is part of the "visa resource string" used by the programs to identify and control the instrument.

The visa resource string has the form:

TCPIP::host address[::LAN device name][::INSTR]

where:

- **TCPIP** designates the network protocol used

- **host address** is the IP address of the device
  The IP address for the analyzer is factory-set to *10.0.0.10*, subnet mask
  255.255.255.0.

- **LAN device name** is the computer name of the instrument (alternative to IP address)

- **INSTR** indicates that the VXI-11 protocol is used

Example:

Instrument has the IP address *192.1.2.3*; the valid resource string is:

`TCPIP::192.1.2.3::INSTR`

The instrument name is *RSFSV*; the valid resource string is:

`TCPIP::RSFSV::INSTR`

Identifying instruments in a network

If several instruments are connected to the network, each instrument has its own IP
address and associated resource string. The controller identifies these instruments by
means of the resource string.

For details on configuring the LAN connection, see "Setting Up a Network (LAN) Con-
nection" in the Quick Start Guide.

VXI-11 Protocol

The VXI-11 standard is based on the ONC RPC (Open Network Computing Remote
Procedure Call) protocol which in turn relies on TCP/IP as the network/transport layer.
The TCP/IP network protocol and the associated network services are preconfigured.
TCP/IP ensures connection-oriented communication, where the order of the exchanged
messages is adhered to and interrupted links are identified. With this protocol, messages
cannot be lost.

Interface Messages

In the LAN connection, the interface messages are called low–level control messages.
These messages can be used to emulate interface messages of the GPIB bus.

Command	Long term	Effect on the instrument
&ABO	Abort	Aborts processing of the commands just received.
&DCL	Device Clear	Aborts processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
&GTL	Go to Local	Transition to the "local" state (manual control).
&GTR	Go to Remote	Transition to the "remote" state (remote control).
&GET	Group Execute Trigger	Triggers a previously active instrument function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.

Command	Long term	Effect on the instrument
&LLO	Local Lockout	Disables switchover from remote control to manual control by means of the front panel keys.
&NREN	Not Remote Enable	Enables switchover from remote control to manual operation by means of the front panel keys
&POL	Serial Poll	Starts a serial poll.

RSIB Protocol

The R&S defined RSIB protocol uses the TCP/IP protocol for communication with the instrument. Remote control over RSIB is done on a message level basis using the SCPI command set of the instrument. The RSIB protocol allows you to control the instrument for example via Visual C++- and Visual Basic programs, via the Windows applications Word and Excel, as well as via National Instruments LabView, LabWindows/CVI, Agilent VEE and others. The control applications run on an external computer in the network.

RSIB Interface Functions

The library functions are adapted to the interface functions of National Instruments for GPIB programming. The functions supported by the libraries are listed in the following table.

Function	Description
RSDLLibfind()	Provides a handle for access to a device.
RSDLLibwrt()	Sends a zero-terminated string to a device.
RSDLLilwrt()	Sends a certain number of bytes to a device.
RSDLLibwrtf()	Sends the contents of a file to a device.
RSDLLibrd()	Reads data from a device into a string.
RSDLLilrd()	Reads a certain number of bytes from a device.
RSDLLibrdf()	Reads data from a device into a file.
RSDLLibtmo()	Sets timeout for RSIB functions.
RSDLLibsre()	Switches a device to the local or remote state.
RSDLLibloc()	Temporarily switches a device to the local state.
RSDLLibeot()	Enables/disables the END message for write operations.
RSDLLibrsp()	Performs a serial poll and provides the status byte.
RSDLLibonl()	Sets the device online/offline.
RSDLLTestSrq()	Checks whether a device has generated an SRQ.
RSDLLWaitSrq()	Waits until a device generates an SRQ.
RSDLLSwapBytes	Swaps the byte sequence for binary numericdisplay (only required for non-Intel platforms).

Telnet Protocol

As an alternative to remote control the instrument can use a simple telnet protocol (port 5025). Unlike using the VXI-11 protocol, no VISA installation is necessary on the remote controller side. This protocol is sometimes also referred to as "socket communication" or "Raw Ethernet mode". To control the instrument, only a Telnet program is required. The Telnet program is part of every operating system.

4.1.1.4 GPIB Interface (IEC 625/IEEE 418 Bus Interface)

To be able to control the instrument via the GPIB bus, the instrument and the controller must be linked by a GPIB bus cable. A GPIB bus card, the card drivers and the program libraries for the programming language used must be provided in the controller. The controller must address the instrument with the GPIB bus address (see "GPIB Instrument Address", on page 385).

Notes and Conditions

In connection with the GPIB interface, note the following:

- Up to 15 instruments can be connected
- The total cable length is restricted to a maximum of 15 m or 2 m times the number of devices, whichever is less; the cable lenth between two instruments should not exceed 2 m.
- A wired "OR"-connection is used if several instruments are connected in parallel.
- Any connected IEC-bus cables should be terminated by an instrument or controller.

GPIB Interface Messages

Interface messages are transmitted to the instrument on the data lines, with the attention line (ATN) being active (LOW). They are used for communication between the controller and the instrument and can only be sent by a computer which has the function of a GPIB bus controller. GPIB interface messages can be further subdivided into:

- **Universal commands**: act on all instruments connected to the GPIB bus without previous addressing
- **Addressed commands**: only act on instruments previously addressed as listeners

The following figure provides an overview of the available communication lines used by the GPIB interface.
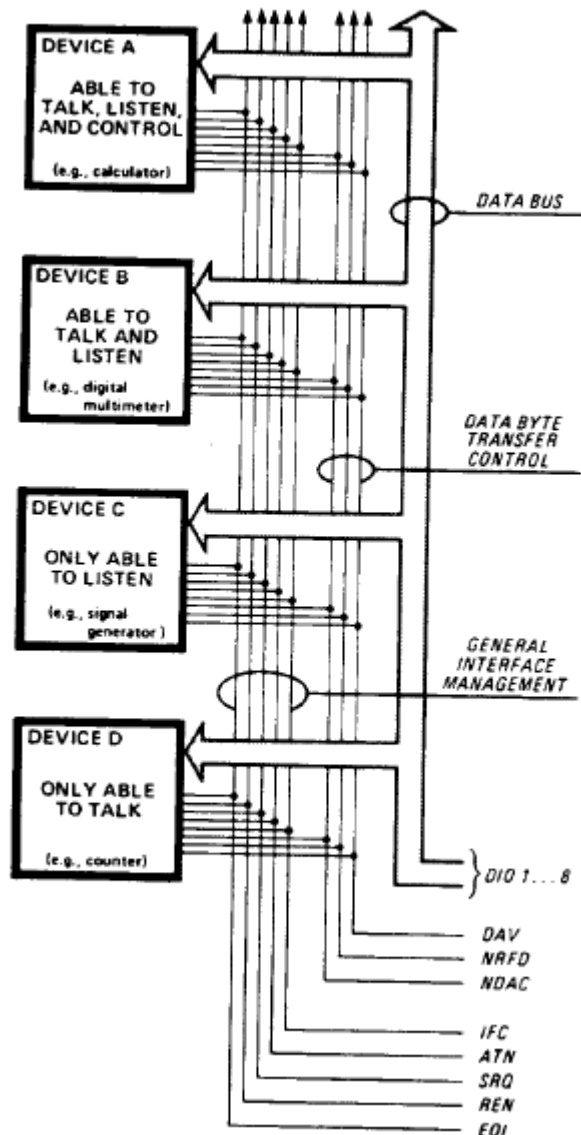
Fig. 4-1: Communication lines used by the GPIB interface

Universal Commands

Universal commands are encoded in the range 10 through 1F hex. They affect all instruments connected to the bus and do not require addressing.

Command	Effect on the instrument
DCL (Device Clear)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument settings.
IFC (Interface Clear) *)	Resets the interfaces to the default setting.
LLO (Local Lockout)	The LOC/IEC ADDR key is disabled.

Command	Effect on the instrument
SPE (Serial Poll Enable)	Ready for serial poll.
SPD (Serial Poll Disable)	End of serial poll.
PPU (Parallel Poll Unconfigure)	End of the parallel-poll state.
*) IFC is not a real universal command, it is sent via a separate line; however, it also affects all instruments connected to the bus and does not require addressing	

Addressed Commands

Addressed commands are encoded in the range 00 through 0F hex. They only affect instruments addressed as listeners.

Command	Effect on the instrument
GET (Group Execute Trigger)	Triggers a previously active instrument function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
GTL (Go to Local)	Transition to the "local" state (manual control).
REN (Remote Enable)	Transition to the "remote" state (remote control). Transition to the "remote" state (remote control). (Not really an addressed command, uses a separate line.)
PPC (Parallel Poll Configure)	Configures the instrument for parallel poll.
SDC (Selected Device Clear)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.

GPIB Instrument Address

In order to operate the instrument via remote control, it must be addressed using the GPIB address. The remote control address is factory-set to 20, but it can be changed if it does not fit in the network environment. For remote control, addresses 0 through 30 are allowed. The GPIB address is maintained after a reset of the instrument settings.

Setting the GPIB address

1. On the analyzer, press the SETUP key.

2. Press the "General Setup" softkey.

3. Press the "GPIB" softkey.

   The submenu for setting the parameters of the remote control interface is displayed.

4. Press the "GPIB Address" softkey.

   The edit dialog box for the GPIB address is displayed.

5. Enter a value between 0 and 30.

Remote command: SYST:COMM:GPIB:ADDR 18

4.1.2 Starting a Remote Control Session

When you switch on the instrument, it is always in manual operation state ("local" state) and can be operated via the front panel.

Starting remote control

1. Send an addressed command (`GTR` - Go to Remote) from a controller to the instrument.

    The instrument is switched to remote control ("remote" state). Operation via the front panel is disabled. Only the "Local" softkey is displayed to return to manual operation. The instrument remains in the remote state until it is reset to the manual state via the instrument or via remote control interfaces. Switching from manual operation to remote control and vice versa does not affect the other instrument settings.

2. During program execution, send the `SYSTem:DISPlay:UPDate ON` command to activate the display of results.

    The changes in the device settings and the recorded measurement values are displayed on the instrument screen.

3. To obtain optimum performance during remote control, send the `SYSTem:DISPlay:UPDate OFF` command to hide the display of results and diagrams again (default setting in remote control).

4. To prevent unintentional return to manual operation, disable the keys of the instrument using the universal command `LLO`.

    Switching to manual mode is only possible via remote control then. This function is only available for the GPIB interface.

5. To enable the keys of the analyzer again, switch the instrument to local mode (`GTL` - Go to Local), i.e. deactivate the `REN` line of the remote control interface.

If the instrument is operated exclusively in remote control, it is recommended that you switch on the power-save mode for the display. For more details on this mode refer to the Quick Start Guide.

4.1.3 Returning to Manual Operation

Before you switch back to manual operation, all remote command processing must be completed. Otherwise, the instrument will switch back to remote control immediately.

► Press the "Local" softkey or the PRESET key, or use the following GPIB command:
    `status = viGpibControlREN(vi, VI_GPIB_REN_ADDRESS_GTL)`

4.1.4 SCPI Command Structure

SCPI commands consist of a so-called header and, in most cases, one or more parameters. The header and the parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several mnemonics (keywords). Queries are formed by appending a question mark directly to the header.

The commands can be either device-specific or device-independent (common commands). Common and device-specific commands differ in their syntax.

4.1.4.1 Syntax for Common Commands

Common (=device-independent) commands consist of a header preceded by an asterisk (*) and possibly one or more parameters.

Examples:

*RST	RESET	Resets the instrument.
*ESE	EVENT STATUS ENABLE	Sets the bits of the event status enable registers.
*ESR?	EVENT STATUS QUERY	Queries the contents of the event status register.
*IDN?	IDENTIFICATION QUERY	Queries the instrument identification string.

4.1.4.2 Syntax for Device-Specific Commands

Not all commands used in the following examples are necessarily implemented in the instrument.

For demonstration purposes only, assume the existence of the following commands for this section:

- `DISPlay[:WINDow<1...4>]:MAXimize <Boolean>`
- `FORMat:READings:DATA <type>[,<length>]`
- `HardCOPy:DEVice:COLor <Boolean>`
- `HardCOPy:DEVice:CMAP:COLor:RGB <red>,<green>,<blue>`
- `HardCOPy[:IMMediate]`
- `HardCOPy:ITEM:ALL`
- `HardCOPy:ITEM:LABel <string>`
- `HardCOPy:PAGE:DIMensions:QUADrant[<N>]`
- `HardCOPy:PAGE:ORIentation LANDscape | PORTrait`
- `HardCOPy:PAGE:SCALe <numeric value>`
- `MMEMory:COPY <file_source>,<file_destination>`
- `SENSE:BANDwidth|BWIDth[:RESolution] <numeric_value>`
- `SENSe:FREQuency:STOP <numeric value>`
- `SENSe:LIST:FREQuency <numeric_value>{,<numeric_value>}`

Long and short form

The mnemonics feature a long form and a short form. The short form is marked by upper case letters, the long form corresponds to the complete word. Either the short form or the long form can be entered; other abbreviations are not permitted.

Example:

`HardCOPy:DEVice:COLor ON` is equivalent to `HCOP:DEV:COL ON`.

Case-insensitivity

Upper case and lower case notation only serves to distinguish the two forms in the manual, the instrument itself is case-insensitive.

Numeric suffixes

If a command can be applied to multiple instances of an object, e.g. specific channels or sources, the required instances can be specified by a suffix added to the command. Numeric suffixes are indicated by angular brackets (<1...4>, <n>, <i>) and are replaced by a single value in the command. Entries without a suffix are interpreted as having the suffix 1.

Example:

Definition: `HardCOPy:PAGE:DIMensions:QUADrant[<N>]`

Command: `HCOP:PAGE:DIM:QUAD2`

This command refers to the quadrant 2.

Different numbering in remote control

For remote control, the suffix may differ from the number of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.

Some standards define a fixed numbering, starting with 0. With GSM, for instance, slots are counted from 0 to 7. In remote control, the slots are selected using the suffixes 1 to 8. If the numbering differs in manual operation and remote control, it is indicated for the corresponding command.

Optional mnemonics

Some command systems permit certain mnemonics to be inserted into the header or omitted. These mnemonics are marked by square brackets in the description. The instrument must recognize the long command to comply with the SCPI standard. Some commands are considerably shortened by these optional mnemonics.

Example:

Definition: `HardCOPy[:IMMediate]`

Command: `HCOP:IMM` is equivalent to `HCOP`

Optional mnemonics with numeric suffixes

Do not omit an optional mnemonic if it includes a numeric suffix that is relevant for the effect of the command.

Example:

Definition: `DISPlay[:WINDow<1...4>]:MAXimize <Boolean>`

Command: `DISP:MAX ON` refers to window 1.

In order to refer to a window other than 1, you must include the optional `WINDow` parameter with the suffix for the required window.

`DISP:WIND2:MAX ON` refers to window 2.

Parameters

Parameters must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma (,). For a description of the parameter types, refer to chapter 4.1.4.3, "SCPI Parameters", on page 390.

Example:

Definition:`HardCOPy:DEVice:CMAP:COLor:RGB <red>,<green>,<blue>`

Command:`HCOP:DEV:CMAP:COL:RGB 3,32,44`

Special characters

│	**Parameters**
	
	A vertical stroke in parameter definitions indicates alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.
	
	Example:
	
	Definition:`HardCOPy:PAGE:ORIentation LANDscape │ PORTrait`
	
	Command `HCOP:PAGE:ORI LAND` specifies landscape orientation
	
	Command `HCOP:PAGE:ORI PORT` specifies portrait orientation
	
	Mnemonics
	
	A selection of mnemonics with an identical effect exists for several commands. These mnemonics are indicated in the same line; they are separated by a vertical stroke. Only one of these mnemonics needs to be included in the header of the command. The effect of the command is independent of which of the mnemonics is used.
	
	Example:
	
	Definition`SENSE:BANDwidth│BWIDth[:RESolution] <numeric_value>`
	
	The two following commands with identical meaning can be created:
	
	`SENS:BAND:RES 1`
	
	`SENS:BWID:RES 1`

[ ]	mnemonics in square brackets are optional and may be inserted into the header or omitted. **Example**: `HardCOPy[:IMMediate]` `HCOP:IMM` is equivalent to `HCOP`

{ }	Parameters in curly brackets are optional and can be inserted once or several times, or omitted.
	
	Example: `SENSe:LIST:FREQuency <numeric_value>{,<numeric_value>}`
	
	The following are valid commands:
	
	`SENS:LIST:FREQ 10`
	
	`SENS:LIST:FREQ 10,20`
	
	`SENS:LIST:FREQ 10,20,30,40`

4.1.4.3 SCPI Parameters

Many commands are supplemented by a parameter or a list of parameters. The parameters must be separated from the header by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). Allowed parameters are:

- Numeric values
- Special numeric values
- Boolean parameters
- Text
- Character strings
- Block data

The parameters required for each command and the allowed range of values are specified in the command description.

Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not allowed. In the case of physical quantities, the unit can be entered. Allowed unit prefixes are G (giga), MA (mega), MOHM and MHZ are also allowed), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example: `SENSe:FREQ:STOP 1.5GHz` **=** `SENSe:FREQ:STOP 1.5E9`

Units

For physical quantities, the unit can be entered. Allowed unit prefixes are:

- G (giga)
- MA (mega), MOHM, MHZ
- K (kilo)
- M (milli)
- U (micro)
- N (nano)

If the unit is missing, the basic unit is used.

Example:

`SENSe:FREQ:STOP 1.5GHz` **=** `SENSe:FREQ:STOP 1.5E9`

Some settings allow relative values to be stated in percent. According to SCPI, this unit is represented by the `PCT` string.

Example:

`HCOP:PAGE:SCAL 90PCT`

Special numeric values

The texts listed below are interpreted as special numeric values. In the case of a query, the numeric value is provided.

- **MIN/MAX**
  MINimum and MAXimum denote the minimum and maximum value.
- **DEF**
  DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the *RST command.
- **UP/DOWN**
  UP, DOWN increases or reduces the numeric value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.

- **INF/NINF**

  INFinity, Negative INFinity (NINF) represent the numeric values 9.9E37 or -9.9E37, respectively. INF and NINF are only sent as instrument responses.

- **NAN**

  Not A Number (NAN) represents the value 9.91E37. NAN is only sent as a instrument response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Example:

Setting command: `SENSe:LIST:FREQ MAXimum`

Query: `SENS:LIST:FREQ?, Response: 3.5E9`

Queries for special numeric values

The numeric values associated to `MAXimum/MINimum/DEFault` can be queried by adding the corresponding mnemonics to the command. They must be entered following the quotation mark.

Example: `SENSe:LIST:FREQ? MAXimum`

Returns the maximum numeric value as a result.

Boolean Parameters

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. The numeric values are provided as the response for a query.

Example:

Setting command: `HCOPy:DEV:COL ON`

Query: `HCOPy:DEV:COL?`

Response: `1`

Text parameters

Text parameters observe the syntactic rules for mnemonics, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example:

Setting command: `HardCOPy:PAGE:ORIentation LANDscape`

Query: `HCOP:PAGE:ORI?`

Response: `LAND`

Character strings

Strings must always be entered in quotation marks (' or ").

Example:

HCOP:ITEM:LABel "Test1" **or** HCOP:ITEM:LABel 'Test1'

Block data

Block data is a format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example:

FORMat:READings:DATA #45168xxxxxxxx

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.

4.1.4.4 Overview of Syntax Elements

The following table provides an overview of the syntax elements:

:	The colon separates the mnemonics of a command. In a command line the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands of a command line. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*	The asterisk marks a common command.
"	Quotation marks introduce a string and terminate it.
#	The hash symbol introduces binary, octal, hexadecimal and block data. ● Binary: #B10110 ● Octal: #O7612 ● Hexa: #HF3A7 ● Block: #21312
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates the header from the parameters.

4.1.4.5 Structure of a command line

A command line may consist of one or several commands. It is terminated by one of the following:

● a <New Line>
● a <New Line> with EOI

- an EOI together with the last data byte

Several commands in a command line must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon.

Example:

`MMEM:COPY "Test1","MeasurementXY";:HCOP:ITEM ALL`

This command line contains two commands. The first command belongs to the MMEM system, the second command belongs to the HCOP system.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Example:

`HCOP:ITEM ALL; HCOP:IMM`

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the `HCOP` command system, i.e. they have one level in common.

When abbreviating the command line, the second command begins with the level below HCOP. The colon after the semicolon is omitted. The abbreviated form of the command line reads as follows:

`HCOP:ITEM ALL;IMM`

However, a new command line always begins with the complete path.

Example:

`HCOP:ITEM ALL`

`HCOP:IMM`

4.1.4.6 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- The requested parameter is transmitted without a header.
  Example: `HCOP:PAGE:ORI?`, Response: `LAND`

- Maximum values, minimum values and all other quantities that are requested via a special text parameter are returned as numeric values.
  Example: `SENSe:FREQuency:STOP? MAX`, Response: `3.5E9`

- Numeric values are output without a unit. Physical quantities are referred to the basic units or to the units set using the `Unit` command. The response `3.5E9` in the previous example stands for 3.5 GHz.

- Truth values (Boolean values) are returned as `0` (for OFF) and `1` (for ON).

Example:
Setting command: `HCOPy:DEV:COL ON`
Query: `HCOPy:DEV:COL?`
Response: `1`

- Text (character data) is returned in a short form.
  Example:
  Setting command: `HardCOPy:PAGE:ORIentation LANDscape`
  Query: `HCOP:PAGE:ORI?`
  Response: `LAND`

4.1.5 Command Sequence and Synchronization

IEEE 488.2 defines a distinction between overlapped and sequential commands:

- A **sequential command** is one which finishes executing before the next command starts executing. Commands that are processed quickly are usually implemented as sequential commands.

- An **overlapping command** is one which does not automatically finish executing before the next command starts executing. Usually, overlapping commands take longer to process and allow the program to do other tasks while being executed. If overlapping commands do have to be executed in a defined order, e.g. in order to avoid wrong measurement results, they must be serviced sequentially. This is called synchronization between the controller and the instrument.

Setting commands within one command line, even though they may be implemented as sequential commands, are not necessarily serviced in the order in which they have been received. In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line.

Example: Commands and queries in one message

The response to a query combined in a program message with commands that affect the queried value is not predictable.

The following commands always return the specified result:

`:FREQ:STAR 1GHZ;SPAN 100 :FREQ:STAR?`

Result:

`1000000000` (1 GHz)

Whereas the result for the following commands is not specified by SCPI:

`:FREQ:STAR 1GHz;STAR?;SPAN 1000000`

The result could be the value of `STARt` before the command was sent since the instrument might defer executing the individual commands until a program message terminator is received. The result could also be 1 GHz if the instrument executes commands as they are received.

As a general rule, send commands and queries in different program messages.

Example: Overlapping command with *OPC

The instrument implements `INITiate[:IMMediate]` as an overlapped command. Assuming that `INITiate[:IMMediate]` takes longer to execute than `*OPC`, sending the following command sequence results in initiating a sweep and, after some time, setting the `OPC` bit in the `ESR`:

`INIT; *OPC.`

Sending the following commands still initiates a sweep:

`INIT; *OPC; *CLS`

However, since the operation is still pending when the instrument executes `*CLS`, forcing it into the "Operation Complete Command Idle" State (OCIS), `*OPC` is effectively skipped. The `OPC` bit is not set until the instrument executes another `*OPC` command.

The following list includes the commands for which a synchronization via *OPC, *OPC? or *WAI is mandatory:

Command	Purpose
INIT	start measurement
INIT:CONM	continue measurement
CALC:MARK:FUNC:ZOOM	zoom frequency range around marker 1
CALC:STAT:SCAL:AUTO ONCE	optimize level settings for signal statistic measurement functions
[SENS:]POW:ACH:PRES:RLEV	optimize level settings for adjacent channel power measurements

4.1.5.1 Preventing Overlapping Execution

To prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI can be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the corresponding action to occur.

*Table 4-2: Synchronization using *OPC, *OPC? and *WAI*

Com-mand	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	• Setting bit 0 in the ESE • Setting bit 5 in the SRE • Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all commands sent before *WAI have been executed.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

Command synchronization using *WAI or *OPC? appended to an overlapped command is a good choice if the overlapped command takes only little time to process. The two synchronization techniques simply block overlapped execution of the command.

For time consuming overlapped commands it is usually desirable to allow the controller or the instrument to do other useful work while waiting for command execution. Use one of the following methods:

*OPC with a service request

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1

2. Set bit no. 5 in the SRE: *SRE 32 to enable ESB service request.

3. Send the overlapped command with *OPC

4. Wait for a service request

   The service request indicates that the overlapped command has finished.

*OPC? with a service request

1. Set bit no. 4 in the SRE: *SRE 16 to enable MAV service request.

2. Send the overlapped command with *OPC?

3. Wait for a service request

   The service request indicates that the overlapped command has finished.

Event Status Register (ESE)

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1

2. Send the overlapped command without *OPC, *OPC? or *WAI

3. Poll the operation complete state periodically (by means of a timer) using the sequence: *OPC; *ESR?

   A return value (LSB) of 1 indicates that the overlapped command has finished.

*OPC? with short timeout

1. Send the overlapped command without *OPC, *OPC? or *WAI

2. Poll the operation complete state periodically (by means of a timer) using the sequence: <short timeout>; *OPC?

3. A return value (LSB) of 1 indicates that the overlapped command has finished. In case of a timeout, the operation is ongoing.

4. Reset timeout to former value

5. Clear the error queue with `SYStem:ERRor?` to remove the "-410, Query interrupted" entries.

Using several threads in the controller application

As an alternative, provided the programming environment of the controller application supports threads, separate threads can be used for the application GUI and for controlling the instrument(s) via SCPI.

A thread waiting for a *OPC? thus will not block the GUI or the communication with other instruments.

4.1.6 Status Reporting System

The status reporting system stores all information on the current operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. Both can be queried via GPIB bus or LAN interface (STATus... commands).

4.1.6.1 Hierarchy of status registers

As shown in the following figure, the status information is of hierarchical structure.
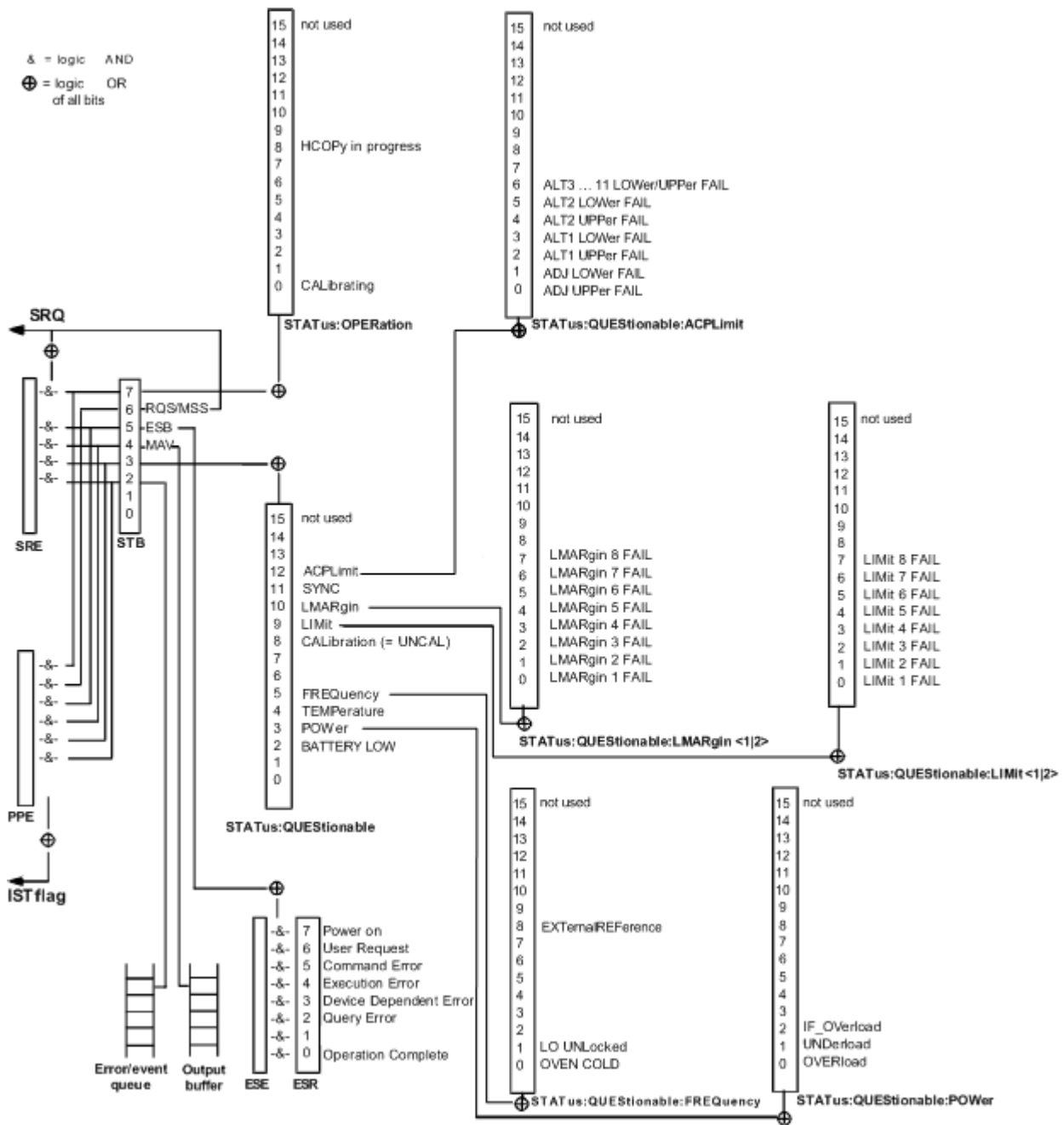
Fig. 4-2: Graphical overview of the status registers hierarchy

- **STB, SRE**
  The STatus Byte (`STB`) register and its associated mask register Service Request Enable (`SRE`) form the highest level of the status reporting system. The `STB` provides a rough overview of the instrument status, collecting the information of the lower-level registers.

- **ESR, SCPI registers**
  The STB receives its information from the following registers:
  – The Event Status Register (`ESR`) with the associated mask register standard Event Status Enable (`ESE`)

– The STATus:OPERation and STATus:QUEStionable registers which are defined by SCPI and contain detailed information on the instrument

● **IST, PPE**

The IST flag ("Individual STatus"), like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills the same function for the IST flag as the SRE for the service request.

● **Output buffer**

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB and thus is represented in the overview.

All status registers have the same internal structure.

SRE, ESE

The service request enable register SRE can be used as ENABle part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be used as the ENABle part of the ESR.

4.1.6.2 Structure of a SCPI Status Register

Each standard SCPI register consists of 5 parts. Each part has a width of 16 bits and has different functions. The individual bits are independent of each other, i.e. each hardware status is assigned a bit number which is valid for all five parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integers.
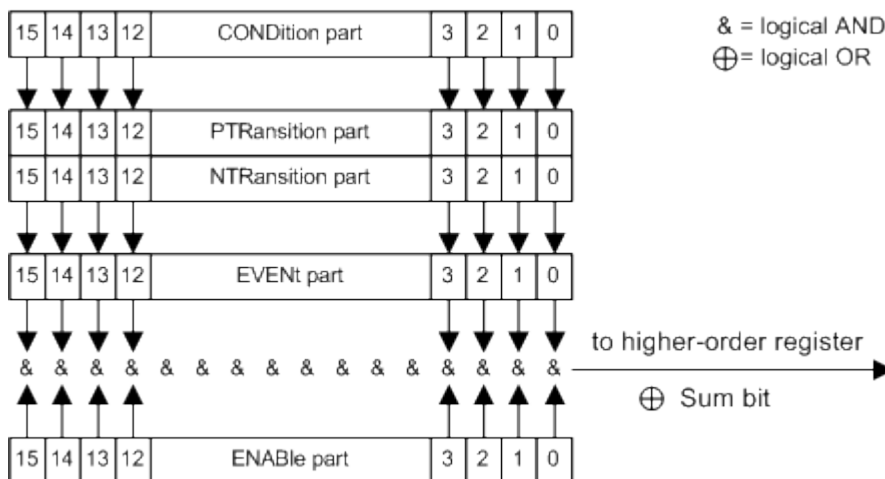
Fig. 4-3: The status-register model

Description of the five status register parts

The five parts of a SCPI register have different properties and functions:

● **CONDition**

The CONDition part is written into directly by the hardware or the sum bit of the next lower register. Its contents reflect the current instrument status. This register part can only be read, but not written into or cleared. Its contents are not affected by reading.

- **PTRansition**
  The two transition register parts define which state transition of the CONDition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENt part.
  The Positive-TRansition part acts as a transition filter. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENt bit is set to 1.
    - PTR bit =1: the EVENt bit is set.
    - PTR bit =0: the EVENt bit is not set.

  This part can be written into and read as required. Its contents are not affected by reading.

- **NTRansition**
  The Negative-TRansition part also acts as a transition filter. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENt bit is set to 1.
    - NTR bit =1: the EVENt bit is set.
    - NTR bit =0: the EVENt bit is not set.

  This part can be written into and read as required. Its contents are not affected by reading.

- **EVENt**
  The EVENt part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the transition filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.

- **ENABle**
  The ENABle part determines whether the associated EVENt bit contributes to the sum bit (see below). Each bit of the EVENt part is "ANDed" with the associated ENABle bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an "OR" function (symbol '+').
  ENABle bit = 0: the associated EVENt bit does not contribute to the sum bit
  ENABle bit = 1: if the associated EVENt bit is "1", the sum bit is set to "1" as well.
  This part can be written into and read by the user as required. Its contents are not affected by reading.

Sum bit

The sum bit is obtained from the EVENt and ENABle part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.

The instrument automatically generates the sum bit for each register. Thus an event can lead to a service request throughout all levels of the hierarchy.

4.1.6.3 Contents of the Status Registers

In the following sections, the contents of the status registers are described in more detail.

Status Byte (STB) and Service Request Enable Register (SRE)

The STatus Byte (STB) is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STB can thus be compared with the CONDition part of an SCPI register and assumes the highest level within the SCPI hierarchy.

The STB is read using the command *STB or a serial poll.

The STatus Byte (STB) is linked to the Service Request Enable (SRE) register. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated. The SRE can be set using the command *SRE and read using the command *SRE?.

Table 4-3: Meaning of the bits used in the status byte

Bit No.	Meaning
0...1	Not used
2	Error Queue not empty
	The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	QUEStionable status sum bit
	The bit is set if an EVENt bit is set in the QUEStionable status register and the associated ENABle bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUEStionable status register.
4	MAV bit (message available)
	The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	ESB bit
	Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.
6	MSS bit (master status summary bit)
	The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	OPERation status register sum bit
	The bit is set if an EVENt bit is set in the OPERation status register and the associated ENABle bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.

IST Flag and Parallel Poll Enable Register (PPE)

As with the SRQ, the IST flag combines the entire status information in a single bit. It can be read by means of a parallel poll (see "Parallel Poll", on page 409) or using the command `*IST`.

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are "ANDed" with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the "ORing" of all results. The PPE can be set using commands `*PRE` and read using command *PRE?.

Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the `EVENt` part of a SCPI register. The event status register can be read out using command `*ESR`*ESR?. The ESE is the associated `ENABle` part. It can be set using the command `*ESE`*ESE and read using the command *ESE?.

Table 4-4: Meaning of the bits used in the event status register

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	User Request This bit is set on pressing the "Local" softkey.
7	Power On (supply voltage on) This bit is set on switching on the instrument.

STATus:OPERation Register

In the `CONDition` part, this register contains information on which actions the instrument is being executing or, in the `EVENt` part, information on which actions the instrument has

executed since the last reading. It can be read using the commands
`STATus:OPERation:CONDition?` or `STATus :OPERation[:EVENt ]?`.

Table 4-5: Meaning of the bits used in the STATus:OPERation register

Bit No.	Meaning
0	`CALibrating` This bit is set as long as the instrument is performing a calibration.
1 to 7	Not used
8	`HardCOPy` in progress This bit is set while the instrument is printing a hardcopy.
9 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands `STATus:QUEStionable: CONDition?` and `STATus:QUEStionable[:EVENt ]?`

Table 4-6: Meaning of the bits used in the STATus:QUEStionable register

Bit No.	Meaning
0 to 1	These bits are not used
2	BATTERY LOW If the instrument is running without any external power supply and the charging level of the internal battery is approximately lower than 5% this bit is set to indicate that the system will be shut down automatically in approx. 5 minutes.
3	POWer This bit is set if a questionable power occurs (see "STATus:QUEStionable:POWer Register", on page 407).
4	TEMPerature This bit is set if a questionable temperature occurs.
5	FREQuency The bit is set if a frequency is questionable (see "STATus:QUEStionable:FREQuency Register", on page 405).
6 to 7	Not used
8	CALibration The bit is set if a measurement is performed unaligned ("UNCAL" display)
9	LIMit (device-specific) This bit is set if a limit value is violated (see "STATus:QUEStionable:LIMit Register", on page 406)
10	LMARgin (device-specific) This bit is set if a margin is violated (see "STATus:QUEStionable:LMARgin Register", on page 407)

Bit No.	Meaning
11	SYNC (device-specific) This bit is set if, in measurements or pre-measurements, synchronization to midamble fails or no burst is found. This bit is also set if, in pre-measurements mode, the result differs too strongly from the expected value.
12	ACPLimit (device-specific) This bit is set if a limit for the adjacent channel power measurement is violated (see "STATus:QUEStionable:ACPLimit Register", on page 405)
13 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:ACPLimit Register

This register contains information about the observance of limits during adjacent power measurements. It can be read using the commands `STATus:QUEStionable:ACPLimit:CONDition?` and `STATus:QUEStionable:ACPLimit[:EVENt]?`

Table 4-7: Meaning of the bits used in the STATus:QUEStionable:ACPLimit register

Bit No.	Meaning
0	ADJ UPPer FAIL This bit is set if the limit is exceeded in the **upper adjacent** channel
1	ADJ LOWer FAIL This bit is set if the limit is exceeded in the **lower adjacent** channel.
2	ALT1 UPPer FAIL This bit is set if the limit is exceeded in the **upper 1st alternate** channel.
3	ALT1 LOWer FAIL This bit is set if the limit is exceeded in the **lower 1st alternate** channel.
4	ALT2 UPPer FAIL This bit is set if the limit is exceeded in the **upper 2nd alternate** channel.
5	ALT2 LOWer FAIL This bit is set if the limit is exceeded in the **lower 2nd alternate** channel.
6	ALT3 … 11 LOWer/UPPer FAIL This bit is set if the limit is exceeded in one of the lower or upper alternate channels 3 … 11.
7 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:FREQuency Register

This register contains information about the reference and local oscillator. It can be read using the commands `STATus:QUEStionable:FREQuency:CONDition?` and `STATus :QUEStionable:FREQuency[:EVENt ]?`.

Table 4-8: Meaning of the bits used in the STATus:QUEStionable:FREQuency register

Bit No.	Meaning
0	OVEN COLD This bit is set if the reference oscillator has not yet attained its operating temperature. "OCXO" is displayed.
1	LO UNLocked This bit is set if the local oscillator no longer locks. "LOUNL" is displayed.
2 to 7	Not used
8	EXTernalREFerence Bit 8 indicates that the external reference oscillator is selected and no useable external reference source is connected to the instrument. Therefore the synthesizer can not lock and the frequency accuracy is not guaranteed.
9 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read using the commands `STATus:QUEStionable:LIMit:CONDition?` and `STATus:QUEStionable:LIMit[:EVENt ]?`.

Table 4-9: Meaning of the bits used in the STATus:QUEStionable:LIMit register

Bit No.	Meaning
0	LIMit 1 FAIL This bit is set if limit line 1 is violated.
1	LIMit 2 FAIL This bit is set if limit line 2 is violated.
2	LIMit 3 FAIL This bit is set if limit line 3 is violated.
3	LIMit 4 FAIL This bit is set if limit line 4 is violated.
4	LIMit 5 FAIL This bit is set if limit line 5 is violated.
5	LIMit 6 FAIL This bit is set if limit line 6 is violated.
6	LIMit 7 FAIL This bit is set if limit line 7 is violated.
7	LIMit 8 FAIL This bit is set if limit line 8 is violated.
8 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:LMARgin Register

This register contains information about the observance of limit margins. It can be read using the commands STATus:QUEStionable:LMARgin:CONDition? and STATus:QUEStionable:LMARgin[:EVENt]?.

Table 4-10: Meaning of the bits used in the STATus:QUEStionable:LMARgin register

Bit No.	Meaning
0	LMARgin 1 FAIL This bit is set if limit margin 1 is violated.
1	LMARgin 2 FAIL This bit is set if limit margin 2 is violated.
2	LMARgin 3 FAIL This bit is set if limit margin 3 is violated.
3	LMARgin 4 FAIL This bit is set if limit margin 4 is violated.
4	LMARgin 5 FAIL This bit is set if limit margin 5 is violated.
5	LMARgin 6 FAIL This bit is set if limit margin 6 is violated.
6	LMARgin 7 FAIL This bit is set if limit margin 7 is violated.
7	LMARgin 8 FAIL This bit is set if limit margin 8 is violated.
8 to 14	Not used
15	This bit is always 0.

STATus:QUEStionable:POWer Register

This register contains all information about possible overloads of the unit. It can be read using the commands STATus:QUEStionable:POWer:CONDition? and STATus:QUEStionable:POWer[:EVENt]?.

Table 4-11: Meaning of the bits used in the STATus:QUEStionable:POWer register

Bit No.	Meaning
0	OVERload This bit is set if the RF input is overloaded. "OVLD" is displayed.
1	UNDerload This bit is set if the RF input is underloaded. "UNLD" is displayed.
2	IF_OVerload This bit is set if the IF path is overloaded. "IFOVL" is displayed.

Bit No.	Meaning
3 to 14	Not used
15	This bit is always 0.

4.1.6.4 Application of the Status Reporting System

The purpose of the status reporting system is to monitor the status of one or several devices in a measuring system. To do this and react appropriately, the controller must receive and evaluate the information of all devices. The following standard methods are used:

- **Service request** (SRQ) initiated by the instrument
- **Serial poll** of all devices in the bus system, initiated by the controller in order to find out who sent a SRQ and why
- **Parallel poll** of all devices
- Query of a **specific instrument status** by means of commands
- Query of the **error queue**

Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from figure 4-2, an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The `ENABle` parts of the status registers can be set such that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

Use of the command *OPC to generate an SRQ at the end of a sweep

1. `CALL InstrWrite(analyzer, "*ESE 1")` 'Set bit 0 in the ESE (Operation Complete)

2. `CALL InstrWrite(analyzer, "*SRE 32")` 'Set bit 5 in the SRE (ESB)

3. `CALL InstrWrite(analyzer, "*INIT;*OPC")` ' Generate an SRQ after operation complete

   After its settings have been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should cause the instrument to initiate a service request if errors occur. The program should react appropriately to the service request.

A detailed example for a service request routine can be found in chapter 4.3.1, "Service Request", on page 782.

Serial Poll

In a serial poll, just as with command `*STB`, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster.

The serial poll method is defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works for instruments which do not adhere to SCPI or IEEE 488.2.

The serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

Parallel Poll

In a parallel poll, up to eight instruments are simultaneously requested by the controller using a single command to transmit 1 bit of information each on the data lines, i.e., to set the data line allocated to each instrument to a logical "0" or "1".

In addition to the SRE register, which determines the conditions under which an SRQ is generated, there is a Parallel Poll Enable register (PPE) which is ANDed with the STB bit by bit, considering bit 6 as well. This register is ANDed with the STB bit by bit, considering bit 6 as well. The results are ORed, the result is possibly inverted and then sent as a response to the parallel poll of the controller. The result can also be queried without parallel poll using the command `*IST`.

The instrument first has to be set for the parallel poll using the command `PPC`. This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using `PPE`.

The parallel poll method is mainly used to find out quickly which one of the instruments connected to the controller has sent a service request. To this effect, SRE and PPE must be set to the same value.

Query of an instrument status

Each part of any status register can be read using queries. There are two types of commands:

● The common commands `*ESR?`, `*IDN?`, `*IST?`, `*STB?` query the higher-level registers.
● The commands of the `STATus` system query the SCPI registers (`STATus:QUEStionable...`)

The returned value is always a decimal number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

Decimal representation of a bit pattern

The STB and ESR registers contain 8 bits, the SCPI registers 16 bits. The contents of a status register are specified and transferred as a single decimal number. To make this possible, each bit is assigned a weighted value. The decimal number is calculated as the sum of the weighted values of all bits in the register that are set to 1.
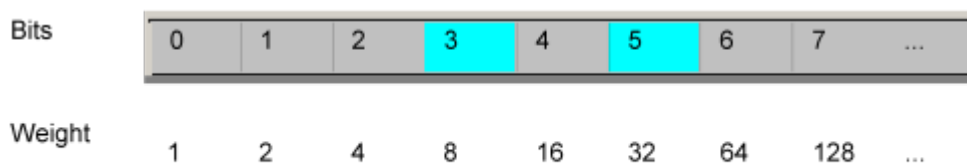
Example:

The decimal value 40 = 32 + 8 indicates that bits no. 3 and 5 in the status register (e.g. the QUEStionable status summary bit and the ESB bit in the STatus Byte) are set.

Error Queue

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain text error messages that can be looked up in the Error Log or queried via remote control using SYSTem:ERRor[:NEXT]? or SYSTem:ERRor:ALL?. Each call of SYSTem:ERRor[:NEXT]? provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

4.1.6.5 Reset Values of the Status Reporting System

The following table contains the different commands and events causing the status reporting system to be reset. None of the commands, except *RST and SYSTem:PRESet, influence the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 4-12: Resetting the status reporting system

Event	Switching on supply voltage Power-On-Status-Clear		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Effect	0	1				
Clear STB, ESR	-	yes	-	-	-	yes
Clear SRE, ESE	-	yes	-	-	-	-
Clear PPE	-	yes	-	-	-	-
Clear EVENt parts of the registers	-	yes	-	-	-	yes
Clear ENABle parts of all OPERation and QUEStionable registers; Fill ENABle parts of all other registers with "1".	-	yes	-	-	yes	-

Event	Switching on supply voltage Power-On-Status-Clear		DCL, SDC (Device Clear, Selected Device Clear)	*RST or SYS-Tem:PRE-Set	STA-Tus:PRE-Set	*CLS
Effect	**0**	**1**				
Fill PTRansition parts with "1"; Clear NTRansition parts	-	yes	-	-	yes	-
Clear error queue	yes	yes	-	-	-	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	-	-	-
1) The first command in a command line that immediately follows a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.						

4.1.7 General Programming Recommendations

Initial instrument status before changing settings

Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the instrument status. Thus, when a command attempts to define incompatible settings, the command is ignored and the instrument status remains unchanged, i.e. other settings are not automatically adapted. Therefore, control programs should always define an initial instrument status (e.g. using the *RST command) and then implement the required settings.

Command sequence

As a general rule, send commands and queries in different program messages. Otherwise, the result of the query may vary depending on which operation is performed first (see also Preventing Overlapping Execution).

Reacting to malfunctions

The service request is the only possibility for the instrument to become active on its own. Each controller program should instruct the instrument to initiate a service request in case of malfunction. The program should react appropriately to the service request.

Error queues

The error queue should be queried after every service request in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

4.2 Remote Control – Commands

This chapter describes all remote control commands for the analyzer functions, firmware options (see list below) and the basic settings functions of the analyzer in detail. Commands that are used both for analyzer functions and firmware options are described in the analyzer commands section. The mode information is provided for each command.

Each subsystem starts with a list of commands, which provides quick access to all commands of the subsystem. Be aware, that for one subsystem more than one SCPI command lists can exist, depending on the functionality (analyzer and basic settings, options). For details on the notation refer to chapter 4.2.1, "Notation", on page 412.

Remote commands of the basic firmware

- chapter 4.2.3, "Remote Control – Description of Analyzer Commands", on page 419

- chapter 4.2.4, "Remote Control – Description of Basic Settings Commands", on page 696

4.2.1 Notation

In the following sections, all commands implemented in the instrument are first listed and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Individual Description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	signal analysis
A-F	signal analysis – span > 0 only (frequency mode)
A-T	signal analysis – zero span only (time mode)
ADEMOD	analog demodulation (option R&S FSV-K7)
BT	Bluetooth (option R&S FSV-K8)
CDMA	CDMA 2000 base station measurements (option R&S FSV-K82)
EVDO	1xEV-DO base station analysis (option R&S FSV-K84)
GSM	GSM/Edge measurements (option R&S FSV-K10)
IQ	IQ Analyzer mode
OFDM	WiMAX IEEE 802.16 OFDM measurements (option R&S FSV-K93)

OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)
NF	Noise Figure measurements (R&S FSV-K30)
PHN	Phase Noise measurements (R&S FSV-K40)
PSM	Power Sensor measurements (option R&S FSV-K9)
SFM	Stereo FM measurements (optionR&S FSV-K7S)
SPECM	Spectogram mode (option R&S FSV-K14)
TDS	TD-SCDMA base station / UE measurements (option R&S FSV-K76/K77)
VSA	Vector Signal Analysis (option R&S FSV-K70)
WCDMA	3GPP Base Station measurements (option R&S FSV-K72), 3GPP UE measurements (option R&S FSV-K73)
WLAN	WLAN TX measurements (option R&S FSV-K91)

The signal analysis (spectrum) mode is implemented in the basic unit. For the other modes, the corresponding options are required.

Upper/Lower Case Notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see chapter 5 "Remote Control – Basics"). The instrument itself does not distinguish between upper and lower case letters.

Special Characters

		A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example:

`SENSe:FREQuency:CW|:FIXed`

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

`SENSe:FREQuency:CW 1E3`

`SENSe:FREQuency:FIXed 1E3`

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example: Selection of the parameters for the command

`[SENSe<1…4>:]AVERage<1…4>:TYPE VIDeo | LINear`

[]	Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
	Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{}	Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

Description of Parameters

Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<…>) and is briefly explained in the following (see also chapter 5 "Remote Control – Basics", section "Parameters").

<Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value> <num>

These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data). The following keywords given below are permitted:

● MAXimum: This keyword sets the parameter to the largest possible value.
● MINimum: This keyword sets the parameter to the smallest possible value.
● DEFault: This keyword is used to reset the parameter to its default value.
● UP: This keyword increments the parameter value.
● DOWN: This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example:

SENSe:FREQuency:CENTer? MAXimum

Returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

4.2.2 Common Commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices. The headers of these commands consist of "*" followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

*CAL

Calibration Query

Initiates a calibration of the instrument and subsequently queries the calibration status. Responses > 0 indicate errors.

*CLS

CLear Status

Sets the status byte (STB), the standard event register (ESR) and the EVENt part of the QUEStionable and the OPERation registers to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

Usage: Setting only

*ESE <Value>

Event Status Enable

Sets the event status enable register to the specified value. The query returns the contents of the event status enable register in decimal form.

Parameters:
<Value>

Range: 0 to 255

---

*ESR?

Event Status Read

Returns the contents of the event status register in decimal form and subsequently sets the register to zero.

Return values:
<Contents>

Range: 0 to 255

Usage: Query only

---

*IDN? <Format>

IDeNtification: returns the instrument identification.

Query parameters:
<Format>   LEGacy | NEW

LEGacy
"Rohde&Schwarz,<device type>,**<serial number>/<model>**,<firmware version>"

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

Example: LEGacy format:
`Rohde&Schwarz,R&S FSV-7,101768/007,1.05`
NEW format:
`Rohde&Schwarz,R&S FSV-7,1307.9002K07/101768,1.05`

Usage: Query only

---

*IST?

Individual STatus query

Returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

Return values:
<ISTflag>   0 | 1

Usage: Query only

---

*OPC

OPeration Complete

Sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request. The query form writes a "1" into the output buffer as soon as all preceding commands have been executed. This is used for command synchronization.

---

*OPT?

OPTion identification query

Queries the options included in the instrument. For a list of all available options and their description refer to the CD-ROM.

Return values:

\<Options>	The query returns a list of all installed options, separated by commas, where: B\<number> describes hardware options K\<number> describes software options
Example:	B4,B5,B6,B7,B8,B10,B22,B30,B31,K7,K9
Usage:	Query only

---

*PCB \<Address>

Pass Control Back

Indicates the controller address to which remote control is returned after termination of the triggered action.

Setting parameters:
\<Address>

	Range:	0 to 30
Usage:	Setting only	

---

*PRE \<Value>

Parallel poll Register Enable

Sets parallel poll enable register to the indicated value. The query returns the contents of the parallel poll enable register in decimal form.

Parameters:
\<Value>

	Range:	0 to 255

---

*PSC \<Action>

Power on Status Clear

Determines whether the contents of the `ENABle` registers are preserved or reset when the instrument is switched on. Thus a service request can be triggered when the instrument is switched on, if the status registers ESE and SRE are suitably configured. The query reads out the contents of the "power-on-status-clear" flag.

Parameters:

<Action>   0 | 1

0
The contents of the status registers are preserved.

1
Resets the status registers.

---

*RST

ReSeT

Sets the instrument to a defined default status. It is equivalent to `SYSTem:PRESet`. The default settings are indicated in the description of commands.

See "Initializing the Configuration - PRESET Key".

Usage: Setting only

---

*SRE <Contents>

Service Request Enable

Sets the service request enable register to the indicated value. This command determines under which conditions a service request is triggered.

Parameters:

<Contents>   Contents of the service request enable register in decimal form. Bit 6 (MSS mask bit) is always 0.

                    Range: 0 to 255

---

*STB?

STatus Byte query

Reads the contents of the status byte in decimal form.

Usage: Query only

---

*TRG

TRiGger

Triggers all actions waiting for a trigger event. In particular, *TRG generates a manual trigger signal (Manual Trigger). This common command complements the commands of the `TRIGger` subsystem.

`*TRG` corresponds to the `INITiate:IMMediate` command. For details, see the "Remote Control - Description of Analyzer Commands", "TRIGger Subsystem".

Usage: Event

*TST?

self TeST query

Triggers selftests of the instrument and returns an error code in decimal form (see Service Manual supplied with the instrument). "0" indicates no errors occured.

Usage: Query only

*WAI

WAIt to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed and all signals have settled (see also command synchronization and *OPC).

Usage: Event

4.2.3 Remote Control – Description of Analyzer Commands

In this section all remote control commands for analyzer functions are described in detail. For details on basic settings commands refer to chapter 4.2.4, "Remote Control – Description of Basic Settings Commands", on page 696.

Subsystems of the analyzer

4.2.3.1   ABORt Subsystem

The ABORt subsystem contains the commands for aborting triggered actions. An action can be triggered again immediately after being aborted. All commands trigger events, and therefore they have no *RST value.

ABORt

This command aborts a current measurement and resets the trigger system.

Example: `ABOR;INIT:IMM`

Mode: all

4.2.3.2   CALCulate Subsystem

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the `SENSe` subsystem.

Some applications offer up to four measurement windows. For those, the suffix <n> for CALCulate selects the measurement window. For all other applications, the suffix is irrelevant.

CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem controls the delta marker functions of the instrument.

Commands of the CALCulate:DELTamarker Subsystem

CALCulate<n>:DELTamarker<m>[:STATe] <State>

This command defines the marker specified by the suffix <m> as a delta marker for the window specified by the suffix <n>. If the corresponding marker was not already active, it is activated and positioned on the maximum of the measurement curve.

If no suffix is given for DELTamarker, delta marker 1 is selected automatically.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:DELT1 ON
	Switches marker 1 to delta marker mode.
Mode:	All

CALCulate<n>:DELTamarker<m>:AOFF

This command switches off all active delta markers in the window specified by the suffix <n>.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                       ment window, the suffix <n> is irrelevant.

<m>   marker number

Example: `CALC:DELT:AOFF`
                       Switches off all delta markers.

Mode: A, ADEMOD, CDMA, EVDO, PHN, TDS, VSA, WCDMA

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] <State>

This command switches the relative measurement to a fixed reference value on or off. Marker 1 is activated previously and a peak search is performed, if necessary. If marker 1 is activated, its position becomes the reference point for the measurement. The reference point can then be modified with the `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X` commands and `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y` independently of the position of marker 1 and of a trace. It applies to all delta markers in the window specified by the suffix <n> as long as the function is active.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                       ment window, the suffix <n> is irrelevant.

<m>   marker number

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.

Mode: A, ADEMOD, EVDO, TDS, WCDMA

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]
     <Value>

For a measurement with a fixed reference point (see `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe]` on page 424), this command sets the reference point level for all delta markers in the window specified by the suffix <n> to the peak of the selected trace.

For phase-noise measurements see(`CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe]` on page 426), the command defines a new reference point level for delta marker 2.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:
<Value>

Example: `CALC:DELT:FUNC:FIX:RPO:MAX`
Sets the reference point level for delta markers to the peak of the selected trace.

Mode: A, ADEMOD, EVDO

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X <Reference>

For a measurement with a fixed reference value (see `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe]` on page 424), this command defines a new frequency reference (span > 0) or time (span = 0) for all delta markers in the window specified by the suffix <n>.

For phase-noise measurements (see `CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO` on page 427), the command defines a new frequency reference or time for delta marker 2.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Reference>	**<numeric_value>**
	*RST: ("CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed" is set to OFF)

Example: `CALC:DELT:FUNC:FIX:RPO:X 128 MHz`
Sets the frequency reference to 128 MHz.

Mode: A, ADEMOD, EVDO, TDS, WCDMA

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y <RefPointLevel>

For a measurement with a fixed reference point (`CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe]`), this command defines a new reference point level for all delta markers in the window specified by the suffix <n>.

For phase-noise measurements (`CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe]` on page 426), the command defines a new reference point level for delta marker 2.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<RefPointLevel>	**<numeric_value>**
	*RST: ("CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed" is set to OFF)
Example:	CALC:DELT:FUNC:FIX:RPO:Y –10dBm
	Sets the reference point level for delta markers to -10 dBm.
Mode:	A, ADEMOD, EVDO, TDS, WCDMA

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y:OFFSet <Offset>

For a measurement with a fixed reference point (CALCulate<n>:
DELTamarker<m>:FUNCtion:FIXed[:STATe]), this command defines an additional
level offset. For this measurement, the offset is included in the display of all delta markers
in the window specified by the suffix <n>.

For phase-noise measurements (CALCulate<n>:DELTamarker<m>:FUNCtion:
PNOise:AUTO), the command defines an additional level offset which is included in the
display of delta marker 2.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Offset>	**<numeric_value>**
	*RST: 0 dB
Example:	CALC:DELT:FUNC:FIX:RPO:Y:OFFS 10dB
	Sets the level offset for the measurement with fixed reference value or the phase-noise measurement to 10 dB.
Mode:	A

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] <State>

This command switches on or off the phase-noise measurement with all active delta
markers in the window specified by the suffix <n>. The correction values for the bandwidth
and the log amplifier are taken into account in the measurement.

Marker 1 is activated, if necessary, and a peak search is performed. If marker 1 is activated, its position becomes the reference point for the measurement.

The reference point can then be modified with the CALCulate<n>:
DELTamarker<m>:FUNCtion:FIXed:RPOint:X and CALCulate<n>:
DELTamarker<m>:FUNCtion:FIXed:RPOint:Y commands independently of the
position of marker 1 and of a trace (the same commands used for the measurement with
fixed reference point).

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant **Note**: marker 2 is always the deltamarker for phase noise measurement results.

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
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO <State>

This command activates an automatic peak search for the reference fixed marker 1 at
the end of each particular sweep in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

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.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:RESult

This command queries the result of the phase-noise measurement in the window specified by the suffix <n>. The measurement is switched on, if necessary.

This command is only a query and therefore has no *RST value.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	2
	Marker 2 is always the deltamarker for phase noise measurements.

Example:	CALC:DELT2:FUNC:PNO:RES?
	Outputs the result of phase-noise measurement of the deltamarker 2.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM

CALCulate\<n>:DELTamarker\<m>:LINK \<State>

This command links delta marker 1 to marker 1. If you change the horizontal position of the marker, so does the delta marker.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	1
	irrelevant

Parameters:

\<State>	ON | OFF
	*RST: OFF
Example:	CALC:DELT:LINK ON
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM VSA

CALCulate\<n>:DELTamarker\<m>:MODE \<Mode>

This command switches between relative and absolute frequency input of the delta marker (or time with span = 0) in the window specified by the suffix \<n>.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Parameters:

\<Mode>	ABSolute | RELative
	*RST: REL
Example:	CALC:DELT:MODE ABS
	Switches the frequency/time indication for all delta markers to absolute values.
	CALC:DELT:MODE REL
	Switches the frequency/time indication for all delta markers to relative to marker 1.
Mode:	All

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command positions the delta marker to the current maximum value on the measured curve in the window specified by the suffix <n>. If necessary, the corresponding delta marker is activated first.

In "Spectrogram" mode, this command positions the specified delta marker on the current peak level of the x-axis. The search is performed within the current frame. It does not change the position of the deltamarker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example: `CALC:DELT3:MAX`
Sets delta marker 3 to the maximum value of the associated trace.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command positions the delta marker to the next smaller maximum value to the left of the current value (i.e. descending X values) in the window specified by the suffix <n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next peak level of the x-axis. The search includes only the data to the left of the current marker position in the current frame. It does not change the position of the deltamarker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example: `CALC:DELT:MAX:LEFT`
Sets delta marker 1 to the next smaller maximum value to the left of the current value.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command positions the delta marker to the next smaller maximum value on the measured curve in the window specified by the suffix <n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next peak level of the x-axis. The search includes the data in both directions of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number
Example:	CALC:DELT2:MAX:NEXT
	Sets delta marker 2 to the next smaller maximum value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate\<n>:DELTamarker\<m>:MAXimum:RIGHt

This command positions the delta marker to the next smaller maximum value to the right of the current value (i.e. ascending X values) in the window specified by the suffix \<n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next peak level of the x-axis. The search includes only the data to the right of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number
Example:	CALC:DELT:MAX:RIGH
	Sets delta marker 1 to the next smaller maximum value to the right of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate\<n>:DELTamarker\<m>:MINimum[:PEAK]

This command positions the delta marker to the current minimum value on the measured curve in the window specified by the suffix \<n>. The corresponding delta marker is activated first, if necessary.

In "Spectrogram" mode, this command positions the specified delta marker on the current minimum level of the x-axis. The search is performed within a specific frame. It does not change the position of the deltamarker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example:	CALC:DELT3:MIN
	Sets delta marker 3 to the minimum value of the associated trace.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate\<n>:DELTamarker\<m>:MINimum:LEFT

This command positions the delta marker to the next higher minimum value to the left of the current value (i.e. descending X values) in the window specified by the suffix \<n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next minimum level of the x-axis. The search includes only the data to the left of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number
Example:	CALC:DELT:MIN:LEFT
	Sets delta marker 1 to the next higher minimum to the left of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate\<n>:DELTamarker\<m>:MINimum:RIGHt

This command positions the delta marker to the next higher minimum value to the right of the current value (i.e. ascending X values) in the window specified by the suffix \<n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next minimum level of the x-axis. The search includes only the data to the right of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number
Example:	CALC:DELT:MIN:RIGH
	Sets delta marker 1 to the next higher minimum value to the right of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command positions the delta marker to the next higher minimum value of the measured curve in the window specified by the suffix <n>. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified delta marker on the next minimum level of the x-axis. The search includes the data in both directions of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example: CALC:DELT2:MIN:NEXT
Sets delta marker 2 to the next higher minimum value.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:DELTamarker<m>:MREF <RefMarkerNo>

This command defines the reference marker for the selected delta marker. The marker values for the delta marker are indicated relative to the specified reference marker.

The reference marker can either be another active marker, or a fixed reference marker (FIXed, see `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe]` on page 424).

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<RefMarkerNo>	1 to 16 or FIXed

Example: CALC:DELT3:MREF 2
Specifies that the values of delta marker 3 are relative to marker 2.

Mode: All

CALCulate<n>:DELTamarker<m>:TRACe <TraceNumber>

This command assigns the selected delta marker to the indicated trace in the window specified by the suffix <n>. The selected trace must be active, i.e. its state must be different from "BLANK".

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<TraceNumber>	**1 to 6** Selects trace 1 through 6.
Example:	CALC:DELT3:TRAC 2 Assigns delta marker 3 to trace 2.
Mode:	A, ADEMOD, CDMA, EVDO, PHN, TDS, WCDMA, SPECM, RT, VSA

CALCulate<n>:DELTamarker<m>:X <Position>

This command positions the selected delta marker to the indicated value in the window specified by the suffix <n>. The input is in absolute values.

You can enter a relative value, if you activate relative entry first with CALCulate<n>: DELTamarker<m>:MODE on page 428.

If fixed reference measurement is active (CALCulate<n>:DELTamarker<m>: FUNCtion:FIXed[:STATe] is ON), relative values refer to the reference position are entered. The query always returns absolute values.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Position>	0 to maximum frequency or sweep time
Example:	CALC:DELT:X? Outputs the absolute frequency/time of delta marker 1.
Mode:	A, ADEMOD, CDMA, EVDO, PHN, TDS, WCDMA, VSA

CALCulate<n>:DELTamarker<m>:X:RELative

This command queries the x-value of the selected delta marker relative to marker 1 or to the reference position (for CALC:DELT:FUNC:FIX:STAT ON) in the window specified by the suffix <n>. The command activates the corresponding delta marker, if necessary.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	CALC:DELT3:X:REL? Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:DELTamarker<m>:Y

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

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

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

Table 4-13: Base unit

Parameter, measuring function or result display	Output unit
DBM | DBPW | DBUV | DBMV | DBUA	dB (lin/log)
WATT | VOLT | AMPere	dB (lin), % (log)
statistics function (APD or CCDF) on	dimensionless output

Table 4-14: Analog demodulation measurements

Parameter, measuring function or result display	Output unit
AM result display (R&S FSV–K7)	% (lin) dB (log)
FM result display (R&S FSV–K7)	Hz (lin) dB (log)
PM result display (R&S FSV–K7)	rad | deg (lin) dB (log)
RF result display (R&S FSV–K7)	dB (Range Log or Range Linear %) % (Range Linear %)

Table 4-15: Bluetooth measurements

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

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

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                                        ment window, the suffix <n> is irrelevant.

<m>   marker number

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.

Mode: A, ADEMOD, BT, CDMA, EVDO, PHN, TDS, WCDMA, VSA

CALCulate:DELTamarker:SPECtrogram | SGRam subsystem

The following commands control the deltamarkers when you are using the spectrogram.

The spectrogram is available if option R&S FSV-K14 is installed.

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:FRAMe <Frame> | <Time>

This command positions the delta marker on a particular frame. The frame is relative to
the position of marker 1.

The command is available for the spectrogram.

Suffix:

<n>   1...4
                                        irrelevant

<m>   1...16
                                        deltamarker

Parameters:

<numeric_value>	**<Frame> (if time stamp is off)** Defines the distance of the deltamarker in frames and in relation to the position of marker 1.
	<time> (if time stamp is on) Defines the distance of the deltamarker in seconds and in relation to the position of marker 1. The reference is the time stamp of marker 1.
Example:	CALC:DELT4:SPEC:FRAM -20 Sets fourth deltamarker 20 frames below marker 1. CALC:DELT4:SPEC:FRAM 2 s Sets fourth deltamarker 2 seconds above the position of marker 1.
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:SARea <Search Area>

This command defines the deltamarker search area.

The command is available for the spectrogram.

Suffix:

<n>	1...4 irrelevant
<m>	1...16 irrelevant

Parameters:

<VISible | MEMory>	**VISible** Performs a search in the visible frames. Note that VISible is ignored if Spectrogram is not visible for any reason (e.g. if the Spectrum Analyzer is in full screen mode or display update is inactive).
	MEMory Performs a search over all frames in the memory.
	*RST: VISible
Example:	CALC:DELT:SPEC:SAR MEM Performs a search over all frames in the memory.
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:XY:MAXimum[:PEAK]

This command positions the specified delta marker on the current peak level of the spectrogram. The possible position depends on the deltamarker search area.

The command is available for the spectrogram.

For more information, see CALCulate<n>:DELTamarker<m>:
SPECtrogram|SGRam:SARea on page 436.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example:	`CALC:DELT2:SPEC:SAR VIS`
	`CALC:DELT2:SPEC:XY:MAX`
	Activates and positions delta marker 2 on the peak level in the visible Spectrogram.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:XY:MINimum[:PEAK]

This command positions the specified delta marker on the current minimum level of the spectrogram. The possible position depends on the deltamarker search area.

The command is available for the spectrogram.

For more information, see `CALCulate<n>:DELTamarker<m>:`
`SPECtrogram|SGRam:SARea` on page 436.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example:	`CALC:DELT3:SPEC:SAR VIS`
	`CALC:DELT3:SPEC:XY:MIN`
	Activates and positions delta marker 3 on the minimum level in the visible Spectrogram.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MAXimum:ABOVe

This command positions the specified delta marker on the next peak level of the vertical axis. The search includes only frames above the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example: CALC:DELT2:SPEC:Y:MAX
Activates and positions delta marker 2 on the peak level of the y-axis.
CALC:DELT2:SPEC:Y:MAX:ABOV
Positions delta marker 2 on the next higher level found in the diagram area above the current marker position.

Usage: Event

Mode: RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MAXimum:BELow

This command positions the specified delta marker on the next peak level of the vertical axis. The search includes only frames below the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example: CALC:DELT2:SPEC:Y:MAX
Activates and positions delta marker 2 on the peak level of the y-axis.
CALC:DELT2:SPEC:Y:MAX:BEL
Positions delta marker 2 on the next higher level found in the diagram area below the current marker position.

Usage: Event

Mode: RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MAXimum:NEXT

This command positions the specified delta marker on the next peak level of the vertical axis. The search includes frames above and below the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example: CALC:DELT2:SPEC:Y:MAX
Activates and positions delta marker 2 on the peak level of the y-axis.
CALC:DELT2:SPEC:Y:MAX:NEXT
Positions delta marker 2 on the next higher level.

Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MAXimum[:PEAK]

This command positions the specified delta marker on the current peak level of the vertical axis. The search is performed over all frames. It does not change the horizontal position of the deltamarker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker
Example:	CALC:DELT2:SPEC:Y:MAX
	Activates and positions delta marker 2 on the peak level of the y-axis.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MINimum:ABOVe

This command positions the specified delta marker on the next minimum level of the vertical axis. The search includes only frames above the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker
Example:	CALC:DELT2:SPEC:Y:MIN
	Activates and positions delta marker 2 on the minimum level of the y-axis.
	CALC:DELT2:SPEC:Y:MIN:ABOV
	Positions delta marker 2 on the next minimum level found in the diagram area above the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MINimum:BELow

This command positions the specified delta marker on the next minimum level of the vertical axis. The search includes only frames below the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example:	CALC:DELT2:SPEC:Y:MIN
	Activates and positions delta marker 2 on the minimum level of the y-axis.
	CALC:DELT2:SPEC:Y:MAX:BEL
	Positions delta marker 2 on the next minimum level found in the diagram area below the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MINimum:NEXT

This command positions the specified delta marker on the next minimum level of the vertical axis. The search includes frames above and below the current marker position. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example:	CALC:DELT2:SPEC:Y:MIN
	Activates and positions delta marker 2 on the minimum level of the y-axis.
	CALC:DELT2:SPEC:Y:MIN:NEXT
	Positions delta marker 2 on the next minimum level.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:Y:MINimum[:PEAK]

This command positions the specified delta marker on the current minimum level of the vertical axis. The search is performed over all captured frames. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	deltamarker

Example:	CALC:DELT2:SPEC:Y:MIN
	Activates and positions delta marker 2 on the minimum level of the y-axis.
Usage:	Event
Mode:	RT, SPECM

CALCulate:DLINe Subsystem

The CALCulate:DLINe subsystem defines the position of the display lines.

CALCulate<n>:DLINe<k> <Position>

This command defines the position of display line 1 or 2. These lines enable the user to mark any levels in the diagram. The unit depends on the setting made with CALCulate<n>:UNIT:POWer.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	1 | 2
	display line 1 or 2

Parameters:

<Position>	minimum to maximum value (depending on current unit)
	*RST: (state is OFF)
Example:	CALC:DLIN -20dBm
Mode:	A

CALCulate<n>:DLINe<k>:STATe <State>

This command switches display line 1 or 2 (level lines) on or off.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	1 | 2
	display line 1 or 2

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:DLIN2:STAT OFF
Mode:	A

CALCulate:ESPectrum Subsystem

The CALCulate:ESPectrum subsystem contains the remote commands for Spectrum Emission Mask (SEM) measurements. Both groups of commands (PSEarch and PEAKsearch) perform the same functions.

CALCulate<n>:ESPectrum:PSEarch|:PEAKsearch:AUTO <State>

This command activates or deactivates the list evaluation.
Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	CALC:ESP:PSE:AUTO OFF
	Deactivates the list evaluation.
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:ESPectrum:PSEarch|:PEAKsearch:[IMMediate]

This command starts the list evaluation.
Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Example:	CALC:ESP:PSE
Usage:	Event
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:ESPectrum:PSEarch|:PEAKsearch:MARGin <Margin>

This command sets the margin used for the limit check/peak search.
Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<Margin>	-200 to 200 dB
	*RST: 200 dB
Example:	CALC:ESP:PSE:MARG 100
	Sets the margin to 100 dB.
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:ESPectrum:PSEarch|:PEAKsearch:PSHow <State>

This command marks all peaks with blue squares in the diagram.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<State>   ON | OFF

                 *RST: OFF

Example: CALC:ESP:PSE:PSH ON

                 Marks all peaks with blue squares.

Mode: A, CDMA, EVDO, TDS

CALCulate:FEED Subsystem

The CALCulate:FEED subsystem selects the evaluation method of the measured data.

CALCulate<n>:FEED <Mode>

Selects the evaluation method of the measured data in the window specified by the suffix <1…4>.

This corresponds to the selection of the result display in manual mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<Mode>   'XPOW:CDP' | 'XPOW:CDP:ABSolute'

                 'XPOW:CDP'
                 Code domain power as bar graph [absolute scaling]

                 'XPOW:CDP:ABSolute'
                 Code domain power ratio as bar graph [absolute scaling]

                 'XPOW:CDP:RATio'
                 Code domain power ratio as bar graph [relative scaling]

Example: CALC:FEED 'XPOW:CDP'

                 Selects CDP as the evaluation method for the power measurement.

Mode: A-F

CALCulate:FLINe Subsystem

The CALCulate:FLINe subsystem defines the position of the frequency lines.

CALCulate<n>:FLINe<k> <Frequency>

This command defines the position of the frequency lines that mark the frequencies.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<k\>	1 | 2 frequency line 1 or 2

Parameters:

\<Frequency\>	0 to fmax
	*RST: (STATe to OFF)
Example:	CALC:FLIN2 120MHz
Mode:	A-F

CALCulate\<n\>:FLINe\<k\>:STATe \<State\>

This command switches the frequency line on or off.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<k\>	1 | 2 frequency line 1 or 2

Parameters:

\<State\>	ON | OFF
	*RST: OFF
Example:	CALC:FLIN2:STAT ON
Mode:	A-F

CALCulate:LIMit Subsystem

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks. Limit lines can be defined as upper or lower limit lines. The individual Y values of the limit lines correspond to the values of the x-axis (CONTrol). The number of X and Y values must be identical. For details on limit lines refer to chapter 3.3.7, "Using Limit Lines and Display Lines – LINES Key", on page 260.

Further information

CALCulate<n>:LIMit<k>:ACTive?

This command queries the names of all active limit lines in all windows.

Suffix:

<n>	irrelevant
<k>	irrelevant

Return values:

Return values	'3GBAA,3GBBA,3GBCR'
	Returns the names of the active limit lines in alphabetical order, separated by commas.
Example:	CALC:LIM:ACT?
	Queries the names of all active limit lines.
Usage:	Query only
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:CLEar[:IMMediate]

This command deletes the result of the current limit check for all limit lines in all windows.

Suffix:

<n>	irrelevant
<k>	irrelevant
Example:	CALC:LIM:CLE
	Deletes the result of the limit check.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WCDMA

CALCulate<n>:LIMit<k>:COMMent <Comment>

This command defines a comment for the selected limit line in all windows (max. 40 characters).

Suffix:

<n>	irrelevant
<k>	limit line

Parameters:

<Comment>	<string>, max. 40 alphanumeric characters
Example:	CALC:LIM5:COMM 'Upper limit for spectrum'
	Defines the comment for limit line 5.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WCDMA

CALCulate<n>:LIMit<k>:COPY <Line>

This command copies one limit line onto another one

Suffix:

<n>	irrelevant
<k>	limit line

Parameters:

<Line>	1 to 8 | <name>

1 to 8
number of the new limit line

<name>
name of the new limit line given as a string

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.

Mode: A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WCDMA

CALCulate<n>:LIMit<k>:DELete

This command deletes the selected limit line.

Suffix:

<n>	irrelevant
<k>	limit line

Example: `CALC:LIM1:DEL`
Deletes limit line 1.

Mode: A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WCDMA

CALCulate<n>:LIMit<k>:FAIL

This command queries the result of the limit check of the indicated limit line. It should be noted that a complete sweep must have been performed for obtaining a correct result. A synchronization with *OPC, *OPC? or *WAI should therefore be provided. The result of the limit check is given with 0 for PASS, 1 for FAIL, and 2 for MARGIN.

Suffix:

<n>	irrelevant
<k>	limit line For option WLAN TX Measurements, R&S FSV-K91/91n, see table below

Return values:

Return values	0 for pass, 1 for 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.

Mode: A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WLAN, WCDMA

For option WLAN TX Measurements, R&S FSV-K91/91n, the numeric suffix <m> specifies the limit lines as follows:

Suffix	Limit
1 to 2	These indexes are not used

3	ETSI Spectrum Mask limit line
4	Spectrum Flatness (Upper) limit line
5	Spectrum Flatness (Lower) limit line
6	IEEE Spectrum Mask limit line
7	PVT Rising Edge max limit
8	PVT Rising Edge mean limit
9	PVT Falling Edge max limit
10	PVT Falling Edge mean limit

CALCulate<n>:LIMit<k>:NAME <Name>

This command assigns a name to a limit line numbered 1 to 8. If it does not exist already, a limit line with this name is created.

Suffix:

<n>	irrelevant
<k>	1...8 (NF: 1...6) limit line

Parameters:

<Name>	<name of limit line>
	*RST: REM1 to REM8 for lines 1 to 8
Example:	CALC:LIM1:NAME 'FM1' Assigns the name FM1 to limit line 1.
Mode:	A, ADEMOD, CDMA, EVDO, NF, TDS, PHN

CALCulate<n>:LIMit<k>:STATe <State>

This command switches on or off the limit check for the selected limit line.

The result of the limit check can be queried with CALCulate<n>:LIMit<k>:FAIL.

Suffix:

<n>	irrelevant
<k>	limit line

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	CALC:LIM:STAT ON Switches on the limit check for limit line 1.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

CALCulate<n>:LIMit<k>:TRACe <TraceNumber>

This command assigns a limit line to a trace.

Suffix:

\<n>	irrelevant
\<k>	limit line

Parameters:

\<TraceNumber>	1 to 6
	*RST: 1
Example:	CALC:LIM2:TRAC 3
	Assigns limit line 2 to trace 3.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n>:LIMit\<k>:UNIT \<Unit>

This command defines the unit of the selected limit line.

Upon selection of the unit DB the limit line is automatically switched to the relative mode. For units different from DB the limit line is automatically switched to absolute mode.

The units DEG, RAD, S, HZ, PCT are not available in "Spectrum" mode.

Suffix:

\<n>	irrelevant
\<k>	limit line

Parameters:

\<Unit>	DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DB | DBUV_M | DBUA_M | DEG | RAD | S | HZ | PCT | (unitless)
	*RST: DBM
Example:	CALC:LIM4:UNIT DBUV
	Sets the unit of limit line 4 to dBµV.
Mode:	A, ADEMOD, CDMA, EVDO, PHN, TDS

CALCulate:LIMit:ACPower Subsystem

The CALCulate:LIMit:ACPower subsystem defines the limit check for adjacent channel power measurement.

CALCulate\<n\>:LIMit\<k\>:ACPower[:STATe] \<State\>

This command switches on and off the limit check for adjacent-channel power measurements. The commands `CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]:STATe` or `CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>[:RELative]:STATe` must be used in addition to specify whether the limit check is to be performed for the upper/lower adjacent channel or for the alternate adjacent channels.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<k\>	irrelevant

Parameters:

\<State\>	ON | OFF
	*RST: OFF
Example:	`CALC:LIM:ACP ON`
	Switches on the ACLR limit check.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate\<n\>:LIMit\<k\>:ACPower:ACHannel[:RELative] \<LowerLimit\>, \<UpperLimit\>

This command defines the relative limit of the upper/lower adjacent channel for adjacent-channel power measurements. The reference value for the relative limit value is the measured channel power.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit value defined with the `CALCulate<n>:LIMit<k>:ACPower:ACHannel:ABSolute` command. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<k\>	irrelevant

Parameters:

\<LowerLimit\>, \<UpperLimit\>	0 to 100dB; the value for the lower limit must be lower than the value for the upper limit
	*RST: 0 dB
Example:	`CALC:LIM:ACP:ACH 30DB, 30DB`
	Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]:STATe <State>

This command activates the limit check for the relative limit value of the adjacent channel when adjacent-channel power measurement is performed. Before this command, the limit check must be activated using `CALCulate<n>:LIMit<k>:ACPower[:STATe]`.

The result can be queried with `CALCulate<n>:LIMit<k>:ACPower:ACHannel:RESult`. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	irrelevant

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	`CALC:LIM:ACP:ACH 30DB, 30DB`
	Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
	`CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM`
	Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.
	`CALC:LIM:ACP ON`
	Switches on globally the limit check for the channel/adjacent channel measurement.
	`CALC:LIM:ACP:ACH:STAT ON`
	Switches on the check of the relative limit values for adjacent channels.
	`CALC:LIM:ACP:ACH:ABS:STAT ON`
	Switches on the check of absolute limit values for the adjacent channels.
	`INIT;*WAI`
	Starts a new measurement and waits for the sweep end.
	`CALC:LIM:ACP:ACH:RES?`
	Queries the limit check result in the adjacent channels.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ACHannel:ABSolute <LowerLimit>, <UpperLimit>

This command defines the absolute limit value for the lower/upper adjacent channel during adjacent-channel power measurement (Adjacent Channel Power).

Note that the absolute limit value has no effect on the limit check as soon as it is below the relative limit value defined with `CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]`. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	irrelevant

Parameters:

<LowerLimit>, <UpperLimit>	first value: -200DBM to 200DBM; limit for the lower and the upper adjacent channel
	*RST: -200DBM
Example:	CALC:LIM:ACP:ACH:ABS –35DBM, –35DBM Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ACHannel:ABSolute:STATe <State>

This command activates the limit check for the adjacent channel when adjacent-channel power measurement (Adjacent Channel Power) is performed. Before the command, the limit check for the channel/adjacent-channel measurement must be globally switched on using CALCulate<n>:LIMit<k>:ACPower[:STATe].

The result can be queried with CALCulate<n>:LIMit<k>:ACPower:ACHannel: RESult. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	irrelevant

Parameters:

<State>	ON	OFF
	*RST: OFF

Example:	`CALC:LIM:ACP:ACH 30DB, 30DB`
	Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
	`CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM`
	Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.
	`CALC:LIM:ACP ON`
	Switches on globally the limit check for the channel/adjacent-channel measurement.
	`CALC:LIM:ACP:ACH:REL:STAT ON`
	Switches on the check of the relative limit values for adjacent channels.
	`CALC:LIM:ACP:ACH:ABS:STAT ON`
	Switches on the check of absolute limit values for the adjacent channels.
	`INIT;*WAI`
	Starts a new measurement and waits for the sweep end.
	`CALC:LIM:ACP:ACH:RES?`
	Queries the limit check result in the adjacent channels.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ACHannel:RESult

This command queries the result of the limit check for the upper/lower adjacent channel when adjacent channel power measurement is performed.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

Suffix:

| <n> | window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant. |
| <k> | irrelevant |

Return values:

| Result | The result is returned in the form <result>, <result> where <result> = PASSED \| FAILED, and where the first returned value denotes the lower, the second denotes the upper adjacent channel. |

Example:	CALC:LIM:ACP:ACH 30DB, 30DB
	Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
	CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
	Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dB.
	CALC:LIM:ACP ON
	Switches on globally the limit check for the channel/adjacent channel measurement.
	CALC:LIM:ACP:ACH:STAT ON
	Switches on the limit check for the adjacent channels.
	INIT;*WAI
	Starts a new measurement and waits for the sweep end.
	CALC:LIM:ACP:ACH:RES?
	Queries the limit check result in the adjacent channels.
Mode:	A, CDMA, EVDO, TDS, WLAN, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ALTernate<channel>[:RELative] <LowerLimit>, <UpperLimit>

This command defines the limit for the alternate adjacent channels for adjacent channel power measurements. The reference value for the relative limit value is the measured channel power.

Note that the relative limit value has no effect on the limit check as soon as it is below the absolute limit defined with CALCulate<n>:LIMit<k>:ACPower: ALTernate<Channel>:ABSolute. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	irrelevant
<Channel>	1...11
	the alternate channel

Parameters:

<LowerLimit>, <UpperLimit>	first value: 0 to 100dB; limit for the lower and the upper alternate adjacent channel
	*RST: 0 DB
Example:	CALC:LIM:ACP:ALT2 30DB, 30DB
	Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.
Mode:	A, CDMA, EVDO, TDS, WLAN, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>[:RELative]:STATe
     <State>

This command activates the limit check for the alternate adjacent channels for adjacent channel power measurements. Before the command, the limit check must be activated using CALCulate<n>:LIMit<k>:ACPower[:STATe].

The result can be queried with CALCulate<n>:LIMit<k>:ACPower: ALTernate<channel>[:RELative]. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are obtained.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	irrelevant
<Channel>	1...11 the alternate channel

Parameters:

<State>	ON | OFF

	*RST: OFF
Example:	CALC:LIM:ACP:ALT2 30DB, 30DB Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power. CALC:LIM:ACP:ALT2:ABS –35DBM, –35DBM Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm. CALC:LIM:ACP ON Switches on globally the limit check for the channel/adjacent channel measurement. CALC:LIM:ACP:ALT2:STAT ON Switches on the check of the relative limit values for the lower and upper second alternate adjacent channel. CALC:LIM:ACP:ALT2:ABS:STAT ON Switches on the check of absolute limit values for the lower and upper second alternate adjacent channel. INIT;*WAI Starts a new measurement and waits for the sweep end. CALC:LIM:ACP:ALT2:RES? Queries the limit check result in the second alternate adjacent channels.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>:ABSolute <LowerLimit>,
     <UpperLimit>

This command defines the absolute limit value for the lower/upper alternate adjacent-channel power measurement (Adjacent Channel Power).

Note that the absolute limit value for the limit check has no effect as soon as it is below the relative limit value defined with `CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]`. This mechanism allows automatic checking of the absolute basic values defined in mobile radio standards for the power in adjacent channels.

Suffix:

`<n>`	window; For applications that do not have more than 1 measurement window, the suffix `<n>` is irrelevant.
`<k>`	irrelevant
`<Channel>`	1...11 the alternate channel

Parameters:

`<LowerLimit>`, `<UpperLimit>`	first value: -200DBM to 200DBM; limit for the lower and the upper alternate adjacent channel
	*RST: -200DBM
Example:	`CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM` Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>:ABSolute:STATe <State>

This command activates the limit check for the alternate adjacent channels for adjacent-channel power measurement (Adjacent Channel Power).

Before the command, the limit check must be globally switched on for the channel/adjacent-channel power with the `CALCulate<n>:LIMit<k>:ACPower[:STATe]` command.

The result can be queried with `CALCulate<n>:LIMit<k>:ACPower:ALTernate<channel>[:RELative]`. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Suffix:

`<n>`	window; For applications that do not have more than 1 measurement window, the suffix `<n>` is irrelevant.
`<k>`	irrelevant
`<Channel>`	1...11 the alternate channel

Parameters:

`<State>`	ON	OFF
	*RST: OFF

Example: CALC:LIM:ACP:ALT2 30DB, 30DB

Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM

Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

CALC:LIM:ACP ON

Switches on globally the limit check for the channel/adjacent channel measurement.

CALC:LIM:ACP:ALT2:STAT ON

Switches on the check of the relative limit values for the lower and upper second alternative adjacent channels.

CALC:LIM:ACP:ALT2:ABS:STAT ON

Switches on the check of absolute limit values for the lower and upper second alternative adjacent channels.

INIT;*WAI

Starts a new measurement and waits for the sweep end.

CALC:LIM:ACP:ALT2:RES?

Queries the limit check result in the second alternate adjacent channels.

Mode: A, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>:RESult?

This command queries the result of the limit check for the alternate adjacent channels for adjacent channel power measurements.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<k>   irrelevant

<Channel>   1...11
               the alternate channel

Parameters:

               The result is returned in the form <result>, <result> where <result> = PASSED | FAILED and where the first (second) returned value denotes the lower (upper) alternate adjacent channel.

Example:	`CALC:LIM:ACP:ALT2 30DB, 30DB`
	Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.
	`CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM`
	Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.
	`CALC:LIM:ACP ON`
	Switches on globally the limit check for the channel/adjacent channel measurement.
	`CALC:LIM:ACP:ALT2:STAT ON`
	Switches on the limit check for the lower and upper second adjacent channel.
	`INIT;*WAI`
	Starts a new measurement and waits for the sweep end.
	`CALC:LIM:ACP:ALT2:RES?`
	Queries the limit check result in the second alternate adjacent channels.
Usage:	Query only
Mode:	A, CDMA, EVDO, TDS, WLAN

CALCulate:LIMit:CONTrol Subsystem

The CALCulate:LIMit:CONTrol subsystem defines the x-axis (CONTrol axis).

CALCulate<n>:LIMit<k>:CONTrol[:DATA] <XValue>, <XValue>

This command defines the x-axis values (frequencies or times) of the upper or lower limit lines.

The number of values for the CONTrol axis and for the corresponding UPPer and/or LOWer limit lines has to be identical. Otherwise default values are entered for missing values or not required values are deleted.

In "Spectrum" mode, the unit of values depends on the span setting of the x-axis. For details refer to `CALCulate<n>:LIMit<k>:CONTrol:DOMain`.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	1...8
	limit line

Parameters:

<XValue>, <XValue>	**<numeric_value>,<numeric_value>**

	*RST: - (CALC:LIM is set to OFF)
Example:	CALC:LIM2:CONT 1 MHz,30 MHz,100 MHz,300 MHz,1 GHz
	Defines 5 reference values for the x-axis of limit line 2.
	CALC:LIM2:CONT?
	Outputs the reference values for the x-axis of limit line 2 separated by a comma.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS, WCDMA

CALCulate<n>:LIMit<k>:CONTrol:DOMain <SpanSetting>

This command defines the span setting for the x-axis values.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	1...8 limit line

Parameters:

<SpanSetting>	FREQuency | TIME
	*RST: FREQuency
Example:	CALC:LIM2:CONT:DOM TIME
	Defines zero span for the x-axis of limit line 2.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:CONTrol:MODE <Mode>

This command selects the relative or absolute scaling for the x-axis of the selected limit line.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<k>	1...8 limit line

Parameters:

<Mode>	RELative | ABSolute
	*RST: ABSolute
Example:	CALC:LIM2:CONT:MODE REL
	Defines the x-axis of limit line 2 as relatively scaled.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n>:LIMit\<k>:CONTrol:OFFSet \<Offset>

This command defines an offset for the x-axis value of the selected relative limit line for span > 0 or zero span in the window specified by the suffix \<n>.

In "Spectrum" mode, the unit of values depends on the span setting of the x-axis. For details refer to CALCulate\<n>:LIMit\<k>:CONTrol:DOMain on page 458.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<k>	1...8 limit line

Parameters:

\<Offset>	**\<numeric_value>**
	*RST: 0
Example:	CALC:LIM2:CONT:OFFS 100us Sets the X offset for limit line 2 (defined in zero span) to 100µs.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n>:LIMit\<k>:CONTrol:SHIFt \<Value>

This command moves a limit line by the indicated value in x direction. In contrast to CALCulate\<n>:LIMit\<k>:CONTrol:OFFSet, the line is shifted by modifying the individual x values and not by means of an additive offset.

In "Spectrum" mode, the unit of values depends on the span setting of the x-axis. For details refer to CALCulate\<n>:LIMit\<k>:CONTrol:DOMain.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<k>	1...8 limit line

Parameters:

\<Value>	**\<numeric_value>**
Example:	CALC:LIM2:CONT:SHIF 50KHZ Shifts all reference values of limit line 2 by 50 kHz.
Usage:	Event
Mode:	A, ADEMOD, CDMA, EVDO, NF, TDS

CALCulate\<n>:LIMit\<k>:CONTrol:SPACing \<InterpolMode>

This command selects linear or logarithmic interpolation for the calculation of limit lines from frequency points.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<k\>	1...8 limit line

Parameters:

\<InterpolMode\>	LINear | LOGarithmic
	*RST: LIN
Example:	CALC:LIM:CONT:SPAC LIN
Mode:	A, CDMA, EVDO, TDS

CALCulate:LIMit:ESPectrum subsystem

The `CALCulate:LIMit:ESPectrum` subsystem defines the limit check for the Spectrum Emission Mask.

CALCulate\<n\>:LIMit\<k\>:ESPectrum:LIMits \<Limits\>

This command sets or queries up to 4 power classes in one step.

Suffix:

\<n\>	irrelevant
\<k\>	irrelevant

Parameters:

\<Limits\>	1–3 numeric values between -200 and 200, separated by commas
	-200, \<0-3 numeric values between -200 and 200, in ascending order, separated by commas\>, 200
Example:	CALC:LIM:ESP:LIM -50,50,70
	Defines the following power classes:
	\<-200, -50\>
	\<-50, 50\>
	\<50, 70\>
	\<70, 200\>
	Query:
	CALC:LIM:ESP:LIM?
	Response:
	-200,-50,50,70,200
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate\<n>:LIMit\<k>:ESPectrum:MODE \<Mode>

This command activates or deactivates the automatic selection of the limit line in the Spectrum Emission Mask measurement.

Suffix:

\<n>	1...4
	window
\<k>	irrelevant

Parameters:

| \<Mode> | AUTO \| MANUAL |

AUTO
The limit line depends on the measured channel power.

MANUAL
One of the three specified limit lines is set. The selection is made with the "CALCulate:LIMit:ESPectrum subsystem", on page 460 command.

	*RST: AUTO
Example:	CALC:LIM:ESP:MODE AUTO
	Activates automatic selection of the limit line.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate\<n>:LIMit\<k>:ESPectrum:PCLass\<Class>[:EXCLusive] \<State>

This command sets the power classes used in the spectrum emission mask measurement. It is only possible to use power classes for which limits are defined. Also, either only one power class at a time or all power classes together can be selected.

Suffix:

\<n>	irrelevant
\<k>	irrelevant
\<Class>	1...4
	the power class to be evaluated

Parameters:

| \<State> | ON \| OFF |

	*RST: OFF
Example:	CALC:LIM:ESP:PCL1 ON
	Activates the first defined power class.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate\<n>:LIMit\<k>:ESPectrum:PCLass\<Class>:COUNt \<NoPowerClasses>

This command sets the number of power classes to be defined.

Suffix:

\<n>	irrelevant
\<k>	irrelevant
\<Class>	irrelevant

Parameters:

<NoPowerClasses>	1 to 4

	*RST: 1
Example:	CALC:LIM:ESP:PCL:COUN 2
	Two power classes can be defined.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate\<n\>:LIMit\<k\>:ESPectrum:PCLass\<Class\>:LIMit[:STATe] \<State\>

This command defines which limits are evaluated in the measurement.

Suffix:

\<n\>	irrelevant
\<k\>	irrelevant
\<Class\>	1...4
	the power class to be evaluated

Parameters:

\<State\>	ABSolute | RELative | AND | OR

ABSolute
Evaluates only limit lines with absolute power values

RELative
Evaluates only limit lines with relative power values

AND
Evaluates limit lines with relative and absolute power values. A negative result is returned if both limits fail.

OR
Evaluates limit lines with relative and absolute power values. A negative result is returned if at least one limit failed.

	*RST: REL
Example:	CALC:LIM:ESP:PCL:LIM ABS
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate\<n\>:LIMit\<k\>:ESPectrum:PCLass\<Class\>:MAXimum \<Level\>

This command sets the upper limit level for one power class. The unit is dBm. The limit always ends at + 200 dBm, i.e. the upper limit of the last power class can not be set. If more than one power class is in use, the upper limit must equal the lower limit of the next power class.

Suffix:

\<n\>	irrelevant
\<k\>	irrelevant
\<Class\>	1...4
	the power class to be evaluated

Parameters:

<Level>   **<numeric value>**

                           *RST: +200

Example: CALC:LIM:ESP:PCL1:MAX -40 dBm

                           Sets the maximum power value of the first power class to -40 dBm.

Mode: A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:MINimum <Level>

This command sets the minimum lower level limit for one power class. The unit is dBm. The limit always start at – 200 dBm, i.e. the first lower limit can not be set. If more than one power class is in use, the lower limit must equal the upper limit of the previous power class.

Suffix:

<n>   irrelevant

<k>   irrelevant

<Class>   1...4
                           the power class to be evaluated

Parameters:

<Level>   **<numeric_value>**

                           *RST: -200 for class1, otherwise +200

Example: CALC:LIM:ESP:PCL2:MIN -40 dBm

                           Sets the minimum power value of the second power class to -40 dBm.

Mode: A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ESPectrum:RESTore

This command restores the predefined limit lines for the Spectrum Emission Mask

measurement. All modifications made to the predefined limit lines are lost and the factory-set values are restored.

Suffix:

<n>   1...4
                           window

<k>   irrelevant

Example: CALC:LIM:ESP:REST

                           Resets the limit lines for the Spectrum Emission Mask to the default setting.

Mode: A, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:LIMit<k>:ESPectrum:VALue <Power>

This command activates the manual limit line selection and specifies the expected power as a value. Depending on the entered value, one of the predefined limit lines is selected.

Suffix:

<n>	1...4
	window
<k>	irrelevant

Parameters:

<Power>	33 | 28 | 0
	33
	P ≥ 33
	28
	28 < P < 33
	0
	P < 28
	*RST: 0
Example:	CALC:LIM:ESP:VAL 33
	Activates manual selection of the limit line and selects the limit line for P = 33.
Mode:	A, CDMA, EVDO, TDS, WCDMA

CALCulate:LIMit:LOWer Subsystem

The CALCulate:LIMit:LOWer subsystem defines the lower limit line.

CALCulate<n>:LIMit<k>:LOWer[:DATA] <LimitLineValues>

This command defines the values for the selected lower limit line.

The number of values for the CONTrol axis and for the corresponding LOWer limit line has to be identical. Otherwise default values are entered for missing values or not necessary values are deleted.

The unit must be identical with the unit selected by CALCulate<n>:LIMit<k>:UNIT. If no unit is indicated, the unit defined with CALCulate<n>:LIMit<k>:UNIT is automatically used.

If the measured values are smaller than the LOWer limit line, the limit check signals errors.

The units DEG, RAD, S, HZ, PCT are not available in the "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<LimitLineValues>	numeric values, separated by commas

	*RST: (LIMit:STATe is set to OFF)
Example:	`CALC:LIM2:LOW -30,-40,-10,-40,-30`
	Defines 5 lower limit values for limit line 2 in the preset unit.
	`CALC:LIM2:LOW?`
	Outputs the lower limit values of limit line 2 separated by a comma.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

CALCulate<n>:LIMit<k>:LOWer:STATe <State>

This command switches on or off the indicated limit line. The limit check is activated separately with `CALCulate<n>:LIMit<k>:STATe`.

In "Spectrum" mode, the result of the limit check can be queried with `CALCulate<n>:LIMit<k>:FAIL`.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<State>	ON | OFF

	*RST: OFF
Example:	`CALC:LIM4:LOW:STAT ON`
	Switches on limit line 4 (lower limit).
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

CALCulate<n>:LIMit<k>:LOWer:OFFSet <Offset>

This command defines an offset for the y-axis of the selected relative lower limit line. In contrast to `CALCulate<n>:LIMit<k>:LOWer:SHIFt`, the line is not shifted by modifying the individual Y values but by means of an additive offset.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Offset>	**<numeric_value>**

	*RST: 0
Example:	`CALC:LIM2:LOW:OFFS 3dB`
	Shifts limit line 2 by 3 dB upwards.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:LOWer:MARGin <Margin>

This command defines a margin to a lower limit line, at which out-of-limit values are signaled (if the limit check is active), but not handled as a violation of the limit value.

Only the unit dB is available in "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Margin>	**<numeric_value>**
	*RST: 0
Example:	CALC:LIM:LOW:MARG 10dB
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:LOWer:MODE <Mode>

This command selects the relative or absolute scaling for the y-axis of the selected lower limit line.

Selecting RELative causes the unit to be switched to DB.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Mode>	RELative	ABSolute
	*RST: ABSolute
Example:	CALC:LIM:LOW:MODE REL
	Defines the y-axis of limit line 2 as relative scaled.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:LOWer:SHIFt <Value>

This command shifts a limit line by the indicated value in Y direction. In contrast to CALCulate<n>:LIMit<k>:LOWer:OFFSet, the line is shifted by modifying the individual Y values but not by means of an additive offset.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Value>	**<numeric_value>**
Example:	CALC:LIM3:LOW:SHIF 20DB
	Shifts all Y values of limit line 3 by 20 dB.

Usage:	Event
Mode:	A, ADEMOD, CDMA, EVDO, NF, TDS

CALCulate<n>:LIMit<k>:LOWer:SPACing <InterpolType>

This command selects linear or logarithmic interpolation for the lower limit line.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<InterpolType>	LINear | LOGarithmic
	*RST: LIN
Example:	CALC:LIM:LOW:SPAC LIN
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:LOWer:THReshold <Value>

This command defines an absolute threshold value for limit lines with relative y-axis scaling. The absolute threshold value is used in the limit check as soon as it exceeds the relative limit value.

The unit must correspond to the unit selected with CALCulate<n>:LIMit<k>:UNIT (except dB which is not allowed). If no unit is indicated, the unit defined with CALCulate<n>:LIMit<k>:UNIT is automatically used (exception: dBm instead of dB).

The units DEG, RAD, S, HZ, PCT are not available in the "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Value>	**<numeric_value>**
	*RST: -200 dBm
Example:	CALC:LIM2:LOW:THR -35DBM
	Defines an absolute threshold value for limit line 2.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate:LIMit:UPPer Subsystem

The CALCulate:LIMit:UPPer subsystem defines the upper limit line.

CALCulate<n>:LIMit<k>:UPPer[:DATA] <LimitLineValues>

This command defines the values for the upper limit lines

The number of values for the CONTrol axis and for the corresponding UPPer and/or LOWer limit line has to be identical. Otherwise default values are entered for missing values or not necessary values are deleted.

The unit must be identical to the unit selected by CALCulate<n>:LIMit<k>:UNIT. If no unit is indicated, the unit defined using CALCulate<n>:LIMit<k>:UNIT is automatically used.

In "Spectrum" mode, the limit check indicates errors if the measured values exceed the UPPer limit line. The units DEG, RAD, S, HZ, PCT are not available in "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<LimitLineValues>	numeric values, separated by commas
	*RST: ("CALCulate<n>:LIMit<k>" is set to OFF)
Example:	CALC:LIM2:UPP -10,0,0,-10,-5
	Defines 5 upper limit values for limit line 2 in the preset unit.
	CALC:LIM2:UPP?
	Outputs the upper limit values for limit line 2 separated by a comma.
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

CALCulate<n>:LIMit<k>:UPPer:MARGin <Value>

This command defines a margin to an upper limit line, at which out-of-limit values are signaled (if the limit check is active), but not handled as a violation of the limit value.

Only the unit dB is available in "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Value>	**<numeric_value>**
	*RST: 0
Example:	CALC:LIM2:UPP:MARG 10dB
	Defines the margin of limit line 2 to 10 dB below the limit value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n\>:LIMit\<k\>:UPPer:MODE \<Mode\>

This command selects the relative or absolute scaling for the y-axis of the selected upper limit line.

Selecting RELative causes the unit to be switched to DB.

Suffix:

\<n\>	irrelevant
\<k\>	1...8
	limit line

Parameters:

\<Mode\>	RELative | ABSolute
	*RST: ABSolute
Example:	CALC:LIM2:UPP:MODE REL
	Defines the y-axis of limit line 2 as relative scaled.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n\>:LIMit\<k\>:UPPer:OFFSet \<Offset\>

This command defines an offset for the y-axis of the selected relative upper limit line. In contrast to CALCulate\<n\>:LIMit\<k\>:UPPer:SHIFt, the line is not shifted by modifying the individual Y values but by means of an additive offset.

Only the unit dB is available in the "Spectrum" mode.

Suffix:

\<n\>	irrelevant
\<k\>	1...8
	limit line

Parameters:

\<Offset\>	**\<numeric_value\>**
	*RST: 0
Example:	CALC:LIM2:UPP:OFFS 3dB
	Shifts limit line 2 by 3 dB upwards.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate\<n\>:LIMit\<k\>:UPPer:SHIFt \<Value\>

This command moves a limit line by the indicated value in Y direction. In contrast to CALCulate\<n\>:LIMit\<k\>:UPPer:OFFSet on page 469, the line is shifted by modifying the individual Y values and not by means of an additive offset.

Suffix:

\<n\>	irrelevant
\<k\>	1...8
	limit line

Parameters:

<Value>	**<numeric_value>**
Example:	CALC:LIM3:UPP:SHIF 20
	Shifts all Y values of limit line 3 by 20 limit line units, e.g. dB.
Usage:	Event
Mode:	A, ADEMOD, CDMA, EVDO, NF, TDS

CALCulate<n>:LIMit<k>:UPPer:SPACing <InterpolType>

This command selects linear or logarithmic interpolation for the upper limit line.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<InterpolType>	LINear | LOGarithmic
	*RST: LIN
Example:	CALC:LIM:UPP:SPAC LIN
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:LIMit<k>:UPPer:STATe <State>

This command switches on or off the indicated limit line. The limit check is activated separately with CALCulate<n>:LIMit<k>:STATe.

In "Spectrum" mode, the result of the limit check can be queried with CALCulate<n>:LIMit<k>:FAIL.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:LIM4:UPP:STAT ON
	Switches on limit line 4 (upper limit).
Mode:	A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

CALCulate<n>:LIMit<k>:UPPer:THReshold <Value>

This command defines an absolute threshold value for limit lines with relative y-axis scaling. The absolute threshold value is used in the limit check as soon as it exceeds the relative limit value.

The unit must correspond to the unit selected with `CALCulate<n>:LIMit<k>:UNIT` (except dB which is not possible). If no unit is indicated, the unit defined with `CALCulate<n>:LIMit<k>:UNIT` is automatically used (exception: dBm instead of dB).

The units DEG, RAD, S, HZ, PCT are not available in the "Spectrum" mode.

Suffix:

<n>	irrelevant
<k>	1...8
	limit line

Parameters:

<Value>	**<numeric_value>**
	*RST: -200 dBm
Example:	`CALC:LIM2:UPP:THR -35DBM`
	Defines an absolute threshold value for limit line 2.
Mode:	A, ADEMOD, CDMA, EVDO, TDS

CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem checks the marker functions of the instrument.

CALCulate<n>:MARKer<m>[:STATe] <State>

This command activates a marker in the specified window. If no indication is made, marker 1 is selected automatically. If activate, the marker is switched to normal mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   depends on mode
                             marker number; For applications that do not have more than 1 marker, the suffix <m> is irrelevant.

Parameters:

<State>   ON | OFF

                             *RST: OFF

Example: CALC:MARK3 ON
                             Switches on marker 3 or switches to marker mode.

Mode: all

CALCulate<n>:MARKer<m>:AOFF

This command switches off all active markers, delta markers, and marker measurement functions in the specified window.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   depends on mode
                             irrelevant

Example: CALC:MARK:AOFF
                             Switches off all markers.

Mode: all

CALCulate<n>:MARKer<m>:COUNt <State>

This command switches on or off the frequency counter at the marker position for marker 1 in the window specified by the suffix <n>.

The count result is queried with CALCulate<n>:MARKer<m>:COUNt:FREQuency on page 473.

Frequency counting is possible only for one marker at a time. If it is activated for another marker, it is automatically deactivated for the previous marker.

It should be noted that a complete sweep must be performed after switching on the frequency counter to ensure that the frequency to be measured is actually reached. The synchronization to the sweep end required for this is only possible in single sweep mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Parameters:

\<State\>	ON | OFF

	*RST: OFF
Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK ON`
	Switches on marker 1.
	`CALC:MARK:COUN ON`
	Switches on the frequency counter for marker 1.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:COUN:FREQ?`
	Outputs the measured value.
Mode:	A, CDMA, EVDO, TDS

CALCulate\<n\>:MARKer\<m\>:COUNt:FREQuency

This command queries the result of the frequency counter for marker 1 in the window specified by the suffix \<n\>. Before the command, the frequency counter should be switched on and a complete measurement performed to obtain a correct count result. Therefore, a single sweep with synchronization must be performed between switching on the frequency counter and querying the count result.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<m\>	irrelevant
Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK ON`
	Switches on marker 2.
	`CALC:MARK:COUN ON`
	Activates the frequency counter for marker 1.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:COUN:FREQ?`
	Outputs the measured value of marker 1.
Mode:	A

CALCulate\<n\>:MARKer\<m\>:COUNt:RESolution \<Resolution\>

This command specifies the resolution of the frequency counter (marker 1) in the window specified by the suffix \<n\>.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<m\>	irrelevant

Parameters:

\<Resolution>	0.001 | 0.01 | 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz

	*RST: 0.1 Hz
Example:	CALC:MARK:COUN:RES 1kHz
	Sets the resolution of the frequency counter to 1 kHz.
Mode:	A

CALCulate\<n>:MARKer\<m>:LOEXclude \<State>

This command switches the local oscillator suppression for peak search on or off. This setting applies to all markers and delta markers in the window specified by the suffix \<n>.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	irrelevant

Parameters:

\<State>	ON | OFF

	*RST: ON
Example:	CALC:MARK:LOEX ON
Mode:	A-F, ADEMOD, TDS

CALCulate\<n>:MARKer\<m>:MAXimum[:PEAK]

This command positions the marker to the current maximum value of the corresponding trace in the specified window. The corresponding marker is activated first or switched to the marker mode.

If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the current peak level of the x-axis. The search is performed within the current frame. It does not change the position of the marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	depends on mode marker number; For applications that do not have more than 1 marker, the suffix \<m> is irrelevant.
Example:	CALC:MARK2:MAX Positions marker 2 to the maximum value of the trace.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM, NF

CALCulate<n>:MARKer<m>:MAXimum:AUTO <State>

Activates the automatic peak search function for marker 1 in the window specified by the suffix <n> at the end of each particular sweep. This function may be used during adjustments of a device under test to keep track of the actual peak marker position and level.

If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:MAX:AUTO ON
	Activates the automatic peak search function for marker 1 at the end of each particular sweep.
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:MARKer<m>:MAXimum:LEFT

This command positions the marker to the next smaller maximum value to the left of the current value (i.e. in descending X values) on the trace in the window specified by the suffix <n>.

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the next peak level of the x-axis. The search includes only the data to the left of the current marker position in the current frame. It does not change the position of the marker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	CALC:MARK2:MAX:LEFT
	Positions marker 2 to the next lower maximum value to the left of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command positions the marker to the next smaller maximum value of the corresponding trace in the window specified by the suffix <n>.

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the next peak level of the x-axis. The search includes the data in both directions of the current marker position in the current frame. It does not change the position of the marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example: CALC:MARK2:MAX:NEXT

Positions marker 2 to the next lower maximum value.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate\<n>:MARKer\<m>:MAXimum:RIGHt

This command positions the marker to the next smaller maximum value to the right of the current value (i.e. in ascending X values) on the corresponding trace in the window specified by the suffix \<n>.

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the next peak level of the x-axis. The search includes only the data to the right of the current marker position in the current frame. It does not change the position of the delta marker on the y-axis.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example: CALC:MARK2:MAX:RIGH

Positions marker 2 to the next lower maximum value to the right of the current value.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate\<n>:MARKer\<m>:MINimum[:PEAK]

This command positions the marker to the current minimum value of the corresponding trace in the specified window. The corresponding marker is activated first or switched to marker mode, if necessary.

If no minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the current minimum level of the x-axis. The search is performed within the current frame. It does not change the position of the marker on the y-axis / frames.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

<m>   depends on mode
                           marker number; For applications that do not have more than 1
                           marker, the suffix <m> is irrelevant.

Example: CALC:MARK2:MIN
                           Positions marker 2 to the minimum value of the trace.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM, NF

CALCulate<n>:MARKer<m>:MINimum:AUTO <State>

Activates the automatic minimum value search function for marker 1 at the end of each
particular sweep in the window specified by the suffix <n>. This function may be used
during adjustments of a device under test to keep track of the actual peak marker position
and level.

If no minimum value is found on the trace (level spacing to adjacent values < peak excur-
sion), an execution error (error code: -200) is produced.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

<State>   ON | OFF

                           *RST: OFF

Example: CALC:MARK:MIN:AUTO ON
                           Activates the automatic minimum value search function for marker
                           1 at the end of each particular sweep.

Mode: A, CDMA, EVDO, TDS

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command positions the marker to the next higher minimum value to the left of the
current value (i.e. in descending X direction) on the corresponding trace in the window
specified by the suffix <n>.

If no next higher minimum value is found on the trace (level spacing to adjacent values
< peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the next mini-
mum level of the x-axis. The search includes only the data to the left of the current marker
position in the current frame. It does not change the position of the marker on the y-axis.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

<m>   marker number

Example:	CALC:MARK2:MIN
	Positions marker 2 to the minimum value of the trace.
	CALC:MARK2:MIN:LEFT
	Positions marker 2 to the next higher minimum value to the left of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, TDS, WCDMA, SPECM, VSA

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command positions the marker to the next higher minimum value of the corresponding trace in the window specified by the suffix <n>.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the next minimum level of the x-axis. The search includes the data in both directions of the current marker position in the current frame. It does not change the position of the marker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	CALC:MARK2:MIN
	Positions marker 2 to the minimum value of the trace.
	CALC:MARK2:MIN:NEXT
	Positions marker 2 to the next higher maximum value.
Mode:	A, ADEMOD, CDMA, EVDO, SPECM, TDS, VSA, WCDMA

CALCulate<n>:MARKer<m>:MINimum:RIGHt

This command positions the marker to the next higher minimum value to the right of the current value (i.e. in ascending X direction) on the corresponding trace in the window specified by the suffix <n>.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

In "Spectrogram" mode, this command positions the specified marker on the current peak level of the x-axis. The search is performed within the current frame. It does not change the position of the marker on the y-axis.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	CALC:MARK2:MIN
	Positions marker 2 to the minimum value of the trace.
	CALC:MARK2:MIN:RIGH
	Positions marker 2 to the next higher minimum value to the right of the current value.
Mode:	A, ADEMOD, CDMA, EVDO, SPECM, TDS, VSA, WCDMA

CALCulate\<n>:MARKer\<m>:PEXCursion \<Value>

This command defines the peak excursion, i.e. the spacing below a trace maximum which must be attained before a new maximum is recognized, or the spacing above a trace minimum which must be attained before a new minimum is recognized. The set value applies to all markers and delta markers in the window specified by the suffix \<n>. The unit depends on the selected operating and display mode.

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

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	irrelevant

Parameters:

\<Value>	**\<numeric_value>**
	*RST: 6dB in "Spectrum" mode and RF displays; 5 PCT in AM displays, 50 kHz in FM displays, (0.5 RAD in PM displays
Example:	CALC:MARK:PEXC 10dB
	Defines peak excursion 10 dB in "Spectrum" mode.
Mode:	A, ADEMOD, BT, TDS

CALCulate\<screen>:MARKer\<m>:SEARch \<MarkRealImag>

This command specifies whether the marker search works on the real or the imaginary trace, or on the magnitude values of the I/Q data (I/Q mode only, see "Search Settings" on page 294).

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
<screen>	1..4
<marker>	1..16 irrelevant; valid for all markers

Setting parameters:

<MarkRealImag>	REAL | IMAG | MAG

REAL
Marker search functions are performed on the real trace of the "I/Q" measurement.

IMAG
Marker search functions are performed on the imaginary trace of the "I/Q" measurement.

MAG
Marker search functions are performed on the magnitude of the I and Q data.

	*RST: REAL
Example:	CALC4:MARK:SEAR IMAG
Mode:	VSA, I/Q

CALCulate<n>:MARKer<m>:TRACe <Trace>

This command assigns the selected marker to the indicated measurement curve in the specified window. The corresponding trace must be active, i.e. its status must not be "BLANK".

If necessary, the corresponding marker is switched on prior to the assignment.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	depends on mode marker number; For applications that do not have more than 1 marker, the suffix <m> is irrelevant.

Parameters:

<Trace>	**1 to 6** Selects trace 1 through 6.
	NOISe | GAIN Only available for NF (R&S FSV-K30).
Example:	CALC:MARK3:TRAC 2 Assigns marker 3 to trace 2.
Mode:	all

CALCulate<n>:MARKer<m>:X <Position>

This command positions the selected marker to the indicated x-value in the window specified by the suffix <n>.

If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

<Position>   0 to MAX (frequency | sweep time | level)

Example: `CALC:MARK2:X 10.7MHz`
Positions marker 2 to frequency 10.7 MHz.

Mode: ALL

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] <State>

This command switches between a limited (ON) and unlimited (OFF) search range.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker

Parameters:

<State>   ON | OFF

                 *RST: OFF

Example: `CALC:MARK:X:SLIM ON`
Switches on search limitation.

Mode: all

CALCulate<n>:MARKer<m>:X:SLIMits:LEFT <Limit>

This command sets the left limit of the search range for markers and delta markers in the window specified by the suffix <n>. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on (see).

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Parameters:

<Limit>   0 to MAX (frequency | sweep time)

                              *RST: (is set to the left diagram border when switching on search limits)

Example: `CALC:MARK:X:SLIM ON`

                              Switches the search limit function on.

                              `CALC:MARK:X:SLIM:LEFT 10MHz`

                              Sets the left limit of the search range to 10 MHz.

Mode: all

CALCulate\<n>:MARKer\<m>:X:SLIMits:RIGHT \<Limit>

This command sets the right limit of the search range for markers and delta markers in the window specified by the suffix \<n>. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on (`CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 481).

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Parameters:

<Limit>   0 to MAX (frequency | sweep time)

                              *RST: (is set to the right diagram border when switching on search limits)

Example: `CALC:MARK:X:SLIM ON`

                              Switches the search limit function on.

                              `CALC:MARK:X:SLIM:RIGH 20MHz`

                              Sets the right limit of the search range to 20 MHz.

Mode: all

CALCulate\<n>:MARKer\<m>:X:SLIMits:ZOOM \<State>

This command sets the limits of the search range for markers and delta markers to the zoom area in the window specified by the suffix \<n>.

Note: The function is only available if the search limit for marker and delta marker is switched on (see `CALCulate<n>:MARKer<m>:X:SLIMits[:STATe]` on page 481).

Suffix:

<n>   irrelevant

<m>   irrelevant

Parameters:

<State>	ON | OFF

	*RST:	OFF
Example:	CALC:MARK:X:SLIM:ZOOM ON	
	Switches the search limit function on.	
	CALC:MARK:X:SLIM:RIGH 20MHz	
	Sets the right limit of the search range to 20 MHz.	
Mode:	all	

CALCulate<n>:MARKer<m>:X:SSIZe <StepSize>

This command defines the step size of the rotary knob for marker or delta marker value changes. It only takes effect in manual operation. It is available for all base unit measurements with the exception of statistics.

Suffix:

<n>	irrelevant
<m>	irrelevant

Parameters:

<StepSize>	STANdard | POINts

STANdard
step size corresponds to space between two pixels

POINts
step size corresponds to space between two measured values (number of measured values is defined via the [SENSe<n>:]SWEep:POINts command, see [SENSe:]SWEep:POINts on page 648)

	*RST:	POINts
Example:	CALC:MARK:X:SSIZ STAN	
	Sets the measured value step size.	
Mode:	all	

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

This command queries the measured value of the selected marker in the window specified by the suffix <n>. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed after the change of a parameter and before the query of the Y value. This is only possible in single sweep mode.

In the default setting, the output is made depending on the unit determined with CALCulate<n>:UNIT:POWer; only with linear level scaling the output is in %.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Return values:

<Result> The measured value of the selected marker is returned.
In I/Q Analyzer mode, if the result display configuration "Real/Imag (I/Q)" is selected, this query returns the Real (Q) value of the marker first, then the Imag (I) value.

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK2 ON`
Switches marker 2.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK2:Y?`
Outputs the measured value of marker 2.
In I/Q Analyzer mode, for "Real/Imag (I/Q)", for example:
`1.852719887E-011,0`

Usage: Query only

Mode: ALL

CALCulate<n>:MARKer<m>:Y:PERCent <Probability>

This command positions the selected marker to the given probability in the window specified by the suffix <n>. If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode.

Note: The command is only available with the CCDF measurement switched on. The associated level value can be determined with the `CALCulate<n>:MARKer<m>:X` command.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Probability> 0 to 100 %

Example: `CALC1:MARK:Y:PERC 95PCT`
Positions marker 1 to a probability of 95 %.

Mode: A, CDMA, EVDO, TDS

CALCulate:MARKer:FUNCtion Subsystem

The CALCulate:MARKer<m>:FUNCtion subsystem checks the marker functions in the instrument.

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:STATe] <State>

This command activates the band power marker in the specified window. For details see chapter 3.3.3.8, "Performing Band Power Measurements", on page 177.

Suffix:

<n>	irrelevant
<m>	irrelevant

Parameters:

<State>	**ON | OFF**
	When switched to on, if no marker is active yet, marker 1 is activated. Otherwise, the currently active marker is used as a band power marker (all other marker functions for this marker are deactivated).
	*RST: OFF
Example:	CALC:MARK:BPOW:STAT ON
Mode:	A-F

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer[:MODE] <Mode>

Defines whether the result is displayed as a power or density.

Suffix:

<n>	irrelevant
<m>	irrelevant

Parameters:

<Mode>   **POWer**
                     Result is displayed as a power in dBm.

                     DENSity
                     Result is displayed as a density in dBm/Hz.

                     *RST: POW
Example: `CALC:MARK:BPOW:MODE DENS`
Mode: A-F

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:SPAN <Span>

Defines the span (band) around the marker for which the power is measured. The span is indicated by lines in the diagram.

Suffix:

<n>	irrelevant
<m>	irrelevant

Parameters:

<Span>   numeric value

                     *RST: 5% of current span
Example: `CALC:MARK:BPOW:SPAN 20`
Mode: A-F

CALCulate<n>:MARKer<m>:FUNCtion:BPOWer:RESult?

Queries the value of the band power marker.

Suffix:

<n>	irrelevant
<m>	irrelevant

Example: Activate the band power marker:
                     `CALC:MARK:BPOW:STAT ON`
                     Select the density mode for the result:
                     `CALC:MARK:BPOW:MODE DENS`
                     Query the result:
                     `CALC:MARK:BPOW:RES?`
                     Response:
                     `20dBm/Hz`
Usage: Query only
Mode: A-F

CALCulate<n>:MARKer<m>:FUNCtion:CENTer

This command sets the center frequency to the frequency of the indicated marker in the specified window.

If a marker other than 1 is selected and used as delta marker, the marker is switched to the marker mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	CALC:MARK2:FUNC:CENT
	Sets the center frequency to the frequency of marker 2.
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:CSTep

This command sets the step size of the center frequency to the X value of the current marker in the window specified by the suffix <n>. If marker 2, 3 or 4 is selected and used as delta marker, it is switched to the marker mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	CALC:MARK3:FUNC:CST
	Sets the center frequency to the same value as the frequency of marker 3.
Usage:	Event
Mode:	A-F

CALCulate<n>:MARKer<m>:FUNCtion:DEModulation:CONTinuous <State>

This command switches on or off the continuous demodulation for span >0 in the window specified by the suffix <n>. Thus acoustic monitoring of the signals can be performed. The suffix <m> is irrelevant.

This command is only available if the analyzer option B3 (Audio Demodulator) is installed.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC2:MARK3:FUNC:DEM:CONT ON
	Switches on the continuous ' demodulation.
Mode:	A, TDS

CALCulate\<n>:MARKer\<m>:FUNCtion:DEModulation:HOLDoff \<Duration>

This command defines the hold time at the marker position for the demodulation with span > 0 in the window specified by the suffix \<n>. The setting is independent of the selected marker, the suffix \<m> is irrelevant.

This command is only available if the analyzer option B3 (Audio Demodulator) is installed.

Suffix:

\<n>   window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.

\<m>   marker number

Parameters:

\<Duration>   10ms to 1000s

                          *RST: (DEModulation is set to OFF)

Example: CALC:MARK:FUNC:DEM:HOLD 3s

Mode: A, TDS

CALCulate\<n>:MARKer\<m>:FUNCtion:DEModulation:SELect \<DemodMode>

This command selects the demodulation mode for the audio demodulator in the window specified by the suffix \<n>.

This command is only available if the analyzer option B3 (Audio Demodulator) is installed.

Suffix:

\<n>   window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.

\<m>   irrelevant

Parameters:

\<DemodMode>   AM | FM

                          *RST: AM

Example: CALC:MARK:FUNC:DEM:SEL FM

Mode: A, TDS

CALCulate\<n>:MARKer\<m>:FUNCtion:DEModulation[:STATe] \<State>

This command switches on or off the audio demodulator in the window specified by the suffix \<n> when the indicated marker is reached. With span > 0 the hold time can be defined at the corresponding marker position with CALCulate\<n>:MARKer\<m>:FUNCtion:DEModulation:HOLDoff. In zero span the demodulation is permanently active.

This command is only available if the analyzer option B3 (Audio Demodulator) is installed.

Suffix:

\<n>   window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.

\<m>   marker number

Parameters:

<State>	ON | OFF
	*RST:　　OFF
Example:	CALC:MARK3:FUNC:DEM ON
	Switches on the demodulation for marker 3.
Mode:	A, TDS

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks[:IMMediate] <NoMaxima>

This command searches the selected trace for the indicated number of maxima in the window specified by the suffix <n>. The results are entered in a list and can be queried with the CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:X and CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:Y commands. The number of maxima found can be queried with CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt. The trace to be examined is selected with CALCulate<n>:MARKer<m>:TRACe. The order of the results in the list can be defined with CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT.

Number of found maxima

The number of maxima found depends on the waveform and value set for the Peak Excursion parameter (see CALCulate<n>:MARKer<m>:PEXCursion on page 479), however, a maximum number of 200 maxima are determined. Only the signals which exceed their surrounding values at least by the value indicated by the peak excursion parameter are recognized as maxima. Therefore, the number of maxima found is not automatically the same as the number of maxima desired.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<NoMaxima>	1 to 200

Example:	`INIT:CONT OFF`
	Switches to single sweep mode
	`INIT;*WAI`
	Starts measurement and synchronizes to end
	`CALC:MARK:TRAC 1`
	Sets marker 1 to trace 1
	`CALC:MARK:FUNC:FPE:SORT X`
	Sets the sort mode to increasing X values
	`CALC:MARK:FUNC:FPE 3;*WAI`
	Searches the 3 highest maxima for trace 1 and synchronizes to end
	`CALC:MARK:FUNC:FPE:COUN?`
	Queries the number of maxima found
	`CALC:MARK:FUNC:FPE:Y?`
	Queries the level of maxima found
	`CALC:MARK:FUNC:FPE:X?`
	Queries the frequencies (span <> 0) or time (span = 0) of maxima found.
Mode:	A, TDS

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt

This query reads out the number of maxima found during the search. If no search for maxima has been performed, 0 is returned.

Suffix:

<n>	irrelevant
<m>	marker number

Example:	`CALC:MARK:FUNC:FPE 3`
	Searches the 3 highest maxima for trace 1
	`CALC:MARK:FUNC:FPE:COUN?`
	Queries the number of maxima found
Mode:	A, ADEMOD, TDS

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:SORT <SortMode>

This command sets the sort mode for the search for maxima in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<SortMode>	X: the maxima are sorted in the list of responses according to increasing X values
	Y: the maxima are sorted in the list of responses according to decreasing Y values

Example:	`CALC:MARK:FUNC:FPE:SORT Y`
	Sets the sort mode to decreasing y values
Mode:	A, ADEMOD

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:X

This query reads out the list of X values of the maxima found in the window specified by the suffix <n>. The number of available values can be queried with `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt`.

With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	`CALC:MARK:FUNC:FPE:SORT Y`
	Sets the sort mode to decreasing y values
	`CALC:MARK:FUNC:FPE 3`
	Searches the 3 highest maxima for trace 1
	`CALC:MARK:FUNC:FPE:COUN?`
	Queries the number of maxima found
	`CALC:MARK:FPE:FUNC:X?`
	Queries the frequencies (span <> 0) or. time (span = 0) of the maxima found
	`107.5E6,153.8E6,187.9E6`
	frequencies in increasing order
	`2.05E-3,2.37E-3, 3.71e-3`
	times in increasing order
Mode:	A, ADEMOD, TDS

CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:Y

This query reads out the list of X values of the maxima found in the window specified by the suffix <n>. The number of available values can be queried with `CALCulate<n>:MARKer<m>:FUNCtion:FPEaks:COUNt` on page 490.

With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Return values:

Return values	-37.5,-58.3,-59.6
	level in decreasing order

Example: CALC:MARK:FUNC:FPE:SORT Y

Sets the sort mode to decreasing y values

CALC:MARK:FUNC:FPE 3

Searches the 3 highest maxima for trace 1

CALC:MARK:FUNC:FPE:COUN?

Queries the number of maxima found

CALC:MARK:FUNC:FPE:Y?

Queries the levels of the maxima found

Mode: A, ADEMOD, TDS

CALCulate\<n>:MARKer\<m>:FUNCtion:MDEPth[:STATe] \<State>

This command switches on the measurement of the AM modulation depth in the window specified by the suffix \<n>. An AM-modulated carrier is required on the screen for correct operation. If necessary, marker 1 is previously activated and set to the largest signal available.

The level value of marker 1 is regarded as the carrier level. On activating the function, marker 2 and marker 3 are automatically set as delta markers symmetrically to the carrier to the adjacent maxima of the trace.

If the position of delta marker 2 is changed, delta marker 3 is moved symmetrically with respect to the reference marker (marker 1). If the position of delta marker 3 is changed, fine adjustment can be performed independently of delta marker 2.

The power at the marker positions is calculated from the measured levels.

The AM modulation depth is calculated from the ratio of power values at the reference marker and the delta markers. If the two AM sidebands differ in power, the average value of the two power values is used for calculating the AM modulation depth.

Suffix:

\<n>   window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.

\<m>   irrelevant

Parameters:
\<State>

                      *RST: OFF

Example: CALC:MARK:X 10MHZ

Sets the reference marker (marker 1) to the carrier signal at 10 MHz.

CALC:MARK:FUNC:MDEP ON

Switches on the modulation depth measurement.

CALC:DELT2:X 10KHZ

Sets delta markers 2 and 3 to the signals at 10 kHz from the carrier signal.

CALC:DELT3:X 9.999KHZ

Corrects the position of delta marker 3 relative to delta marker 2.

Mode: A

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth:RESult?

This command queries the AM modulation depth in the window specified by the suffix <n>.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK:X 10MHZ`
Sets the reference marker (marker 1) to the carrier signal at 10 MHz.
`CALC:MARK:FUNC:MDEP ON`
Switches on the modulation depth measurement.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK:FUNC:MDEP:RES?`
Outputs the measured value.

Usage: Query only

Mode: A

CALCulate<n>:MARKer<m>:FUNCtion:MDEPth:SEARchsignal ONCE

This command starts the search of the signals required for the modulation depth measurement in the window specified by the suffix <n>.

No new measurement is performed. Only the currently available trace selected for the modulation depth measurement is used.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Example: `CALC:MARK:FUNC:MDEP:SEAR ONCE`
Executes the search of an AM modulated signal at the currently available trace.

Usage: SCPI conform

Mode: A

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown <LevelSpacing>

This command defines the level spacing of the two temporary markers to the right and left of marker 1 in the window specified by the suffix <n>.

The temporary markers T1 and T2 are positioned by n dB below the active reference marker. The value measured by these markers can be queried with CALCulate<n>: MARKer<m>:FUNCtion:NDBDown:RESult?.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

Parameters:

<LevelSpacing>   <numeric_value>

                           *RST: 6dB

Example: CALC:MARK:FUNC:NDBD 3dB
                           Sets the level spacing to 3 dB.

Mode: A, ADEMOD

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown:FREQuency

This command queries the values of the two temporary markers for span>0 in the window specified by the suffix <n>. The frequency values are separated by comma and output in ascending order.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

This command is only a query and therefore has no *RST value.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   irrelevant

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?
                           Outputs the frequencies of the temporary markers.

Mode: A, ADEMOD

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown:QFACtor

This command queries the Q factor (quality) of the measured bandwidth for span>0 in the window specified by the suffix <n>.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

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:QFAC?
	Queries the Q factor of the measured bandwidth.
Mode:	A, ADEMOD

CALCulate\<n>:MARKer\<m>:FUNCtion:NDBDown:RESult

This command queries the measured value in the window specified by the suffix \<n>. The value depends on the span setting:

- span > 0: frequency spacing of the two temporary markers (in Hz)
- span = 0: pulse width between the two temporary markers (in s)

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	irrelevant

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.
Mode:	A, ADEMOD

CALCulate\<n>:MARKer\<m>:FUNCtion:NDBDown:STATe \<State>

This command switches the "N dB Down" function on or off in the window specified by the suffix \<n>. Marker 1 is activated first, if necessary.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	irrelevant

Parameters:

\<State>	ON | OFF
	*RST: OFF

Example:	`CALC:MARK:FUNC:NDBD:STAT ON`
	Switches on the "N dB Down" function.
Mode:	A, ADEMOD

CALCulate<n>:MARKer<m>:FUNCtion:NDBDown:TIME

This command queries the values of the two temporary markers in zero span in the window specified by the suffix <n>. The time values are separated by comma and output in ascending order.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant
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.
Mode:	A-T, ADEMOD

CALCulate<n>:MARKer<m>:FUNCtion:NOISe[:STATe] <State>

This command switches the noise measurement on or off for all markers in the window specified by the suffix <n>. The noise power density is measured at the position of the markers. The result can be queried with `CALCulate<n>:MARKer<m>:FUNCtion:NOISe:RESult`.

Suffix:

| <n> | window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant. |
| <m> | marker number |

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	`CALC:MARK:FUNC:NOIS ON`
	Switches on the noise measurement.
Mode:	A, TDS

CALCulate<n>:MARKer<m>:FUNCtion:NOISe:RESult

This command queries the result of the noise measurement in the window specified by the suffix <n>.

A complete sweep with synchronization to the sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK2 ON`
Switches on marker 2.
`CALC:MARK:FUNC:NOIS ON`
Switches on noise measurement.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK2:NOIS:RES?`
Outputs the noise result of marker 2.

Mode: A, TDS

CALCulate<n>:MARKer<m>:FUNCtion:REFerence

This command sets the reference level to the power measured by the indicated marker in the window specified by the suffix <n>. If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

Example: `CALC:MARK2:FUNC:REF`
Sets the reference level to the level of marker 2.

Mode: A, TDS

CALCulate<n>:MARKer<m>:FUNCtion:TOI[:STATe] <State>

This command initiates the measurement of the third-order intercept point in the window specified by the suffix <n>.

A two-tone signal with equal carrier levels is expected at the RF input of the instrument. Marker 1 and marker 2 (both normal markers) are set to the maximum of the two signals. Delta marker 3 and delta marker 4 are positioned to the intermodulation products. The delta markers can be modified separately afterwards with the CALCulate<n>: DELTamarker<m>:X command.

The third-order intercept is calculated from the level spacing between the normal markers and the delta markers.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:FUNC:TOI ON
	Switches on the measurement of the third-order intercept.
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:TOI:RESult?

This command queries the third-order intercept point measurement in the window specified by the suffix <n>.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant
Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:TOI ON
	Switches the intercept measurement.
	INIT;*WAI
	Starts a sweep and waits for the end.
	CALC:MARK:FUNC:TOI:RES?
	Outputs the measured value.
Usage:	Query only
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:TOI:SEARchsignal ONCE

This command starts the search of the signals required for the third order intercept measurement in the window specified by the suffix <n>.

No new measurement is performed. Only the currently available trace selected for the TOI measurement is used.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	CALC:MARK:FUNC:TOI:SEAR ONCE
	Executes the search for 2 signals and their intermodulation product at the currently available trace.
Usage:	SCPI conform
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:ZOOM <Range>

This command defines the range to be zoomed around marker 1 in the window specified by the suffix <n>. Marker 1 is activated first, if necessary.

The subsequent frequency sweep is stopped at the marker position and the frequency of the signal is counted. This frequency becomes the new center frequency, and the zoomed span is set. In order to recognize the end of the operation the synchronization to the sweep end should be activated. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Range>	**<numeric_value>**
Example:	INIT:CONT OFF
	Switches to single sweep mode
	CALC:MARK:FUNC:ZOOM 1kHz;*WAI
	Activates zooming and waits for its end.
Mode:	A-F, ADEMOD, PHN

CALCulate:MARKer:FUNCtion:HARMonics Subsystem

The CALCulate:MARKer<m>:FUNCtion:POWER subsystem contains the commands to define the settings for harmonics measurement.

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics[:STATe] <State>

This command activates/deactivates the harmonic distortion measurement in the window specified by the suffix <n>.

If the measurement is started in span > 0, the last span defines the search range for the first harmonic. The level is determined for the first harmonic.

If the measurement is started in zero span, center frequency and level are used unchanged.

Suffix:

<n>	window; For applications that do not have more than one measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Parameters:

<State>	ON | OFF

	*RST:	OFF
Example:	CALC:MARK:FUNC:HARM ON	
	Activates the harmonic distortion measurement.	
Mode:	A-F, A-T	

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:BANDwidth:AUTO <State>

This command defines the resolution bandwidth of the harmonic in respect to the bandwidth of the first harmonic in the window specified by the suffix <n>. For details refer to "Harmonic RBW Auto" on page 260.

Suffix:

<n>	window; For applications that do not have more than one measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Parameters:

<State>	OFF | ON
	OFF identical
	ON a multiple

	*RST:	ON
Example:	CALC:MARK:FUNC:HARM:BAND:AUTO OFF	
	Deactivates the automatic bandwidth enlargement.	
Mode:	A-F, A-T	

CALCulate<n>:MARKer<m>:FUNCtion:HARMonics:DISTortion?

This command queries the distortion results (THD: total harmonic distortion) in the window specified by the suffix <n>. Two values separated by a comma are returned: <THD in %>, <THD in dB>.

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

Suffix:

<n>	window; For applications that do not have more than one measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Parameters:

TOTal

Example: INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK:FUNC:HARM:NHARM 3

Sets the number of harmonics to be measured to 3.

CALC:MARK:FUNC:HARM ON

Activates the harmonic distortion measurement.

INIT;*WAI

Starts a sweep and waits for the end of the sweep.

CALC:MARK:FUNC:HARM:DIST? TOT

Returns the total distortion in % and dB.

Usage: Query only

Mode: A-F, A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:HARMonics:LIST?

This command reads out the list of the harmonics in the window specified by the suffix \<n>. The first value is the absolute power of the first harmonic (the unit is set via the CALCulate\<n>:UNIT:POWer command). The following values are relative to the carrier signal and have the unit dB. They are separated by commas and correspond to the harmonics to be measured (set via the CALCulate\<n>:MARKer\<m>:FUNCtion: HARMonics:NHARmonics command).

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

Suffix:

\<n>   window; For applications that do not have more than one measurement window, the suffix \<n> is irrelevant.

\<m>   marker number

Example: INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK:FUNC:HARM:NHARM 3

Sets the number of harmonics to be measured to 3.

CALC:MARK:FUNC:HARM ON

Activates the harmonic distortion measurement.

INIT;*WAI

Starts a sweep and waits for the end of the sweep.

CALC:MARK:FUNC:HARM:LIST?

Returns the values for the 3 measured harmonics.

Usage: Query only

Mode: A-F, A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:HARMonics:NHARmonics \<NoHarmonics>

This command sets the number of harmonics to be measured in the window specified by the suffix \<n>.

Suffix:

\<n>   window; For applications that do not have more than one measurement window, the suffix \<n> is irrelevant.

\<m>   irrelevant

Parameters:

\<NoHarmonics>   1…26

    *RST: 10

Example: CALC:MARK:FUNC:HARM:NHARM 3

    Sets the number of harmonics to be measured to 3.

Mode: A-F, A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:HARMonics:PRESet?

This command optimizes the device settings in the window specified by the suffix \<n> depending on the span setting:

span > 0	Frequency and level of the first harmonic are determined and used for the measurement list.
zero span	The level of the first harmonic is determined. The frequency remains unchanged.

Suffix:

\<n>   window; For applications that do not have more than one measurement window, the suffix \<n> is irrelevant.

\<m>   irrelevant

Example: CALC:MARK:FUNC:HARM:PRES

    Optimizes the device settings for the harmonic measurement.

Usage: Query only

Mode: A-F, A-T

CALCulate:MARKer:FUNCtion:POWer Subsystem

The CALCulate:MARKer\<m>:FUNCtion:POWER subsystem contains the commands for control of power measurement.

Further information

- "Predefined CP/ACLR Standards", on page 515

CALCulate<n>:MARKer<m>:FUNCtion:POWer[:STATe] <State>

This command switches off the power measurement in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	OFF

Example:	CALC:MARK:FUNC:POW OFF
	Switches off the power measurement.
Usage:	Event
Mode:	A-F

CALCulate<n>:MARKer<m>:FUNCtion:POWer:MODE <Mode>

This commands defines the method by which the channel power values are calculated from the current trace in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Mode>	WRITe | MAXHold
	WRITe The channel power and the adjacent channel powers are calculated directly from the current trace
	MAXHold The power values are calculated from the current trace and compared with the previous power value using a maximum algorithm.

Example:	CALC:MARK:FUNC:POW:MODE MAXH
	Sets the Maxhold channel power mode.
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:POWer:PRESet <Standard> |
    <UserStandard>

This command selects the power measurement setting for a standard in the window specified by the suffix <n>, and switches on the corresponding measurement, if required.

The configuration for a standard comprises of the parameters weighting filter, channel bandwidth and spacing, resolution and video bandwidth, as well as detector and sweep time.

The settings for standards IS95A and C differ as far as the calculation method of channel spacings is concerned. For IS95A and J-STD008 the spacing is calculated from the center of the main channel to the center of the corresponding adjacent channel, for IS95C from the center of the main channel to the nearest border of the adjacent channel.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Standard>	EUTRa | REUTra | TETRA | PDC | PHS | CDPD | FWCDma | RWCDma | FW3Gppcdma | RW3Gppcdma | FIS95A | RIS95A | FIS95C0 | RIS95C0 | FIS95C1 | RIS95C1 | FJ008 | RJ008 | TCDMa | FTCDMa | RTCDMa | AWLan | BWLan | WIMax | WIBRo | RFID14443 | GSM | NONE | <string>
	with <string> being the name of a user standard. Note that predefined standards go without quotes, while user standards have to be in quotes ('user standard').
	For further details refer to "Predefined CP/ACLR Standards", on page 515.

Example:	CALC:MARK:FUNC:POW:PRES TETRA
	Selects the standard setting for TETRA
Example:	CALC:MARK:FUNC:POW:PRES 'my_aclr_standard'
	Selects the user standard my_aclr_standard
Mode:	A-F

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? <ResultType>

This command queries the result of the performed power measurement in the window specified by the suffix <n>. If necessary, the measurement is switched on prior to the query.

The channel spacings and channel bandwidths are configured in the SENSe:POWer subsystem.

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<ResultType> ACPower | CN | CN0 | CPOWer | PPOWer | MCACpower | OBANdwidth | OBWidth | BANDwidth

ACPower
Adjacent-channel power measurement
Results are output in the following sequence, separated by commas:
Power of transmission channel
Power of lower adjacent channel
Power of upper adjacent channel
Power of lower alternate channel 1
Power of upper alternate channel 1
Power of lower alternate channel 2
Power of upper alternate channel 2
The number of measured values returned depends on the number of adjacent/alternate channels selected with [SENSe:]POWer: ACHannel:ACPairs.
With logarithmic scaling (RANGE LOG), the power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If [SENSe:]POWer: ACHannel:MODE is set to REL, the adjacent/alternate-channel power is output in dB.

CN
Measurement of carrier-to-noise ratio
The carrier-to-noise ratio in dB is returned.

CN0
Measurement of carrier-to-noise ratio referenced to 1 Hz bandwidth.
The carrier-to-noise ratio in dB/Hz is returned.

CPOWer
Channel power measurement
In a Spectrum Emission Mask measurement, the query returns the power result for the reference range, if this power reference type is selected.
With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.

PPOWer
Power of the highest peak
In a Spectrum Emission Mask measurement, the query returns the power result for the reference range, if this power reference type is selected.

MCACpower
Channel/adjacent-channel power measurement with several carrier signals
Results are output in the following sequence, separated by commas:
Power of carrier signal 1 to 18s in ascending order

Total power of all carrier signals
Power of lower adjacent channel
Power of upper adjacent channel
Power of lower alternate channel 1
Power of upper alternate channel 1
Power of lower alternate channel 2
Power of upper alternate channel 2
The number of measured values returned depends on the number of carrier signals and adjacent/alternate channels selected with [SENSe:]POWer:ACHannel:TXCHannel:COUNt and [SENSe:]POWer:ACHannel:ACPairs.
If only one carrier signal is measured, the total value of all carrier signals is not output.
With logarithmic scaling (RANGE LOG), the power is output in dBm; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If [SENSe:]POWer:ACHannel:MODE is set to "REL", the adjacent/alternate-channel power is output in dB.

OBANdwidth | OBWidth
Measurement of occupied bandwidth
The occupied bandwidth in Hz is returned.

Example: **For an example of channel/adjacent-channel power measurement see** chapter 4.3.4, "Measuring the Channel and Adjacent Channel Power", on page 791**.**
Example of occupied bandwidth measurement
POW:BAND 90PCT
Defines 90 % as the percentage of the power to be contained in the bandwidth range to be measured.
INIT:CONT OFF
Switches over to single sweep mode.
INIT;*WAI
Starts a sweep and waits for the end of the sweep.
CALC:MARK:FUNC:POW:RES? OBW
Queries the occupied bandwidth measured.

Mode: A-F, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult:PHZ <State>

This command switches the query response of the power measurement results in the window specified by the suffix <n> between output of absolute values and output referred to the measurement bandwith.

The measurement results are output with the CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult command.
Suffix:
<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

<State>   ON | OFF

ON
Results output: channel power density in dBm/Hz

OFF
Results output: channel power is displayed in dBm

*RST: OFF

Example: CALC:MARK:FUNC:POW:RES:PHZ ON
Output of results referred to the channel bandwidth.
For details on a complete measurement example refer to
CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult
on page 504.

Mode: A-F, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect <MeasType>

This command selects – and switches on – the specified power measurement type in the window specified by the suffix <n>.

The channel spacings and channel bandwidths are configured in the SENSe:POWer subsystem.

Note: If CPOWer is selected, the number of adjacent channels ([SENSe:]POWer:ACHannel:ACPairs) is set to 0. If ACPower is selected, the number of adjacent channels is set to 1, unless adjacent-channel power measurement is switched on already.

The channel/adjacent-channel power measurement is performed for the trace selected with [SENSe:]POWer:TRACe.

The occupied bandwidth measurement is performed for the trace on which marker 1 is positioned. To select another trace for the measurement, marker 1 is to be positioned on the desired trace by means of CALCulate<n>:MARKer<m>:TRACe.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

<MeasType>	ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CNO

ACPower
Adjacent-channel power measurement with a single carrier signal

CPOWer
Channel power measurement with a single carrier signal (equivalent to adjacent-channel power measurement with "NO. OF ADJ CHAN" = 0)

MCACpower
Channel/adjacent-channel power measurement with several carrier signals

OBANdwidth | OBWidth
Measurement of occupied bandwidth

CN
Measurement of carrier-to-noise ratio

CN0
Measurement of carrier-to-noise ratio referenced to 1 Hz bandwidth

Example:	`CALC:MARK:FUNC:POW:SEL ACP`
	Switches on adjacent-channel power measurement.
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:CATalog?

This command queries all available standards, including user standards.

The numeric suffix at MARKer is irrelevant.

Example:	`CALC:MARK:FUNC:POW:STAN:CAT?`
	Queries the available standards.
Usage:	Query only
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:DELete <Standard>

This command deletes an ACLR standard.

The numeric suffix at MARKer is irrelevant.

Parameters:

<Standard>	Name of the standard you want to delete.
Example:	`CALC:MARK:FUNC:POW:STAN:DEL 'CDMA2000'`
	Deletes the CDMA2000 standard.
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:POWer:STANdard:SAVE <Standard>

This command saves a cutomized ACLR standard.

The numeric suffix at MARKer is irrelevant.

Parameters:

<Standard>	Specifies the name of the user standard.

Example: CALC:MARK:FUNC:POW:STAN:SAVE 'CDMA2000'
Saves the user standard with the name CDMA2000.

Mode: A

CALCulate:MARKer:SPECtrogram | SGRam subsystem

The following commands control the markers when you are using the spectrogram.

The spectrogram is available if option R&S FSV-K14 is installed.

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:FRAMe <Frame> | <Time>

This command positions the marker on a particular frame.

The command is available for the spectrogram.

Suffix:

<n>	1...4 irrelevant
<m>	1...16 marker

Parameters:

<numeric_value>	**<Frame> (if time stamp is off)** Defines the frame to place the marker on. The range is {0...number of recorded frames-1}
	<time> (if time stamp is on) Defines the distance of the marker in seconds to the last measured frame (frame 0).

Example:	CALC:MARK:SPEC:FRAM -20
	Sets the marker on the 20th frame before the present.
	CALC:MARK2:SPEC:FRAM 2 s
	Sets second marker on the frame 2 seconds ago.
Mode:	RT, SPECM

CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:SARea \<Search Area\>

This command defines the marker search area.

The command is available for the spectrogram.

Suffix:

\<n\>	1...4
	irrelevant
\<m\>	1...16
	irrelevant

Parameters:

\<VISible | MEMory\>	**VISible**
	Performs a search in the visible frames.
	Note that VISible is ignored if Spectrogram is not visible for any reason (e.g. if the Spectrum Analyzer is in full screen mode or display update is inactive).
	MEMory
	Performs a search over all frames in the memory.
	*RST: VISible
Example:	CALC:DELT:SPEC:SAR MEM
	Performs a search over all frames in the memory.
Mode:	RT, SPECM

CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:XY:MAXimum[:PEAK]

This command positions the specified marker on the current peak level of the spectrogram. The possible position depends on the marker search area.

The command is available for the spectrogram.

For more information, see CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:SARea on page 510.

Suffix:

\<n\>	1...4
	irrelevant
\<m\>	1...16
	marker
Example:	CALC:MARK2:SPEC:SAR VIS
	CALC:MARK2:SPEC:XY:MAX
	Activates and positions marker 2 on the peak level in the visible Spectrogram.

Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:XY:MINimum[:PEAK]

This command positions the specified marker on the current minimum level of the spectrogram. The possible position depends on the marker search area.

The command is available for the spectrogram.

For more information, see CALCulate<n>:MARKer<m>:SPECtrogram|SGRam: SARea on page 510 .

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK3:SPEC:SAR VIS
	CALC:MARK3:SPEC:XY:MIN
	Activates and positions marker 3 on the minimum level in the visible Spectrogram.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:Y:MAXimum:ABOVe

This command positions the specified marker on the next peak level of the vertical axis. The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MAX
	Activates and positions marker 2 on the peak level of the y-axis.
	CALC:MARK2:SPEC:Y:MAX:BEL
	Positions marker 2 on the next higher level found in the diagram area above the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:Y:MAXimum:BELow

This command positions the specified marker on the next peak level of the vertical axis. The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

\<n\>	1...4
	irrelevant
\<m\>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MAX
	Activates and positions marker 2 on the peak level of the y-axis.
	CALC:MARK2:SPEC:Y:MAX:BEL
	Positions marker 2 on the next higher level found in the diagram area below the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:Y:MAXimum:NEXT

This command positions the specified marker on the next peak level of the vertical axis. The search includes frames above and below the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

\<n\>	1...4
	irrelevant
\<m\>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MAX
	Activates and positions marker 2 on the peak level of the y-axis.
	CALC:MARK2:SPEC:Y:MAX:NEXT
	Positions marker 2 on the next higher level.
Usage:	Event
Mode:	RT, SPECM

CALCulate\<n\>:MARKer\<m\>:SPECtrogram|SGRam:Y:MAXimum[:PEAK]

This command positions the specified marker on the current peak level of the vertical axis. The search is performed over all frames. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MAX
	Activates and positions marker 2 on the peak level of the y-axis.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:Y:MINimum:ABOVe

This command positions the specified marker on the next minimum level of the vertical axis. The search includes only frames above the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MIN
	Activates and positions marker 2 on the minimum level of the y-axis.
	CALC:MARK2:SPEC:Y:MIN:ABOV
	Positions marker 2 on the next minimum level found in the diagram area above the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:Y:MINimum:BELow

This command positions the specified marker on the next minimum level of the vertical axis. The search includes only frames below the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker

Example:	CALC:MARK2:SPEC:Y:MIN
	Activates and positions marker 2 on the minimum level of the y-axis.
	CALC:MARK2:SPEC:Y:MAX:BEL
	Positions marker 2 on the next minimum level found in the diagram area below the current marker position.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:Y:MINimum:NEXT

This command positions the specified marker on the next minimum level of the vertical axis. The search includes frames above and below the current marker position. It does not change the horizontal position of the marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MIN
	Activates and positions marker 2 on the minimum level of the y-axis.
	CALC:MARK2:SPEC:Y:MIN:NEXT
	Positions marker 2 on the next minimum level.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:Y:MINimum[:PEAK]

This command positions the specified marker on the current minimum level of the vertical axis. The search is performed over all captured frames. It does not change the horizontal position of the delta marker.

The command is available for the spectrogram.

Suffix:

<n>	1...4
	irrelevant
<m>	1...16
	marker
Example:	CALC:MARK2:SPEC:Y:MIN
	Activates and positions marker 2 on the minimum level of the y-axis.
Usage:	Event
Mode:	RT, SPECM

Predefined CP/ACLR Standards

Parameter	Standard
W-CDMA 3GPP FWD	W-CDMA 3.84 MHz forward
W-CDMA 3GPP REV	W-CDMA 3.84 MHz reverse
CDMA IS95A FWD	CDMA IS95A forward
CDMA IS95A REV	CDMA IS95A reverse
CDMA IS95C Class 0 FWD	CDMA IS95C Class 0 forward
CDMA IS95C Class 0 REV	CDMA IS95C Class 0 reverse
CDMA J-STD008 FWD	CDMA J-STD008 forward
CDMA J-STD008 REV	CDMA J-STD008 reverse
CDMA IS95C Class 1 FWD	CDMA IS95C Class 1 forward
CDMA IS95C Class 1 REV	CDMA IS95C Class 1 reverse
CDMA 2000	CDMA 2000
TD SCDMA FWD	TD-SCDMA forward
TD SCDMA REV	TD-SCDMA reverse
WLAN 802.11A	WLAN 802.11A
WLAN 802.11B	WLAN 802.11B
WiMAX	WiMAX
WIBRO	WIBRO
RFID 14443	RFID 14443
EUTRa	EUTRA/LTE Square
REUTra	EUTRA/LTE Square/RRC
TETRA	TETRA
PDC	PDC
PHS	PHS
CDPD	CDPD
GSM	GSM

CALCulate:MARKer:FUNCtion:STRack Subsystem

The CALCulate:MARKer<m>:FUNCtion:STRack subsystem defines the settings of the signal track.

CALCulate\<n>:MARKer\<m>:FUNCtion:STRack[:STATe] \<State>

This command switches the signal-track function on or off in the window specified by the suffix \<n>.

With signal track activated, the maximum signal is determined after each frequency sweep and the center frequency is set to the frequency of this signal. Thus with drifting signals the center frequency follows the signal.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Parameters:

\<State>	ON | OFF
	*RST: OFF
Example:	`CALC:MARK:FUNC:STR ON`
	Switches on the signal track function.
Mode:	A-F

CALCulate\<n>:MARKer\<m>:FUNCtion:STRack:BANDwidth\|BWIDth \<Bandwidth>

These commands have the same function. They define the bandwidth around the center frequency within which the largest signal is searched in the window specified by the suffix \<n>.

Entering the search bandwidth is only possible if the Signal Track function is switched on (`CALCulate<n>:MARKer<m>:FUNCtion:STRack[:STATe]` on page 516).

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Parameters:

\<Bandwidth>	10 Hz to MAX (span)
	*RST: (= span/10 on activating the function)
Example:	`CALC:MARK:FUNC:STR:BAND 1 MHZ`
	Sets the search bandwidth to 1 MHz.
	`CALC:MARK:FUNC:STR:BWID 1 MHZ`
	Alternative command for the same function.
Mode:	A-F

CALCulate\<n>:MARKer\<m>:FUNCtion:STRack:THReshold \<Value>

This command defines the threshold above which the largest signal is searched for in the window specified by the suffix \<n>.

The response unit depends on the settings defined with `CALCulate<n>:UNIT:POWer`.

Note: The entry of the search bandwidth is only possible if the Signal Track function is switched on (CALCulate<n>:MARKer<m>:FUNCtion:STRack[:STATe] on page 516).

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<Value>	-330dBm to +30dBm
	*RST: -120 dBm
Example:	CALC:MARK:FUNC:STR:THR -50DBM
	Sets the threshold for signal tracking to -50 dBm.
Mode:	A-F

CALCulate<n>:MARKer<m>:FUNCtion:STRack:TRACe <TraceNumber>

This command defines the trace on which the largest signal is searched for in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<TraceNumber>	1 to 6
	*RST: 1
Example:	CALC:MARK:FUNC:STR:TRAC 3
	Defines trace 3 as the trace for signal tracking.
Mode:	A-F

CALCulate:MARKer:FUNCtion:SUMMary Subsystem

This subsystem contains the control commands for the power functions in zero span.

CALCulate<n>:MARKer<m>:FUNCtion:MSUMmary?

The commands of this subsystem are used to determine the power of a sequence of signal pulses that have the same interval in the window specified by the suffix <n>, as for example the slots of a GSM signal typically do. The number of pulses to be measured as well as the measurement time and the period can be set. To define the position of the first pulse in the trace, a suitable offset can be entered.

The evaluation is performed on the measurement data of a previously recorded trace. The data recorded during the set measurement time is combined to a measured value for each pulse according to the detector specified and the indicated number of results is output as a list.

Trace 1 is always used by the function.
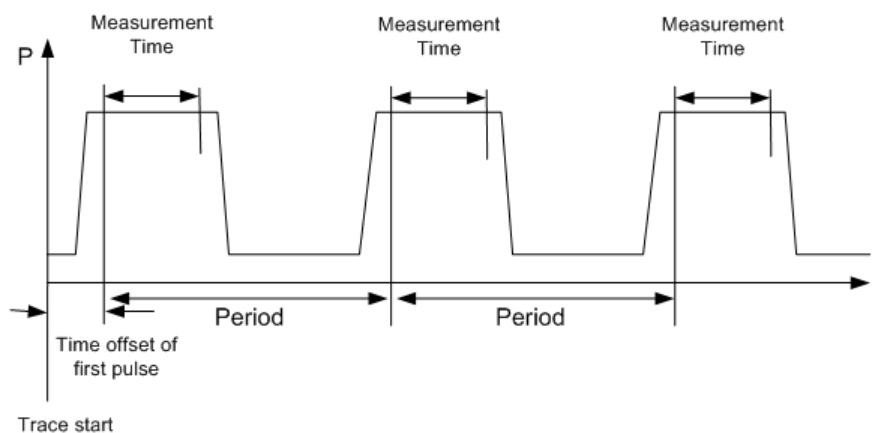
Suffix:

<n>   window; For applications that do not have more than 1 measure-
                             ment window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

                             <time offset of first pulse>, <measurement time>, <period>, < # of
                             pulses to measure>

Example: DISP:WIND:TRAC:Y:RLEV -10dBm

Sets the reference level to 10 dB

INP:ATT 30 dB

Sets the input attenuation to 30 dB

FREQ:CENT 935.2MHz;SPAN 0 Hz

Sets the receive frequency to 935.2 MHz and the span to 0 Hz

BAND:RES 1 MHz;VID 3 MHz

Sets the resolution bandwidth to 1 MHz and the video bandwidth
to 3 MHz

DET RMS

Sets the RMS detector

TRIG:SOUR VID;LEV:VID 50 PCT

Selects the trigger source VIDeo and sets the level of the video
trigger source to 50 PCT

SWE:TIME 50 ms

Sets the sweep time to 50 ms

INIT;*WAI

Starts the measurement with synchronization

CALC:MARK:FUNC:MSUM? 50US,450US,576.9US,8

Queries 8 bursts with an offset of 50 µs, a test time of 450 µs and
a period of 576.9 µs

Usage: Query only

Mode: A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary[:STATe] <State>

This command switches on or off the previously selected power measurements in zero
span in the window specified by the suffix <n>. Thus one or several measurements can
be first selected and then switched on and off together using this command.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                   ment window, the suffix <n> is irrelevant.

<m>   marker number

Parameters:

<State>   ON | OFF

                   *RST: OFF

Example: CALC:MARK:FUNC:SUMM:STAT ON

Mode: A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:AOFF

This command switches off all measurements in zero span in the window specified by
the suffix <n>.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example:	CALC:MARK:FUNC:SUMM:AOFF
	Switches off the functions for power measurement in zero span.
Usage:	Event
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:AVERage \<State>

This command switches on or off averaging for the active power measurement in zero span in the window specified by the suffix \<n>.

Averaging is reset by switching it off and on again.

The number of results required for the calculation of average is defined with [SENSe:]AVERage\<n>:COUNt.

Synchronization to the end of averaging is only possible in single sweep mode.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Parameters:

\<State>	ON | OFF
	*RST: OFF
Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:SUMM:AVER ON
	Switches on the calculation of average.
	AVER:COUN 200
	Sets the measurement counter to 200.
	INIT;*WAI
	Starts a sweep and waits for the end.
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:MEAN[:STATe] \<State>

This command switches on or off the measurement of the mean value in the window specified by the suffix \<n>.

Note: The measurement is performed on the trace on which marker 1 is positioned. In order to evaluate another trace, marker 1 must be positioned on another trace with CALCulate\<n>:MARKer\<m>:TRACe.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:FUNC:SUMM:MEAN ON
	Switches on the function.
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN:AVERage:RESult?

This command queries the result of the measurement of the averaged mean value in the window specified by the suffix <n>. The query is only possible if averaging has been activated previously using CALCulate<n>:MARKer<m>:FUNCtion:SUMMary: AVERage on page 520.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:SUMM:MEAN ON
	Switches on the function.
	CALC:MARK:FUNC:SUMM:AVER ON
	Switches on the average value calculation.
	INIT;*WAI
	Starts a sweep and waits for the end.
	CALC:MARK:FUNC:SUMM:MEAN:AVER:RES?
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN:PHOLd:RESult?

This command queries the result of the measurement of the mean value with active peak hold in the window specified by the suffix <n>. The query is only possible if the peak hold function has been switched on previously using CALCulate<n>:MARKer<m>: FUNCtion:SUMMary:PHOLd on page 523.

The query is possible only if the peak hold function is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK:FUNC:SUMM:MEAN ON`
Switches on the function.
`CALC:MARK:FUNC:SUMM:PHOL ON`
Switches on the peak value measurement.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK:FUNC:SUMM:MEAN:PHOL:RES?`
Outputs the result.

Usage: Query only

Mode: A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN:RESult?

This command queries the result of the measurement of the mean value in the window specified by the suffix <n>.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK:FUNC:SUMM:MEAN ON`
Switches on the function.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK:FUNC:SUMM:MEAN:RES?`
Outputs the result.

Usage: Query only

Mode: A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MODE <Mode>

This command selects absolute or relative power measurement in zero span in the window specified by the suffix <n>.

The reference power for relative measurement is defined with `CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:REFerence:AUTO ONCE` on page 525. If the reference power is not defined, the value 0 dBm is used.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Parameters:

<Mode>	ABSolute | RELative
	*RST: ABSolute
Example:	CALC:MARK:FUNC:SUMM:MODE REL
	Switches the power measurement in zero span to relative.
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PHOLd <State>

This command switches on or off the peak-hold function for the active power measurement in zero span in the window specified by the suffix <n>.

The peak-hold function is reset by switching it off and on again.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:FUNC:SUMM:PHOL ON
	Switches on the function.
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PPEak[:STATe] <State>

This command switches on or off the measurement of the positive peak value in the window specified by the suffix <n>.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:FUNC:SUMM:PPE ON
	Switches on the function.
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:PPEak:AVERage:RESult?

This command is used to query the result of the measurement of the averaged positive peak value in the window specified by the suffix \<n>. The query is only possible if averaging has been activated previously using CALCulate\<n>:MARKer\<m>:FUNCtion: SUMMary:AVERage on page 520.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK:FUNC:SUMM:PPE ON`
	Switches on the function.
	`CALC:MARK:FUNC:SUMM:AVER ON`
	Switches on the calculation of average.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:FUNC:SUMM:PPE:AVER:RES?`
	Outputs the result.

Usage:	Query only
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:PPEak:PHOLd:RESult?

This command is used to query the result of the measurement of the positive peak value with active peak hold function in the window specified by the suffix \<n>. The query is only possible if the peak hold function has been activated previously using CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:PHOLd on page 523.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number

Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK:FUNC:SUMM:PPE ON`
	Switches on the function.
	`CALC:MARK:FUNC:SUMM:PHOL ON`
	Switches on the measurement of the peak value.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:FUNC:SUMM:PPE:PHOL:RES?`
	Outputs the result.

Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PPEak:RESult?

This command is used to query the result of the measurement of the positive peak value in the window specified by the suffix <n>. The measurement may have to be switched on previously.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK:FUNC:SUMM:PPE ON`
	Switches on the function.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:FUNC:SUMM:PPE:RES?`
	Outputs the result.

Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:REFerence:AUTO ONCE

This command sets the currently measured average value (`CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:MEAN[:STATe]`) and RMS value (`CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:RMS[:STATe]`) as reference values for relative measurements in zero span in the window specified by the suffix <n>.

If the measurement of RMS value and average is not activated, the reference value 0 dBm is used.

If the function `CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:AVERage` or
`CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PHOLd` is switched on, the current
value is the accumulated measurement value at the time considered.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	irrelevant

Example:	`CALC:MARK:FUNC:SUMM:REF:AUTO ONCE`
	Takes the currently measured power as reference value for the relative power measurement in zero span.
Usage:	Event
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:RMS[:STATe] <State>

This command switches on or off the measurement of the effective (RMS) power in the
window specified by the suffix <n>. If necessary the function is switched on previously.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	`CALC:MARK:FUNC:SUM:RMS ON`
	Switches on the function.
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:RMS:AVERage:RESult?

This command queries the result of the measurement of the averaged RMS value in the
window specified by the suffix <n>. The query is only possible if averaging has been
activated previously using `CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:
AVERage` on page 520.

A complete sweep with synchronization to sweep end must be performed between
switching on the function and querying the measured value to obtain a correct query
result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK:FUNC:SUMM:RMS ON`
	Switches on the function.
	`CALC:MARK:FUNC:SUMM:AVER ON`
	Switches on the average value calculation.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:FUNC:SUMM:RMS:AVER:RES?`
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:RMS:PHOLd:RESult?

This command queries the result of the measurement of the RMS value with active peak hold in the window specified by the suffix \<n>. The query is only possible only if the peak hold function has been activated previously using `CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:PHOLd` on page 523.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.
\<m>	marker number
Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`CALC:MARK:FUNC:SUMM:RMS ON`
	Switches on the function.
	`CALC:MARK:FUNC:SUMM:PHOL ON`
	Switches on the peak value measurement.
	`INIT;*WAI`
	Starts a sweep and waits for the end.
	`CALC:MARK:FUNC:SUMM:RMS:PHOL:RES?`
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate\<n>:MARKer\<m>:FUNCtion:SUMMary:RMS:RESult?

This command queries the result of the measurement of the RMS power value in the window specified by the suffix \<n>.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:SUMM:RMS ON
	Switches on the function.
	INIT;*WAI
	Starts a sweep and waits for the end.
	CALC:MARK:FUNC:SUMM:RMS:RES?
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation[:STATe] <State>

This command switches on or off the measurement of the standard deviation in the window specified by the suffix <n>.

On switching on the measurement, the mean power measurement is switched on as well.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CALC:MARK:FUNC:SUMM:SDEV ON
	Switches on the measurement of the standard deviation.
Mode:	A

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation:AVERage:RESult?

This command queries the result of the averaged standard deviation determined in several sweeps in the window specified by the suffix <n>. The query is possible only if averaging is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number

Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:SUMM:SDEV ON
	Switches on the function.
	CALC:MARK:FUNC:SUMM:AVER ON
	Switches on the calculation of average.
	INIT;*WAI
	Starts a sweep and waits for the end.
	CALC:MARK:FUNC:SUMM:MEAN:SDEV:RES?
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation:PHOLd:RESult?

This command queries the maximum standard deviation value determined in several sweeps in the window specified by the suffix <n>. The query is possible only if the peak hold function is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
Example:	INIT:CONT OFF
	Switches to single sweep mode.
	CALC:MARK:FUNC:SUMM:SDEV ON
	Switches on the function.
	CALC:MARK:FUNC:SUMM:PHOL ON
	Switches on the peak value measurement.
	INIT;*WAI
	Starts a sweep and waits for the end.
	CALC:MARK:FUNC:SUMM:SDEV:PHOL:RES?
	Outputs the result.
Usage:	Query only
Mode:	A-T

CALCulate<n>:MARKer<m>:FUNCtion:SUMMary:SDEViation:RESult?

This command queries the results of the standard deviation measurement in the window specified by the suffix <n>.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.
\<m\>	marker number

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`CALC:MARK:FUNC:SUMM:SDEV ON`
Switches on the function.
`INIT;*WAI`
Starts a sweep and waits for the end.
`CALC:MARK:FUNC:SUMM:SDEV:RES?`
Outputs the result.

Usage: Query only

Mode: A-T

CALCulate:MATH Subsystem

The CALCulate:MATH subsystem allows data from the SENSe-subsystem to be processed in numeric expressions.

CALCulate\<n\>:MATH[:EXPression][:DEFine] \<Expression\>

This command defines the mathematical expression for relating traces to trace1.

Suffix:

\<n\>	irrelevant

Parameters:

\<Expression\>	(TRACe1-TRACe2) | (TRACe1-TRACe3) | (TRACe1-TRACe4) | (TRACe1-TRACe5) | (TRACe1-TRACe6)

      (TRACe1-TRACe2)
      Subtracts trace 2 from trace 1.

      (TRACe1-TRACe3)
      Subtracts trace 3 from trace 1.

      (TRACe1-TRACe4)
      Subtracts trace 4 from trace 1.

      (TRACe1-TRACe5)
      Subtracts trace 5 from trace 1.

      (TRACe1-TRACe6)
      Subtracts trace 6 from trace 1.

Example: `CALC1:MATH (TRACe1 – TRACe2)`
Selects the subtraction of trace 2 from trace 1.

Mode: A, SPECM, PHN

CALCulate\<n\>:MATH:POSition \<Position\>

This command defines the position of the result of the trace mathematics. The indication is in % of the screen height, with 100 % corresponding to the upper diagram border.

Suffix:

\<n\>   window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.

Parameters:

\<Position\>   -100PCT to 200PCT

                          *RST: 50PCT

Example: CALC:MATH:POS 50PCT

                          Sets the position to the horizontal diagram center.

Mode: A, SPECM

CALCulate\<n\>:MATH:STATe \<State\>

This command switches the mathematical relation of traces on or off.

Suffix:

\<n\>   irrelevant

Parameters:

\<State\>   ON | OFF

                          *RST: OFF

Example: CALC:MATH:STAT ON

                          Switches on the trace mathematics.

Mode: A, PHN, SPECM

CALCulate\<n\>:MATH:MODE \<Method\>

This command selects the method for the trace math calculations.

For details see "Trace Math Mode" on page 137.

Suffix:

\<n\>   irrelevant

Parameters:

\<Method\>   LINear | LOGarithmic | POWer

                          *RST: LOG

Example: CALC:MATH:MODE LIN

                          Selects linear averaging for trace math calculations.

Mode: A, SPECM

CALCulate:PMETer Subsystem (Power Sensor, R&S FSV-K9)

This subsystem controls the instrument settings for power sensor measurements. It is only available if the R&S FSV-K9 Power Sensor option is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

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

This command sets the reference value for relative measurements for the selected power sensor.

Suffix:

<n>	irrelevant
<p>	1...4 Power sensor index

Parameters:

<Value>	-200 to 200
	*RST: 0
Example:	CALC:PMET2:REL -30 Sets the reference value for relative measurements to -30 dBm for power sensor 2.
Mode:	PSM

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

This command takes the current measurement value as reference value for relative measurements for the selected power sensor.

Suffix:

<n>	irrelevant
<p>	1...4 Power sensor index
Example:	CALC:PMET2:REL:AUTO ONCE Takes the current measurement value as reference value for relative measurements for power sensor 2.
Mode:	PSM

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

This command switches between relative and absolute display of the measured power for the selected power sensor.

Suffix:

<n>	irrelevant
<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.	
Mode:	PSM	

CALCulate:PSEarch|PEAKsearch Subsystem

The CALCulate:PSEarch|PEAKsearch subsystem contains the remote commands for Spurious Emissions measurements. Both groups of commands (PSEarch and PEAKsearch) perform the same functions.

CALCulate<n>:PSEarch|PEAKsearch[:IMMediate]

This command determines the list of the subrange maximums from the existing sweep results.

Suffix:

<n>	irrelevant

Example:	`CALC:PSE`
	Starts to determine the list.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:PSEarch|PEAKsearch:AUTO <State>

This command activates or deactivates the list evaluation.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<State>	ON | OFF

	*RST:	ON
Example:	`CALC:ESP:PSE:AUTO OFF`	
	Deactivates the list evaluation.	
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA, SPECM	

CALCulate<n>:PSEarch|PEAKsearch:MARGin

This command sets the margin used for the limit check/peak search.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<Margin>	-200 to 200 dB
	*RST: 200 dB
Example:	`CALC:ESP:PSE:MARG 100`
	Sets the margin to 100 dB.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:PSEarch|PEAKsearch:PSHow

This command marks all peaks with blue squares in the diagram.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	`CALC:ESP:PSE:PSH ON`
	Marks all peaks with blue squares.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:PSEarch|PEAKsearch:SUBRanges <NumberPeaks>

This command sets the number of peaks per range that are stored in the list. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range.

Suffix:

<n>	irrelevant

Parameters:

<NumberPeaks>	1 to 50
	*RST: 25
Example:	`CALC:PSE:SUBR 10`
	Sets 10 peaks per range to be stored in the list.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate:SPECtrogram subsystem

These commands are only available if the "Spectrogram" measurements option R&S FSV-K14 is installed.

CALCulate<n>:SPECtrogram|SGRam:CLEar[:IMMediate]

This command resets the Spectrogram result display and clears the history buffer.

Suffix:

<n>	1...4 window

Example:	CALC:SPEC:CLE Resets the result display and clears the memory.
Usage:	Event
Mode:	RT, SPECM

CALCulate<n>:SPECtrogram|SGRam:COLor <color>

This command selects the color scheme of the spectrogram result display.

This command is available for analyzer-K14 only. To define the color scheme in the spectrogram of the realtime analyzer, use DISPlay:WINDow:SPECtrogram|SGRam:COLor[:STYLe] on page 556.

Suffix:

<n>	1...4 window

Parameters:

<color>	**COLor** RGB colors
	RADar black - green - white
	GRAYscale black and white
	*RST: COLor
Example:	CALC:SPEC:COL GRAY Selects black and white color scheme.
Mode:	RT, SPECM

CALCulate<n>:SPECtrogram|SGRam:CONT <boolean>

This command determines whether the results of the last measurement are deleted before starting a new measurement in single sweep mode.

Suffix:

<n>	1...4 window

Parameters:

\<boolean\>	**ON | OFF**
	*RST: OFF
Example:	INIT:CONT OFF
	Selects single sweep mode.
	INIT;*WAI
	Starts the sweep and waits for the end of the sweep.
	CALC:SPEC:CONT ON
	Repeats the single sweep measurement without deleting the results of the last measurement.
Mode:	RT, SPECM

CALCulate\<n\>:SPECtrogram\|SGRam:FRAMe:COUNt \<numeric_value\>

This command sets the number of frames to be recorded in a single sweep.

Suffix:

\<n\>	1...4
	window

Parameters:

\<numeric_value\>	The maximum number of frames depends on the .CALCulate\<n\>:SPECtrogram|SGRam:HDEPth on page 537
	Range: 1 to depends on history depth
	Increment: 1
	*RST: 1
Example:	INIT:CONT OFF
	Selects single sweep mode.
	CALC:SPEC:FRAM:COUN 200
	Sets the number of frames to 200.
Mode:	RT, SPECM

CALCulate\<n\>:SPECtrogram\|SGRam:FRAMe:SELect \<numeric_value\>

This command selects a specific frame for further analysis. The command is available only if no measurement is running or after a single sweep has ended.

Suffix:

\<n\>	1...4
	window

Parameters:

\<numeric_value\>	**\<frame_number\> (if time stamp is off)**
	Selects the frame. The range is {0...number of recorded frames-1}
	\<time\> (if time stamp is on)
	Time distance in seconds. It selects the frame that is x seconds away from frame 0.

Example:	INIT:CONT OFF
	Stop the continuous sweep.
	CALC:SPEC:FRAM:SEL -25
	Selects frame number -25.
Mode:	RT, SPECM

CALCulate<n>:SPECtrogram|SGRam:HDEPth <numeric_value>

This command sets the number of frames to be stored in the analyzer's memory.

Suffix:

<n>	1...4
	window

Parameters:

<numeric_value>	The maximum number of frames depends on the number of sweep points.
	Range: 781 to 20000
	Increment: 1
	*RST: 3000
Example:	CALC:SPEC:SPEC 1500
	Sets the history depth to 1500.
Mode:	RT, SPECM

CALCulate<n>:SPECtrogram|SGRam[:STATe] <boolean>

This command activates and deactivates the spectrogram result display.

Suffix:

<n>	1...4
	window

Parameters:

<boolean>	**ON	OFF**
	*RST: OFF
Example:	CALC:SPEC ON
	Activates the Spectrogram result display.
Mode:	RT, SPECM

CALCulate<n>:SPECtrogram|SGRam:TSTamp[:STATe] <boolean>

This command activates and deactivates the time stamp.

If the time stamp is active, some commands do not address frames as numbers, but as (relative) time values:

- CALCulate<n>:DELTamarker<m>:SPECtrogram|SGRam:FRAMe on page 435
- CALCulate<n>:MARKer<m>:SPECtrogram|SGRam:FRAMe on page 509
- CALCulate<n>:SPECtrogram|SGRam:FRAMe:SELect on page 536

Suffix:

\<n>	1...4
	window

Parameters:

\<boolean>	**ON	OFF**
	*RST: OFF
Example:	CALC:SPEC:TST ON
	Activates the time stamp.
Mode:	RT, SPECM

CALCulate\<n>:SPECtrogram|SGRam:TSTamp:DATA? \<frames>

This command queries the time stamp of the frames. All available frame results are returned via the TRACe\<n>[:DATA] command.

Suffix:

\<n>	1...4
	window

Return values:

\<numeric_value>	The return values consist of four values for each frame.
	The first value is the date of the measurement in seconds that have passed since 01.01.1970 in seconds. For a better resolution the second value shows the additional milliseconds. This value is also displayed on screen.
	These numbers are appropiate for relative uses, but you can also calculate the absolute date and time as displayed on the screen. The third and fourth value are reserved for future uses.
	If the Spectrogram is empty, the command returns '0,0,0,0'

Query parameters:

\<frames>	**CURRent**
	Returns the time stamp of the current frame.
	ALL
	Returns the time stamps of all frames. The result are sorted in descending order, beginning with the current frame.
Example:	CALC:SPEC:TST ON
	Activates the time stamp.
	CALC:SPEC:TST:DATA? ALL
	Returns the time stamp of all frames sorted in a descending order.
Usage:	Query only
Mode:	RT, SPECM

CALCulate:STATistics Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the instrument.

CALCulate<n>:STATistics:APD[:STATe] <State>

This command switches on or off the measurement of amplitude distribution (APD). On activating this function, the CCDF measurement is switched off.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                        *RST: OFF

Example: CALC:STAT:APD ON
                        Switches on the APD measurement.

Mode: A

CALCulate<n>:STATistics:CCDF[:STATe] <State>

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF). On activating this function, the APD measurement is switched off.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                        *RST: OFF

Example: CALC:STAT:CCDF ON
                        Switches on the CCDF measurement.

Mode: A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:CCDF:X<Trace> <Probability>

This command queries the results of the complementary cumulative distribution function (CCDF) for the specified probability (corresponding to the "Percent Marker" in the display, see "Percent Marker" on page 248).The suffix of X defines the trace number.

Suffix:

<n>	irrelevant
<Trace>	1...6
	trace

Parameters:

<Probability>	P0_01: Level value for 0.01 % probability
	P0_1: Level value for 0.1 % probability
	P1: Level value for 1 % probability
	P10: Level value for 10 % probability
Example:	`CALC:STAT:CCDF:X1? P10`
	Returns the level values that are over 10 % above the mean value.
Mode:	A, CDMA, EVDO, TDS

CALCulate<n>:STATistics:NSAMples <NoMeasPoints>

This command sets the number of measurement points to be acquired for the statistical measurement functions.

Suffix:

<n>	irrelevant

Parameters:

<NoMeasPoints>	100 to 1E9
	*RST: 100000
Example:	`CALC:STAT:NSAM 500`
	Sets the number of measurement points to be acquired to 500.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:PRESet

This command resets the scaling of the X and Y axes in a statistical measurement. The following values are set:

x-axis ref level:	-20 dBm
x-axis range APD:	100 dB
x-axis range CCDF:	20 dB
y-axis upper limit:	1.0
y-axis lower limit:	1E-6

Suffix:

<n>	irrelevant
Example:	`CALC:STAT:PRES`
	Resets the scaling for statistical functions
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:RESult<Trace> <ResultType>

This command reads out the results of statistical measurements of a recorded trace.
Suffix:

<n>	irrelevant
<Trace>	1...6
	trace

Parameters:

<ResultType>	MEAN | PEAK | CFACtor | ALL

MEAN
Average (=RMS) power in dBm measured during the measurement time.

PEAK
Peak power in dBm measured during the measurement time.

CFACtor
Determined CREST factor (= ratio of peak power to average power) in dB.

ALL
Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

The required result is selected via the following parameters:

Example:	CALC:STAT:RES2? ALL
	Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, CREST factor 13.69 dB
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:SCALe:AUTO ONCE

This command optimizes the level setting of the instrument depending on the measured peak power, in order to obtain maximum instrument sensitivity.

To obtain maximum resolution, the level range is set as a function of the measured spacing between peak power and the minimum power for the APD measurement and of the spacing between peak power and mean power for the CCDF measurement. In addition, the probability scale for the number of test points is adapted.

Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.
Suffix:

<n>	irrelevant
Example:	CALC:STAT:SCAL:AUTO ONCE;*WAI
	Adapts the level setting for statistical measurements.
Mode:	A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:SCALe:X:RANGe <Value>

This command defines the level range for the x-axis of the measurement diagram. The setting is identical to the level range setting defined with the `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` command.

Suffix:

<n>   irrelevant

Parameters:

<Value>   10dB to 200dB

                             *RST: 100dB
Example: CALC:STAT:SCAL:X:RANG 20dB

Mode: A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:SCALe:X:RLEVel <Value>

This command defines the reference level for the x-axis of the measurement diagram. The setting is identical to the reference level setting using the `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` command.

With the reference level offset <> 0 the indicated value range of the reference level is modified by the offset.

The unit depends on the setting performed with `CALCulate<n>:UNIT:POWer`.

Suffix:

<n>   irrelevant

Parameters:

<Value>   -120dBm to 20dBm

                             *RST: -20dBm
Example: CALC:STAT:SCAL:X:RLEV –60dBm

Mode: A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:SCALe:Y:LOWer <Value>

This command defines the lower limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Suffix:

<n>   selects the screen

Parameters:

<Value>   1E-9 to 0.1

                             *RST: 1E-6
Example: CALC:STAT:SCAL:Y:LOW 0.001

Mode: A, CDMA, EVDO, TDS, VSA, WCDMA

CALCulate<n>:STATistics:SCALe:Y:UNIT <Unit>

This command defines the scaling type of the y-axis.

Suffix:

<n>   selects the screen

Parameters:

<Unit>   PCT | ABS

                           *RST: ABS

Example: CALC:STAT:SCAL:Y:UNIT PCT

                           Sets the percentage scale.

Mode: A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:STATistics:SCALe:Y:UPPer <Value>

This command defines the upper limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Suffix:

<n>   irrelevant

Parameters:

<Value>   1E-8 to 1.0

                           *RST: 1.0

Example: CALC:STAT:Y:UPP 0.01

Mode: A, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate:THReshold Subsystem

The CALCulate:THReshold subsystem controls the threshold value for the maximum/minimum search of markers.

CALCulate<n>:THReshold <Mode>

This command defines the threshold value for the maximum/minimum search of markers with marker search functions. The associated display line is automatically switched on.

Suffix:

<n>   irrelevant

Parameters:

<Mode>   MINimum to MAXimum (depending on current unit)

                           *RST: (STATe to OFF)

Example: CALC:THR -82DBM

                           Sets the threshold value to -82 dBm.

Mode: A, ADEMOD, EVDO, SPECM, CDMA, TDS

CALCulate<n>:THReshold:STATe <State>

This command switches on or off the threshold line. The unit depends on the setting performed with `CALCulate<n>:UNIT:POWer`.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                        *RST: OFF

Example: `CALC:THR:STAT ON`
                        Switches on the threshold line.

Mode: A, ADEMOD, SPECM

CALCulate:TLINe Subsystem

The CALCulate:TLINe subsystem defines the position of the time lines.

CALCulate<n>:TLINe<Line> <Time>

This command defines the position of the time lines that mark the times.

Suffix:

<n>   irrelevant

<Line>   1 | 2
                        time line

Parameters:

<Time>   0 to 1000s

                        *RST: (STATe to OFF)

Example: `CALC:TLIN 10ms`

Mode: A-T

CALCulate<n>:TLINe<Line>:STATe <State>

This command switches the time line on or off.

Suffix:

<n>   irrelevant

<Line>   1 | 2
                        time line

Parameters:

<State>   ON | OFF

                        *RST: OFF

Example: `CALC:TLIN2:STAT ON`

Mode: A-T

CALCulate:UNIT Subsystem

The `CALCulate:UNIT` subsystem defines the units for the parameters that can be set and the measurement results.

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit for power.

The unit is defined globally for all windows.

Suffix:

<n>	irrelevant

Parameters:

<Unit>	DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere
	*RST: dBm
Example:	`CALC:UNIT:POW DBM`
	Sets the power unit to dBm.
Mode:	A, ADEMOD, BT, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

Other commands in the Calculate subsystem

CALCulate<n>:FORMat <Format>

This command defines the display type of the IQ data.

Suffix:

<n>	irrelevant

Setting parameters:

<Format>	RIMag | MAGNitude | FREQuency | VECTor
	RIMag
	IQ data
	MAGNitude
	Magnitude
	FREQuency
	Spectrum
	VECTor
	IQ-Vector
Mode:	IQ

4.2.3.3 CALibration:PMETer Subsystem (Power Sensor, R&S FSV-K9)

The CALibration:PMETer Subsystem determines the error correction data for measurements in the power meter mode. It is only available if the R&S FSV-K9 Power Sensor option is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

CALibration:PMETer<p>:ZERO:AUTO ONCE

This command starts zeroing of the selected power sensor.

Note: Before starting the zeroing process disconnect all signals from the input of the power sensor.

Suffix:

<p>	1...4
	Power sensor index

Example: CAL:PMET2:ZERO:AUTO ONCE;*WAI

Starts zeroing the power sensor 2 and delays the execution of further commands until zeroing is concluded.

Mode: PSM

4.2.3.4 DISPlay Subsystem

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

Some applications offer up to four measurement windows. For those, the suffix <1....4> for WINDow selects the measurement window. For all other applications, the suffix is irrelevant.

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

This command toggles the display of the marker table. With automatic display, the table is displayed if 2 or more markers are active.

Suffix:

<n>	irrelevant

Parameters:

<DisplayMode>   ON | OFF | AUTO

                       ON
                       Marker table is displayed.

                       OFF
                       Marker table is not displayed.

                       AUTO
                       Marker table is only displayed if 2 or more markers are active.

                       *RST: AUTO

Example: To activate the table display:
                       DISP:MTAB ON
                       To query the current state of the marker table display:
                       DISP:MTAB?

Mode: All

DISPlay[:WINDow<n>][:SUBWindow<m>]:SIZE <Size>

This command configures the measurement display.

Suffix:

<n>   1 | 2
                       window;
                       Channel and adjacent-channel power measurements: Only "1" is
                       allowed as a suffix for the window.
                       Spectrum Emission Mask and Spurious Emissions measure-
                       ments:
                       selects the window that is displayed in full size (if no suffix is
                       defined, "1" is used):
                       1: diagram/result list
                       2: marker table

<m>   1 | 2
                       selects the item in the window to be displayed in full size:
                       1: diagram
                       2: result list

Parameters:

<Size>   LARGe | SMALl

                       LARGe
                       Channel and adjacent-channel power measurements: diagram in
                       full screen.
                       Spectrum Emission Mask and Spurious Emissions
                       measurements: diagram or list in full screen, depending on the
                       value of the suffix.

                       SMALl
                       split screen (diagram and list and table)

                       *RST: SMALl

Example: DISP:SIZE LARG

Displays the measurement diagram in full screen size.

DISP:WIND1:SUBW2:SIZE LARG

Displays the result list in full screen size.

DISP:WIND2:SIZE LARG

Displays the marker table in full screen size.

Mode: all

DISPlay[:WINDow<n>]:SSELect

This command selects which window (screen) is active for applications with more than one measurement window.

Suffix:

<n>   1...4

window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

*RST: 1

Example: DISP:WIND1:SSEL

Sets the window 1 active.

Mode: all (except A)

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command switches on or off the display of the corresponding trace in the window specified by the suffix <n>. The other measurements are not aborted but continue running in the background.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t>   trace

Parameters:

<State>   ON | OFF

*RST: ON for TRACe1, OFF for TRACe2 to 6

Example: DISP:TRAC3 ON

Mode: all

DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>

This command defines the type of display and the evaluation of the traces in the window specified by the suffix <n>. WRITE corresponds to the Clr/Write mode of manual operation. The trace is switched off (= BLANK in manual operation) with DISPlay[:WINDow<n>]:TRACe<t>[:STATe].

The number of measurements for AVERage, MAXHold and MINHold is defined with the `[SENSe:]AVERage<n>:COUNt` or `[SENSe:]SWEep:COUNt` commands. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

If calculation of average values is active, selection between logarithmic and linear averaging is possible. For more detail see `[SENSe:]AVERage<n>:TYPE` on page 579.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	trace

Parameters:

<Mode>	WRITe | VIEW | AVERage | MAXHold | MINHold | BLANk
	*RST: WRITe for TRACe1, STATe OFF for TRACe2/3/4/5/6 For details on trace modes refer to chapter 3.2.8.4, "Trace Mode Overview", on page 140.

Example:	`INIT:CONT OFF`
	 Switching to single sweep mode.
	 `SWE:COUN 16`
	 Sets the number of measurements to 16.
	 `DISP:TRAC3:MODE MAXH`
	 Switches on the calculation of the maximum peak for trace 3.
	 `INIT;*WAI`
	 Starts the measurement and waits for the end of the 16 sweeps.

Mode:	all

DISPlay[:WINDow<n>]:TRACe<t>:MODE:HCONtinuous <State>

This command defines whether traces in Min Hold, Max Hold and Average mode (see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 548) are reset after a parameter is changed.

Normally, the measurement is started anew after parameter changes, before the measurement results are evaluated (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.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	trace

Parameters:

<State>	**ON** The automatic reset is switched off.
	OFF After certain parameter changes the traces are reset.
	*RST: OFF

Example:	DISP:WIND:TRAC3:MODE:HCON ON
	Switches off the reset function.
Mode:	A

DISPlay[:WINDow\<n>]:TRACe\<t>:X:SPACing \<ScalingType>

This command toggles between linear and logarithmic display of the x-axis.

Suffix:

| \<n> | window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant. |
| \<t> | irrelevant |

Parameters:

\<ScalingType>	LOGarithmic | LINear
	LOGarithmic
	Selects logarithmic scaling.
	LINear
	Selects linear scaling.
	*RST: LINear
Example:	DISP:TRAC:X:SPAC LOG
Mode:	A, ADEMOD

DISPlay[:WINDow\<n>]:TRACe\<t>:Y:SPACing \<ScalingType>

This command selects the scaling for the level display range in the window specified by the suffix \<n>.

Suffix:

| \<n> | window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant. |
| \<t> | irrelevant |

Parameters:

\<ScalingType>	LOGarithmic | LINear | LDB
	LOGarithmic
	Selects logarithmic scaling.
	LINear
	Selects linear scaling in %.
	LDB
	Selects linear scaling in dB.
	*RST: LOGarithmic
Example:	DISP:TRAC:Y:SPAC LIN
Mode:	A, ADEMOD, BT, VSA

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] <Range>

This command defines the display range of the y-axis (level axis) with logarithmic scaling (`DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 550) in the window specified by the suffix <n>.

For linear scaling, the display range is fixed and cannot be modified.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t>   irrelevant

Parameters:

<Range>   10 dB to 200 dB or value in Hz

                 *RST: 100dB
Example: `DISP:TRAC:Y 110dB`
Mode: all

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

This command defines the scale type of the y-axis (absolute or relative) in the window specified by the suffix <n>.

When `SYSTem:DISPlay:UPDate` is set to OFF, this command has no immediate effect on the screen (see `SYSTem:DISPlay:UPDate` on page 742).

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t>   irrelevant

Parameters:

<Mode>   ABSolute | RELative

                 *RST: ABS
Example: `DISP:TRAC:Y:MODE REL`
Mode: all

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <Value>

This command sets the reference level.

With the reference level offset <> 0, the indicated value range of the reference level is modified by the offset.

The unit depends on the setting defined with `CALCulate<n>:UNIT:POWer`.

Suffix:

<n>   irrelevant.

<t>   irrelevant

Parameters:

<Value>   <numeric_value>, range specified in data sheet

                        *RST: -10dBm
Example: DISP:TRAC:Y:RLEV -60dBm

Mode: A, ADEMOD, BT, CDMA, EVDO, TDS, VSA, WCDMA

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>

This command sets the reference level offset.

Suffix:

<n>   irrelevant.

<t>   irrelevant

Parameters:

<Value>   -200dB to 200dB

                        *RST: 0dB
Example: DISP:TRAC:Y:RLEV:OFFS –10dB

Mode: ALL

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

This remote command defines the position of the reference value on the Y axis (1 – 100 %) in the window specified by the suffix <n>.

When using a tracking generator (only with option R&S FSV-B9 or -B10, requires active normalization), and in Bluetooth mode (option R&S FSV-K8) this command defines the position of the reference value for all windows.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                        ment window, the suffix <n> is irrelevant.

<t>   irrelevant

Parameters:

<Position>   0 to 100PCT

                        *RST: 100 PCT = "Spectrum" mode, AF spectrum display;
                                       50 PCT = Tracking Generator mode or time display
Example: DISP:TRAC:Y:RPOS 50PCT

Mode: A, BT, CDMA, EVDO, TDS, WCDMA, ADEMOD, VSA

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

The command defines the power value assigned to the reference position in the grid.

When using a tracking generator (only with option R&S FSV-B9 or -B10), this command requires active normalization.

Suffix:

\<n\>	irrelevant
\<t\>	irrelevant

Parameters:

\<Value\>	\<numeric_value\>

	*RST: 0 dB, coupled to reference level
Example:	`DISP:TRAC:Y:RVAL -20dBm`
	(Analyzer)
	`DISP:TRAC:Y:RVAL 0`
	Sets the power value assigned to the reference position to 0 dB (tracking generator)
Mode:	A, BT, CDMA, EVDO, TDS, WCDMA, ADEMOD

DISPlay[:WINDow\<n\>]:ZOOM:AREA \<x1\>, \<y1\>, \<x2\>, \<y2\>

This command defines the area for which the display is enlarged in the specified window in zoom mode.

The query returns the currently defined coordinates as x1,y1,x2,y2.
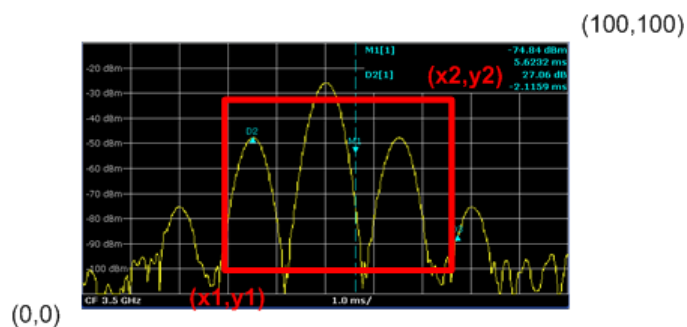
Suffix:

\<n\>	window; For applications that do not have more than 1 measurement window, the suffix \<n\> is irrelevant.

Parameters:

\<x1\>, \<y1\>, \<x2\>, \<y2\>	percentage values between 0 and 100
	The area is defined via the coordinates of the lower left (x1, y1) and top right (x2,y2) corners of a rectangle, where x and y are percentages of the complete diagram. (0,0) defines the lower left corner of the diagram area, (100,100) defines the top right corner.
Example:	`DISP:ZOOM ON`
	Activates the zoom mode.
	`DISP:ZOOM:AREA 5,30,20,100`
	Enlarges the display of the measurement results in the area defined by the coordinates (5,30) and (20,100).
Mode:	A, ADEMOD, VSA

DISPlay[:WINDow<n>]:ZOOM:STATe <State>

This command activates and deactivates the zoom mode in the window specified by the suffix <n>. When activated, the display of the measurement results is enlarged in the area specified by DISPlay[:WINDow<n>]:ZOOM:AREA on page 553.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<State>   ON | OFF

                            *RST: OFF

Example: DISP:ZOOM ON

                            Activates the zoom mode.

Mode: A, ADEMOD, VSA

4.2.3.5 DISPlay:WINDow:PSPectrum and DISPlay:WINDow:SPECtrogram Subsystems

The commands in the DISPlay:WINDow:PSPectrum and DISPlay:WINDow:SPECtrogram subsystems define the color settings of the persistence spectrum and spectrogram result display of the realtime analyzer.

DISPlay:WINDow:PSPectrum:COLor:DEFault

This command sets the color settings for the persistence spectrum result display to its default state.

Usage: Event

Mode: RT

DISPlay:WINDow:PSPectrum:COLor:LOWer <Percentage>

This command sets the lower percentage boundary of the persistence spectrum.

Parameters:

<Percentage>   Statistical frequency percentage.

Range: 0 to 66
*RST: 0
Default unit: %

Example: `DISP:WIND:HIST:COL:LOW 10`
Sets the start of the color map to 10%.

Mode: RT

DISPlay:WINDow:PSPectrum:COLor:SHAPe <Shape>

This command defines the shape and focus of the color curve for the persistence spectrum result display.

Parameters:

<Shape>   Shape of the color curve.

Range: -1 to 1
*RST: 0

Mode: RT

DISPlay:WINDow:PSPectrum:COLor[:STYLe] <ColorScheme>

This command sets the color scheme for the persistance spectrum.

Parameters:

<ColorScheme>   **HOT**

COLD

RADar

GREYscale

*RST: HOT

Example: `DISP:WIND:HIST:COL GREY`
Changes the color scheme of the persistance spectrum to black and white.

Mode: RT

DISPlay:WINDow:PSPectrum:COLor:TRUNcate <State>

This command reduces the range of the color map of the persistence spectrum if there are no hits at the start or end of the value range.

Parameters:

<State>   **ON**

OFF

*RST: OFF

Example: `DISP:WIND:PSP:COL:TRUN ON`
Activates truncation of the color map.

Mode: RT

DISPlay:WINDow:PSPectrum:COLor:UPPer <Percentage>

This command sets the upper percentage boundary of the persistence spectrum.

Parameters:

<Percentage>   Statistical frequency percentage.

                    Range: 0 to 66
                    *RST: 0
                    Default unit: %

Example: DISP:WIND:HIST:COL:UPP 95

                    Sets the start of the color map to 95%.

Mode: RT

DISPlay:WINDow:SPECtrogram|SGRam:COLor:DEFault

This command sets the color settings for the spectrogram result display to its default state.

Usage: Event

Mode: RT

DISPlay:WINDow:SPECtrogram|SGRam:COLor:LOWer <Percentage>

This command sets the lower percentage boundary of the spectrogram.

Parameters:

<Percentage>   Statistical frequency percentage.

                    Range: 0 to 66
                    *RST: 0
                    Default unit: %

Example: DISP:WIND:SPEC:COL:LOW 10

                    Sets the start of the color map to 10%.

Mode: RT

DISPlay:WINDow:SPECtrogram|SGRam:COLor:SHAPe <Shape>

This command defines the shape and focus of the color curve for the spectrogram result display.

Parameters:

<Shape>   Shape of the color curve.

                    Range: -1 to 1
                    *RST: 0

Mode: RT

DISPlay:WINDow:SPECtrogram|SGRam:COLor[:STYLe] <ColorScheme>

This command sets the color scheme for the spectrogram.

Parameters:

<ColorScheme>	**HOT**

HOT
Available in realtime mode.

COLD
Available in realtime mode.

COLor
In realtime mode, this parameter selects the HOT color scheme.
In spectrum mode, it selects the color scheme Color.

RADar

GREYscale

*RST: HOT

Example: DISP:WIND:SPEC:COL GREY
Changes the color scheme of the spectrogram to black and white.

Mode: RT, SPECM

DISPlay:WINDow:SPECtrogram|SGRam:COLor:UPPer <Percentage>

This command sets the upper percentage boundary of the spectrogram.

Parameters:

<Percentage>   Statistical frequency percentage.

Range: 0 to 66
*RST: 0
Default unit: %

Example: DISP:WIND:SPEC:COL:UPP 95
Sets the start of the color map to 95%.

Mode: RT

4.2.3.6 FETCh:PMETer Subsystem (Power Sensor, R&S FSV-K9)

The FETCh:PMETer subsystem contains commands to read measurement results of power sensor measurements without starting the measurement itself. It is only available if the R&S FSV-K9 Power Sensor option is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

FETCh<n>:PMETer<p>?

This command reads the result of the power sensor measurement for the selected power sensor. These results are also displayed in the marker table.

If no measurement has been performed, this command will lead to a query error.

Suffix:

<n>	irrelevant
<p>	1...4
	Power sensor index

Example:	`FETC:PMET2?`
	Reads the result of the power sensor measurement for the power sensor 2.
Usage:	Query only
Mode:	PSM

4.2.3.7 FORMat Subsytem

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

FORMat:DEXPort:DSEParator <Separator>

This command defines which decimal separator (decimal point or comma) is to be used for outputting measurement data to the file in ASCII format. Different languages of evaluation programs (e.g. MS-Excel) can thus be supported.

The suffix <1…4> is irrelevant, the separator is defined globally for all windows.

Parameters:

<Separator>	POINt | COMMA	
	*RST:	(factory setting is POINt; *RST does not affect setting)
Example:	`FORM:DEXP:DSEP POIN`	
	Sets the decimal point as separator.	
Mode:	all	

4.2.3.8 INITiate Subsystem

The INITiate subsystem is used to control the init-measurement function.

INITiate<n>[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command *OPC, *OPC? or *WAI. In continuous-sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

Suffix:

<n>	irrelevant

Example:	INIT:CONT OFF
	Switches to single sweep mode.
	DISP:WIND:TRAC:MODE AVER
	Switches on trace averaging.
	SWE:COUN 20
	Setting the sweep counter to 20 sweeps.
	INIT;*WAI
	Starts the measurement and waits for the end of the 20 sweeps.
Mode:	all

INITiate<n>:CONMeas

This command continues a stopped measurement at the current position in single sweep mode. The function is useful especially for trace functions MAXHold, MINHold and AVERage, if the previous results are not to be cleared with sweep count > 0 or average count > 0 on restarting the measurement (INIT:IMMediate resets the previous results on restarting the measurement).

The single sweep mode is automatically switched on. Synchronization to the end of the indicated number of measurements can then be performed with the commands *OPC, *OPC? or *WAI. In the continuous sweep mode, synchronization to the sweep end is not possible since the overall measurement "never" ends.

Suffix:

<n>	irrelevant

Example:	INIT:CONT OFF
	Switches to single sweep mode.
	DISP:WIND:TRAC:MODE AVER
	Switches on trace averaging.
	SWE:COUN 20
	Setting the sweep counter to 20 sweeps.
	INIT;*WAI
	Starts the measurement and waits for the end of the 20 sweeps.
	INIT:CONM;*WAI
	Continues the measurement (next 20 sequences) and waits for the end.
Mode:	A, ADEMOD, CDMA, EVDO, VSA, WCDMA, TDS

INITiate<n>:CONTinuous <State>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

In the **"Spectrum" mode**, this setting refers to the sweep sequence (switching between continuous/single sweep).

Suffix:

<n>	irrelevant

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	INIT:CONT OFF
	Switches the sequence to single sweep.
	INIT:CONT ON
	Switches the sequence to continuous sweep.
Mode:	all

INITiate<n>:DISPlay <State>

This command switches the display during a single sweep measurement on (ON) or off (OFF).

Suffix:

<n>	irrelevant

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	INIT:CONT OFF
	Switches to single sweep mode
	INIT:DISP OFF
	Sets the display behavior to OFF
	INIT;*WAI
	Starts the measurement with display switched off.
Mode:	A

INITiate<n>:ESPectrum

This command starts a Spectrum Emission Mask measurement.

Suffix:

<n>	irrelevant
Example:	INIT:ESP
	Starts a Spectrum Emission Mask measurement.
Mode:	A, CDMA, EVDO, TDS, WCDMA

INITiate<n>:SPURious

This command starts a Spurious Emissions measurement.

Suffix:

<n>   irrelevant

Example: INIT:SPUR

Starts a Spurious Emissions measurement.

Usage: Event

Mode: A

4.2.3.9   INPut Subsystem

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

INPut:ATTenuation <Value>

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the DOWN command.

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

In the default state with "Spectrum" mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Parameters:

<Value>   <numeric_value> in dB; range specified in data sheet

*RST: 10 dB (AUTO is set to ON)

Example:	INP:ATT 30dB
	Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.
Mode:	all

INPut:ATTenuation:AUTO <State>

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	INP:ATT:AUTO ON
	Couples the attenuation set on the attenuator to the reference level.
Mode:	All

INPut:COUPling <CouplingType>

Toggles the RF input of the analyzer between AC and DC coupling.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Parameters:

<CouplingType>	AC | DC
	*RST: AC
Example:	INP:COUP:DC
Mode:	A, ADEMOD, BTS, CDMA, EVDO, TDS, VSA, WCDMA

INPut:DIQ:CDEVice

This command queries the current configuration and the status of the digital baseband input from the optional Digital Baseband interface (option R&S FSV-B17).

For details see the section "Interface Status Information" for the Digital Baseband Interface (R&S FSV-B17) in the description of the base unit.

Return values:

<ConnState>	Defines whether a device is connected or not.
	0
	No device is connected.
	1
	A device is connected.
<DeviceName>	Device ID of the connected device
<SerialNumber>	Serial number of the connected device

<PortName>	Port name used by the connected device
<SampleRate>	Maximum or currently used sampling 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 sampling rate is displayed
	1
	Current sampling rate is displayed
<Placeholder>	for future use; currently "0"
Example:	`INP:DIQ:CDEV?`
	Result:
	`1,SMU200A,103634,Out`
	`A,70000000,100000000,Passed,Not Started,0,0`
Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS

INPut:DIQ:RANGe:COUPling <State>

If enabled, the reference level for digital input is adjusted to the full scale level automatically if the fullscale level changes.

(See the Auto Level softkey).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<State>	ON | OFF

	*RST:	OFF
Example:	INP:DIQ:RANG:COUP OFF	
Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS	

INPut:DIQ:RANGe[:UPPer] <Level>

Defines the level that should correspond to an I/Q sample with the magnitude "1".

It can be defined either in dBm or Volt (see "Full Scale Level" on page 273).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see chapter 3.7.5, "Interface Status Information", on page 338.

Parameters:

<Level>	<numeric value>

	Range:	70.711 nV to 7.071 V
	*RST:	1 V
Example:	INP:DIQ:RANG 1V	
Mode:	A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN	

INPut:DIQ:RANGe[:UPPer]:UNIT <Unit>

Defines the unit of the full scale level (see "Level Unit" on page 273). The availability of units depends on the measurement application you are using.

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<Level>	V | dBm | dBpW | W | dBmV | dBuV | dBuA | A

	*RST:	Volt
Example:	INP:DIQ:RANG:UNIT A	
Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS	

INPut:DIQ:SRATe <SampleRate>

This command specifies the sample rate of the digital baseband IQ input signal (see "Input Sample Rate" on page 273).

Note: the final user sample rate of the analyzer may differ and is defined using TRAC:IQ:SRAT (see TRACe<n>:IQ:SRATe on page 688).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<SampleRate>

	Range:	1 Hz to 10 GHz
	*RST:	32 MHz

Example: INP:DIQ:SRAT 200 MHz

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

INPut:EATT <Attenuation>

Requires option R&S FSV-B25.

Switches the electronic attenuator on (if not already active) and allows the attenuation of the electronic attenuator to be set.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

The attenuation can be varied in 1 dB steps from 0 to 25 dB. Other entries are rounded to the next lower integer value.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Parameters:

<Attenuation>   0...25

	*RST:	0 dB (OFF)

Example: INP1:EATT 10 dB

Mode: all

INPut:EATT:AUTO <State>

Switches the automatic behaviour of the electronic attenuator on or off. If activated, electronic attenuation is used to reduce the operation of the mechanical attenuation whenever possible.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State>   ON | OFF

	*RST:	ON

Example: INP1:EATT:AUTO OFF

Mode: all

INPut:EATT:STATe <State>

Switches the electronic attenuator on or off.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	INP:EATT:STAT ON
	Switches the electronic attenuator into the signal path.
Mode:	all

INPut:GAIN:STATe <State>

This command switches the preamplifier on or off (only for option RF Preamplifier, R&S FSV-B22/B24).

With option R&S FSV-B22, the preamplifier only has an effect below 7 GHz.

With option R&S FSV-B24, the amplifier applies to the entire frequency range.

This command is not available when using Digital Baseband Interface (R&S FSV-B17).

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	INP:GAIN:STAT ON
	Switches on 20 dB preamplification.
Mode:	A, ADEMOD, BT, CDMA, EVDO, NF, PHN, WCDMA, GSM, VSA, TDS

INPut:IMPedance <Value>

This command sets the nominal input impedance of the instrument. The set impedance is taken into account in all level indications of results.

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

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Parameters:

<Value>	50 | 75
	*RST: 50 Ω
Example:	INP:IMP 75
Mode:	all

INPut:SELect <Source>

This command selects the signal source for measurements.

Parameters:

<Source> RF | DIQ

RF
Radio Frequency ("RF INPUT" connector)

DIQ
Baseband Digital (IQ) (only available with Digital Baseband Interface, option R&S FSV-B17)

*RST: RF

Example: INP:SEL RF

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

INPut:UPORt[:VALue]?

This command queries the control lines of the user ports.

Example: INP:UPOR?

Usage: Query only

Mode: all

INPut:UPORt:STATe <State>

This command toggles the control lines of the user ports between INPut and OUTPut. With ON, the user port is switched to INPut, with OFF to OUTPut.

Parameters:

<State> ON | OFF

*RST: ON

Example: INP:UPOR:STAT ON

Mode: all

4.2.3.10 INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

INSTrument[:SELect] <Mode> | <ChannelName>

This command selects the measurement mode by means of text parameters.

In case you are working with more than one spectrum display, the command also selects the spectrum display (or channel) you need.

Also see

- Remote program example: chapter 4.3.16, "Usage of Four Spectrum Instances", on page 818

Parameters:

<Mode>   **SANalyzer**
                           Spectrum mode

                           Spectrum 2 | Spectrum 3 | Spectrum 4
                           Selects one of the additional spectrum displays. The first spectrum display is always active. You can select it with SANalyzer.
                           A spectrum display must exist in order to be able to select it.

                           ADEMod
                           Analog demodulation mode
                           (Analog Demodulation option, R&S FSV-K7)

                           SFM
                           FM Stereo (R&S FSV–K7S option)

                           BTOoth
                           Bluetooth mode (R&S FSV-K8 option)

                           MGSM
                           GSM mode (R&S FSV-K10 option)

                           NOISe
                           Noise Figure Measurements option, R&S FSV-K30

                           PNOise
                           Phase Noise mode (R&S FSV-K40 option)

                           DDEM
                           VSA mode (R&S FSV-K70 option)

                           BWCD
                           3G FDD BTS Mode (R&S FSV-K72 option)

                           MWCD
                           3G FDD UE Mode (R&S FSV-K73 option)

                           BTDS
                           TD-SCDMA BTS mode (R&S FSV-K76 option)

                           MTDS
                           TD-SCDMA UE mode (R&S FSV-K77 option)

                           BC2K
                           CDMA2000 BS Analysis mode (R&S FSV-K82 option)

                           BDO
                           1xEV-DO BS Analysis option, R&S FSV-K84

                           WLAN
                           WLAN TX mode (R&S FSV-K91/91n option)

                           WiMAX
                           WiMax mode (WiMAX 802.16 OFDM Measurements option and WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

                           *RST: SANalyzer

Example:	INST SAN
	Switches the instrument to "Spectrum" mode.
Usage:	SCPI conform
Mode:	all

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds an additional spectrum display. You can add up to three additional spectrum displays.

Also see

- INSTrument[:SELect] on page 567
- INSTrument:DELete on page 569
- Remote program example: chapter 4.3.16, "Usage of Four Spectrum Instances", on page 818
-

Parameters:

<ChannelType>	**SANalyzer**
	The channel type is always SANalyzer to indicate that you add a new spectrum display.
<ChannelName>	Sets the name of the additional spectrum display.
	Spectrum 2 | Spectrum 3 | Spectrum 4
	The names of the spectrum displays you add have to be Spectrum 2 for the second spectrum display, Spectrum 3 for the third and Spectrum 4 for the fourth.
Example:	INST:CRE SAN, Spectrum 2
	Adds a second spectrum display.
Mode:	A

INSTrument:DELete <ChannelName>

This command deletes a spectrum display.

Also see

- INSTrument:CREate[:NEW] on page 569
- Remote program example: chapter 4.3.16, "Usage of Four Spectrum Instances", on page 818

Parameters:

<ChannelName>	Selects the spectrum display you want to delete.
	Spectrum 2 | Spectrum 3 | Spectrum 4
	A spectrum display must exist in order to be able delete it.
Example:	INST:DEL Spectrum 4
	Deletes the fourth spectrum display.
Mode:	A

INSTrument:NSELect <Mode>

This command selects the operating mode by means of numbers.

Parameters:

<Mode>　　　　　　　Selects the operating with numbers.

1

Spectrum mode

2

VSA mode (R&S FSV-K70 option)

3

Analog demodulation mode

5

GSM mode (R&S FSV-K10 option)

6

Selects WiMax mode (WiMAX IEEE 802.16 OFDM, OFDMA
Measurements option, R&S FSV-K93)

7

FM Stereo (R&S FSV–K7S option)

8

3G FDD BTS Mode (R&S FSV-K72 option)

9

3G FDD UE Mode (R&S FSV-K73 option)

10

CDMA2000 BS Analysis mode (R&S FSV-K82 option)

12

Bluetooth mode (R&S FSV-K8 option)

14

1xEV-DO BS Analysis mode (R&S FSV-K84 option)

16

Selects WLAN TX mode (R&S FSV-K91/91n option)

17

TD-SCDMA BTS mode (R&S FSV-K76 option)

18

TD-SCDMA UE mode (R&S FSV-K77 option)

19

Noise Figure mode (R&S FSV-K30 option)

20

Phase Noise mode ((R&S FSV-K40 option)

23

Selects WiMax mode (WiMAX 802.16 OFDM Measurements
option, R&S FSV-K93

*RST:　　　　1
The parameters of the other measurement modes are included in
the option descriptions.

Example:	INST:NSEL 1
	Switches the instrument to "Spectrum" mode.
Usage:	SCPI conform
Mode:	all

4.2.3.11 MMEMory Subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings.

For detailed information on the MMemory subsystem, see chapter 4.2.4.7, "MMEMory Subsystem", on page 717.

MMEMory:STORe\<n>:LIST \<FileName>

This command stores the current list evaluation results in a `<file name>.dat` file. The file consists of a data section containing the list evaluation results.

Suffix:

\<n>	irrelevant

Parameters:

\<FileName>	\<file name>

Example:	MMEM:STOR:LIST 'test'
	Stores the current list evaluation results in the `test.dat` file.
Mode:	A, ADEMOD, CDMA, EVDO, NF, TDS, WCDMA

MMEMory:STORe\<n>:PEAK \<FileName

This command stores the current marker peak list in the specified window in a *.dat file. The file consists of a data section containing the peak list.

Suffix:

\<n>	window; For applications that do not have more than 1 measurement window, the suffix \<n> is irrelevant.

Parameters:

\<FileName>	DOS file name without extension
	The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example:	MMEM:STOR:PEAK 'test'
	Saves the current marker peak list in the file `test.dat`.
Usage:	Event
Mode:	all

MMEMory:STORe<n>:SPURious <FileName>

Saves the marker peak list for Spurious Emissions measurements in the defined file name.

Suffix:

<n>	irrelevant

Parameters:

<FileName>	<file_name>
	<file_name>
	DOS file name without extension
	The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example:	`MMEM:STOR:SPUR 'test'`
	Saves the current marker peak list in the file test.dat.

Usage:	Event
Mode:	all

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command stores the selected trace in the specified window in a file with ASCII format. The file format is described in chapter 3.2.8.7, "ASCII File Export Format", on page 144

The decimal separator (decimal point or comma) for floating-point numerals contained in the file is defined with the `FORMat:DEXPort:DSEParator` command (see `FORMat:DEXPort:DSEParator` on page 558).

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<Trace>	1 to 6
	selected measurement trace
<FileName>	DOS file name
	The file name includes indication of the path and the drive name. Indication of the path complies with DOS conventions.

Example:	`MMEM:STOR:TRAC 3,'TEST.ASC'`
	Stores trace 3 in the file TEST.ASC.

Mode:	all

4.2.3.12 OUTPut Subsystem

The OUTPut subsystem controls the output-related features of the instrument.

OUTPut:DIQ <State>

If enabled, the captured IQ data is output to the Digital Baseband interface in a continuous stream. This function requires the LVDS interface option (R&S FSV-B17).

Digital input and digital output cannot be used simultaneously.

Parameters:

<State>	**ON	OFF**
	*RST: OFF
Example:	OUTP:DIQ ON
Mode:	ADEMOD, IQ, VSA

OUTPut:DIQ:CDEVice

This command queries the current configuration and the status of the digital baseband output to the optional Digital Baseband interface (option R&S FSV-B17).

For details see the Digital Baseband Interface description for the base unit.

Return values:

<ConnState>	Defines whether a device is connected or not.
	0
	No device is connected.
	1
	A device is connected.
<DeviceName>	Device ID of the connected device
<SerialNumber>	Serial number of the connected device
<PortName>	Port name used by the connected device
<NotUsed>	to be ignored
<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**
<NotUsed>	to be ignored
<Placeholder>	for future use; currently "0"
Example:	OUTP:DIQ:CDEV? Result: 1,SMU200A,103634,Out A,70000000,100000000,Passed,Not Started,0,0
Mode:	IQ, VSA

OUTPut[:STATe] <State>

This command switches the selected tracking generator on or off.

this command is only available if analyzer option Tracking Generator (R&S FSV-B9) or External Tracking Generator (R&S FSV-B10) is installed.

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	OUTP1 ON Switches on the external tracking generator 1.
Usage:	SCPI conform
Mode:	A

OUTPut:UPORt[:VALue] <Value>

This command sets the control lines of the user ports.

The user port is written to with the given binary pattern.

Parameters:

<Value>	#B00000000 to #B00111111
Example:	OUTP:UPOR #B00100101
Mode:	all

OUTPut:UPORt:STATe <State>

This command switches the control line of the user ports between INPut and OUTPut. The user port is switched to OUTPut with parameter ON, to INPut with OFF.

Parameters:

\<State>	ON | OFF

	*RST: OFF
Example:	`OUTP:UPOR:STAT ON`
Mode:	all

4.2.3.13   READ:PMETer Subsystem

This subsystem contains commands to start power sensor measurements and to read the results after the measurement is concluded. It is only available if the R&S FSV-K9 Power Sensor option is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

READ\<n>:PMETer\<p>?

This command starts a power sensor measurement and reads the result for the selected power sensor after the measurement is concluded. These results are also displayed in the marker table.

Suffix:

\<n>	irrelevant
\<p>	1...4
	Power sensor index
Example:	`READ:PMET3?`
	Starts a measurement and reads the result.
Usage:	Query only
Mode:	PSM

4.2.3.14   SENSe Subsystem

The SENSe subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSe" is optional for this reason, which means that it is not necessary to include the SENSe node in command sequences.

SENSe:ADJust Subsystem

The ADJust subsystem controls automatic definition of frequency and level settings.

[SENSe:]ADJust:ALL

Activates all automatic settings:

● Frequency

● Level

Example: ADJ:ALL

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

[SENSe:]ADJust:FREQuency

Defines the center frequency automatically by determining the highest level in the frequency span.

Example: ADJ:FREQ

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

[SENSe:]ADJust:LEVel

This command automatically sets the optimal reference level for the current measurement.

Example: ADJ:LEV

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

[SENSe:]ADJust:CONFigure:LEVel:DURation <Duration>

Defines the duration of the level measurement used to determine the optimal reference level automatically (for `SENS:ADJ:LEV ON`).

Parameters:

<Duration>   <numeric value> in seconds

                        Range: 0.001 to 16000.0
                        *RST: 0.001
                        Default unit: s

Example: `ADJ:CONF:LEV:DUR:5`

Mode: A, ADEMOD, CDMA, EVDO, TDS, VSA, WCDMA

[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

Defines whether the duration of the level measurement used to determine the optimal reference level (for `SENS:ADJ:LEV`) is determined automatically or if the value defined via [SENSe:]ADJust:CONFigure:LEVel:DURation is used.

Parameters:

<Mode>   AUTO | MANual

                       *RST: AUTO

Example: `ADJ:CONF:LEV:DUR:MODE MAN`
                       Specifies manual definition of the measurement duration.
                       `ADJ:CONF:LEV:DUR:5`
                       Specifies the duration manually.

Mode: A, CDMA, EVDO, TDS, VSA, WCDMA

SENSe:AVERage Subsystem

The SENSe:AVERage subsystem calculates the average of the acquired data. A new test result is obtained from several successive measurements.

There are two types of average calculation: logarithmic and linear. In case of logarithmic average calculation (denoted with VIDeo), the average value of the measured logarithmic power is calculated and in case of linear average calculation, the linear power is averaged before the logarithm is applied.

[SENSe:]AVERage<n>[:STATe<Trace>] <State>

This command switches on or off the average calculation for the selected trace in the window specified by the AVERage<n> suffix.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<Trace>	1...6 trace

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	AVER OFF Switches off the average calculation for trace 1. AVER:STAT3 ON Switches on the average calculation for trace 3.
Mode:	all

[SENSe:]AVERage<n>:COUNt <NoMeasurements>

This command defines the number of measurements which contribute to the average value in the window specified by the AVERage<n> suffix.

Note that continuous averaging is performed after the indicated number has been reached in continuous sweep mode.

In single sweep mode, the sweep is stopped as soon as the indicated number of measurements (sweeps) is reached. Synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

This command has the same effect as the [SENSe<source>:]SWEep:COUNt command. In both cases, the number of measurements is defined whether the average calculation is active or not.

The number of measurements applies to all traces in the window.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<NoMeasurements>	0 to 32767
	*RST: 0
Example:	SWE:CONT OFF Switching to single sweep mode. AVER:COUN 16 Sets the number of measurements to 16. AVER:STAT ON Switches on the calculation of average. INIT;*WAI Starts the measurement and waits for the end of the 16 sweeps.
Mode:	all

[SENSe:]AVERage<n>:TYPE <FunctionType>

This command selects the type of average function in the window specified by the AVERage<n> suffix.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<FunctionType>   VIDeo | LINear | POWer

VIDeo
The logarithmic power values are averaged.

LINear
The power values are averaged before they are converted to logarithmic values.

POWer
The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

*RST: VIDeo

Example: `AVER:TYPE LIN`
Switches to linear average calculation.

Mode: A, ADEMOD, BT, WCDMA

SENSe:BANDwidth Subsystem

This subsystem controls the setting of the instruments filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

[SENSe:]BANDwidth|BWIDth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth.

The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121.

If the resolution bandwidth is modified, the coupling to the span is automatically switched off.

Parameters:

<Bandwidth>	refer to data sheet

                                      *RST: (AUTO is set to ON)

Example: `BAND 1 MHz`
Sets the resolution bandwidth to 1 MHz

Mode: all, except ADEMOD

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO <State>

This command either automatically couples the resolution bandwidth of the instrument to the span or cancels the coupling.

The automatic coupling adapts the resolution bandwidth to the currently set frequency span according to the relationship between frequency span and resolution bandwidth. The 6 dB bandwidths 200 Hz, 9 kHz and 120 kHz and the channel filters available are not set by the automatic coupling.

The ratio resolution bandwidth/span can be modified with the `[SENSe:]BANDwidth|BWIDth[:RESolution]:RATio` command.

Parameters:

<State>	ON	OFF

                                      *RST: ON

Example: `BAND:AUTO OFF`
Switches off the coupling of the resolution bandwidth to the span.

Mode: A-F, BT, CDMA, EVDO, TDS, WCDMA

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT <FilterMode>

Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

This command is only available when using the sweep type "FFT".

Parameters:

<FilterMode>	WIDE	AUTO	NARRow

                                      WIDE
The FFT filters with the wider partial span are used.

                                      AUTO
The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

                                      NARRow
The FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

                                      *RST: AUTO

Example: `BAND:TYPE FFT`
Select FFT filter.

Example:	BAND:FFT NARR
	Select narrow partial span for FFT filter.
Mode:	all, except ADEMOD

[SENSe:]BANDwidth|BWIDth[:RESolution]:RATio <Ratio>

This command defines the ratio resolution bandwidth (Hz)/span (Hz). The ratio to be entered is reciprocal to the ratio span/RBW used in manual operation.

Parameters:

<Ratio>	0.0001 to 1
	*RST: 0.01
Example:	BAND:RAT 0.1
Mode:	A, BT, CDMA, EVDO, TDS, WCDMA

[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE <FilterType>

This command switches the filter type for the resolution bandwidth.

For detailed information on filters see chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121 and chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122.

When changing the filter type, the next larger filter bandwidth is selected if the same filter bandwidth is not available for the new filter type.

5 Pole filters are not available when using the sweep type "FFT".

Parameters:

<FilterType>	**NORMal**
	Gaussian filters
	FFT
	FFT filters
	CFILter
	channel filters
	RRC
	RRC filters
	PULSe
	EMI (6dB) filters
	P5
	5 Pole filters
	*RST: NORMal
Example:	BAND:TYPE NORM
Mode:	all, except ADEMOD

[SENSe:]BANDwidth|BWIDth:VIDeo <Bandwidth>

This command defines the instruments video bandwidth. The available video bandwidths are specified in the data sheet.

The command is not available if FFT filtering is switched on and the set bandwidth is ≤ 30 kHz or if the quasi-peak detector is switched on.

Parameters:

<Bandwidth>   refer to data sheet

                       *RST: (AUTO is set to ON)
Example: BAND:VID 10 kHz

Mode: A, CDMA, EVDO, TDS, WCDMA

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO <State>

This command either automatically couples the instruments video bandwidth to the resolution bandwidth or cancels the coupling.

The ratio video bandwidth/resolution bandwidth can be modified with the [SENSe:]BANDwidth|BWIDth[:RESolution]:RATio command.

Parameters:

<State>   ON | OFF

                       *RST: ON
Example: BAND:VID:AUTO OFF

Mode: A, CDMA, EVDO, TDS, WCDMA

[SENSe:]BANDwidth|BWIDth:VIDeo:RATio <Ratio>

This command defines the ratio video bandwidth (Hz)/resolution bandwidth (Hz). The ratio to be entered is reciprocal to the ratio RBW/VBW used in manual operation.

Parameters:

<Ratio>   0.01 to 1000

                       *RST: 3
Example: BAND:VID:RAT 3
                       Sets the coupling of video bandwidth to video bandwidth = 3*resolution bandwidth

Mode: A, CDMA, EVDO, TDS, WCDMA

[SENSe:]BANDwidth|BWIDth:VIDeo:TYPE <Mode>

This command selects the position of the video filter in the signal path, provided that the resolution bandwidth is ≤100 kHz.

The essential difference between the two modes is the transient response at falling signal edges: If LINear is selected, the measurement with logarithmic level scaling yields a much "flatter" falling edge than LOGarithmic. This behavior is due to the conversion of linear power into logarithmic level. If the linear power is halved, the level decreases by only 3 dB.

Parameters:

<Mode>	LOGarithmic | LINear

LINear
The video filter is connected ahead of the logarithmic amplifier (default).

LOGarithmic
The video filter follows the logarithmic amplifier

	*RST:	LIN
Example:	BAND:VID:TYPE LIN	
	Video filter ahead of the logarithmic amplifier	
Mode:	A, CDMA, EVDO, TDS, WCDMA	

SENSe:CORRection Subsystem

This subsystem controls calibration and normalization during operation with the tracking generator (only with analyzer option B9 or B10). Furthermore, configuration of conversion loss tables for external mixers (option B21) is performed using these commands.

[SENSe:]CORRection[:STATe]

This command activates/deactivates the normalization of the measurement results provided that a tracking generator is active. The command is available only after acquisition of a reference trace for the selected type of measurement (transmission/reflection, see [SENSe:]CORRection:COLLect[:ACQuire] on page 584 command).

This command is only available with option B9 or B10 installed.

Parameters:

      ON | OFF

	*RST: OFF
Example:	CORR ON
	Activates normalization.
Usage:	SCPI conform
Mode:	A

[SENSe:]CORRection:COLLect[:ACQuire] <MeasType>

When the tracking generator is active, this command determines the type of result acquisition for the normalization reference measurement and starts the measurement selected.

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 with option B9 or B10 installed.

Parameters:

<MeasType>	THRough	OPEN
	THRough
	"TRANsmission" mode: calibration with direct connection between tracking 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: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 conform
Mode:	A

[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.

Example:	CORR:CVL:CAT?
Usage:	Query only
Mode:	all

[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'

Mode: all

[SENSe:]CORRection:CVL:MIXer <Type>

This command defines the mixer name in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

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'

Mode: all

[SENSe:]CORRection:CVL:SNUMber <SerialNo>

This command defines the serial number of the mixer in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<SerialNo>   '<string>'

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'

Mode: all

[SENSe:]CORRection:CVL:BAND <Type>

This command defines the waveguide band in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Band>	A | Q | U | V | E | W | F | D | G | Y | J | USER
	Standard waveguide band or user-defined band.
	*RST: F (90 GHz - 140 GHz)
Example:	CORR:CVL:SEL 'LOSS_TAB_4'
	Selects the conversion loss table.
	CORR:CVL:BAND A
	Sets the band to A (26.5 GHz - 40 GHz).
Mode:	all

[SENSe:]CORRection:CVL:HARMonic <HarmOrder>

This command defines the harmonic order used in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

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
Mode:	all

[SENSe:]CORRection:CVL:PORTs <PortNo>

This command defines the mixer type in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

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
Mode:	all

[SENSe:]CORRection:CVL:BIAS <BiasSetting>

This command defines the bias setting in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<BiasSetting>

*RST:	0.0 A

Default unit: A

Example: CORR:CVL:SEL 'LOSS_TAB_4'

Selects the conversion loss table.

CORR:CVL:BIAS 3A

Mode: all

[SENSe:]CORRection:CVL:COMMent <Text>

This command defines a comment in the conversion loss table. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Text>   <string> with a maximum of 60 characters

Example: CORR:CVL:SEL 'LOSS_TAB_4'

Selects the conversion loss table.

CORR:CVL:COMM 'Conversion loss table for FS_Z60'

Mode: all

[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 pairs of frequency/level may be entered. Before this command can be performed, the conversion loss table must be selected (see [SENSe:]CORRection:CVL:SELect on page 585).

This command is only available with option B21 (External Mixer) installed.

Parameters:

<Freq>   The frequencies have to be sent in ascending order.

Example: CORR:CVL:SEL 'LOSS_TAB_4'

Selects the conversion loss table.

CORR:CVL:DATA 1MHZ,-30DB,2MHZ,-40DB

Mode: all

[SENSe:]CORRection:CVL:CLEar

This 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 585).

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

Mode: all

[SENSe:]CORRection:EGAin:INPut[:MAGNitude]

This command makes an external gain known to the analyzer, which will take it into account during the display of measurement results. With this function the gain of an antenna or of an external preamplifier can be taken into account for the measurement values.

This command is only available with option K8, B9 or B10 installed.

Parameters:

-200...200dB

*RST: 0 dB

Example: CORR:EGA:INP 10DB
Takes 10 dB external gain into account.

Mode: A, BT

[SENSe:]CORRection:METHod

This command selects the type of measurement with active tracking generator (transmission/reflection).

This command is only available with option B9 or B10 installed.

Parameters:

TRANsmission | REFLection

*RST: TRANsmission

Example: CORR:METH TRAN
Sets the type of measurement to "transmission".

Mode: A

[SENSe:]CORRection:RECall

This command restores the instrument setting that was applied to the measurement of the reference data, provided that the tracking generator is active.

This command is only available with option B9 or B10 installed.

Example: CORR:REC

Usage: Event
SCPI conform

Mode: A

[SENSe:]CORRection:TRANsducer:GENerator <Name>

This command uses the normalized measurement data to generate a transducer factor with up to 625 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 of the `[SENSe<source>:]CORRection:TRANsducer` subsystem (see `[SENSe:]CORRection:TRANsducer:DELete` on page 731).

This command is only available if the analyzer option B10 (External Tracking Generator) is installed and normalization is switched on.

Parameters:

<Name>	'<name>

Example:	CORR:TRAN:GEN 'SMU01'
	Creates the transducer file `C:\r_s\instr\trd\SMU01.trd`.
Usage:	SCPI conform
Mode:	A

SENSe:ESPectrum Subsystem

The `SENSe:ESPectrum` subsystem contains the remote commands to configure Spectrum Emission Mask (SEM) measurements.

[SENSe:]ESPectrum:BWID <Bandwidth>

This command defines the bandwidth used for measuring the channel power (reference range). This setting takes only effect if channel power is selected as power reference type (see `[SENSe:]ESPectrum:RTYPe` on page 600).

Parameters:

<Bandwidth>	minimum span ≤ value ≤ span of reference range
	*RST: 3.84 MHz
Example:	`ESP:RTYP CPOW`
	Sets the power reference type to channel power.
	`ESP:BWID 1 MHZ`
	Sets the Tx bandwidth to 1 MHz.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:FILTer[:RRC][:STATe] <State>

This command activates or deactivates the use of an RRC filter. This setting only takes effect if channel power is selected as power reference type (see `[SENSe:]ESPectrum:RTYPe` on page 600).

Parameters:

<State>	ON	OFF
	*RST: ON
Example:	`ESP:RTYP CPOW`
	Sets the power reference type to channel power.
	`ESP:FILT OFF`
	Deactivates the use of an RRC filter.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:FILTer[:RRC]:ALPHa <Value>

This command sets the alpha value of the RRC filter. This setting takes only effect if channel power is selected as power reference type (`[SENSe:]ESPectrum:RTYPe` command) and if the RRC filter is activated (`[SENSe:]ESPectrum:FILTer[:RRC][:STATe]` command).

Parameters:

<Value>	0 to 1
	*RST: 0.22

Example:	`ESP:RTYP CPOW`
	Sets the power reference type to channel power.
	`ESP:FILT ON`
	Activates the use of an RRC filter.
	`ESP:FILT:ALPH 0.5`
	Sets the alpha value of the RRC filter to 0.5.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:HighSPeed <State>

Activates Fast SEM mode to accelerate spurious emission mask measurements. For details see "Fast Spectrum Emission Mask Measurements", on page 229.

Note that in Fast SEM mode, the following parameters cannot be changed in all ranges:

- Filter type, see `[SENSe:]ESPectrum:RANGe<range>:FILTer:TYPE` on page 594

- RBW, see `[SENSe:]ESPectrum:RANGe<range>:BANDwidth` on page 592

- VBW, see `[SENSe:]ESPectrum:RANGe<range>:BANDwidth:VIDeo` on page 593

- Sweep Time Mode, see `[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME:AUTO` on page 599

- Sweep Time, see `[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME` on page 599

- Reference level, see `[SENSe:]ESPectrum:RANGe<range>:RLEVel` on page 598

- RF Att Mode, see `[SENSe:]ESPectrum:RANGe<range>:INPut:ATTenuation:AUTO` on page 595

- Rf Attenuation, see `[SENSe:]ESPectrum:RANGe<range>:INPut:ATTenuation` on page 595

- Preamp, see `[SENSe:]ESPectrum:RANGe<range>:INPut:GAIN:STATe` on page 596

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	`ESP:HSP ON`
Mode:	A, EVDO, TDS, WCDMA

[SENSe:]ESPectrum:PRESet[:STANdard]

This command selects the specified XML file under `C:\r_s\instr\sem_std`. If the file is stored in a subdirectory, include the relative path.

Example:	`ESP:PRES 'WCDMA\3GPP\DL\PowerClass_31_39.xml'`
	Selects the `PowerClass_31_39.xml` XML file in the `C:` `\R_S\instr\sem_std\WCDMA\3GPP\DL` directory.
	`ESP:PRES?`
	`W-CDMA 3GPP DL (31,39)dBm`
	The query returns information about the selected standard, the link direction and the power class. If no standard has been selected, the query returns None.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:PRESet:RESTore

This command copies the XML files from the `C:\R_S\instr\sem_backup` folder to the `C:\R_S\instr\sem_std` folder. Files of the same name are overwritten.

Example:	`ESP:PRES:REST`
	Restores the originally provided XML files.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:PRESet:STORe <FileName>

This command stores the current settings as presettings in the specified XML file under `C:\r_s\instr\sem_backup`.

Parameters:

<FileName>	<string>; specifies the file in which the presettings are stored.

Example:	`ESP:PRES:STOR`
	`'WCDMA\3GPP\DL\PowerClass_31_39.xml'`
	Stores the settins in the `PowerClass_31_39.xml` file in the `C:` `\R_S\instr\sem_std\WCDMA\3GPP\DL` directory.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:BANDwidth <Value>

Both commands are identical and set the RBW value for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see `[SENSe:]ESPectrum:HighSPeed` on page 591).

Suffix:

<range>	1...20
	range

Parameters:

<Value>	Refer to the data sheet.
	*RST: 30.0 kHz

Example:	`ESP:RANG2:BAND:RES 5000`
	Sets the RBW for range 2 to 5 kHz.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:BANDwidth:VIDeo <Value>

This command sets the VBW value for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see `[SENSe:]ESPectrum:HighSPeed` on page 591).

Suffix:

<range>	1...20
	range

Parameters:

<Value>	Refer to the data sheet.
	*RST: 10.0 MHz
Example:	`ESP:RANG1:BAND:VID 5000000`
	Sets the VBW for range 1 to 5 MHz.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:COUNt

This command returns the number of defined ranges.

Suffix:

<range>	1...20
	range
Example:	`ESP:RANG:COUNt?`
	Returns the number of defined ranges.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:DELete

This command deletes the specified range. The range numbers are updated accordingly. The reference range cannot be deleted. A minimum of three ranges is mandatory.

Suffix:

<range>	1...20
	range
Example:	`ESP:RANG4:DEL`
	Deletes range 4.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>[:FREQuency]:STARt <Frequency>

This command sets the start frequency for the specified range.

In order to change the start/stop frequency of the first/last range, select the appropriate span. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last range are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Suffix:

<range>	1...20
	range

Parameters:

<Frequency>	see rules in chapter 4, "Ranges and settings"
	*RST: -250.0 MHz (range 1), -2.52 MHz (range 2), 2.52 MHz (range 3)
Example:	ESP:RANG1:STAR 100000000
	Sets the start frequency for range 1 to 100 MHz.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>[:FREQuency]:STOP <Frequency>

This command sets the stop frequency for the specified range. For further details refer to the `[SENSe:]ESPectrum:RANGe<range>[:FREQuency]:STARt` command.

Suffix:

<range>	1...20
	range

Parameters:

<Frequency>	see rules in chapter 4, "Ranges and settings"
	*RST: -2.52 MHz (range 1), 2.52 MHz (range 2), 250.0 MHz (range 3)
Example:	ESP:RANG3:STOP 10000000
	Sets the stop frequency for range 2 to 10 MHz.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:FILTer:TYPE <Type>

This command sets the filter type for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see `[SENSe:]ESPectrum:HighSPeed` on page 591).

Suffix:

<range>	1...20
	range

Parameters:

<Type>   **NORMal**
                                Gaussian filters

                                CFILter
                                channel filters

                                RRC
                                RRC filters

                                PULSe
                                EMI (6dB) filters

                                P5
                                5 Pole filters

                                *RST: NORM
                                The available bandwidths of the filters are specified in the data
                                sheet.

Example: ESP:RANG1:FILT:TYPE RRC
                                Sets the RRC filter type for range 1.

Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe\<range>:INPut:ATTenuation \<Value>

This command sets the attenuation for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated
(see [SENSe:]ESPectrum:HighSPeed on page 591).

Suffix:

<range>   1...20
                                range

Parameters:

<Value>   Refer to the data sheet.

                                *RST: 0 dB

Example: ESP:RANG3:INP:ATT 10
                                Sets the attenuation of range 3 to 10 dB.

Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe\<range>:INPut:ATTenuation:AUTO \<State>

This command activates or deactivates the automatic RF attenuation setting for the
specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated
(see [SENSe:]ESPectrum:HighSPeed on page 591).

Suffix:

<range>   1...20
                                range

Parameters:

<State>   ON | OFF

                           *RST: ON
Example: `ESP:RANG2:INP:ATT:AUTO OFF`
                           Deactivates the RF attenuation auto mode for range 2.
Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:INPut:GAIN:STATe <State>

This command switches the preamplifier on or off for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated
(see `[SENSe:]ESPectrum:HighSPeed` on page 591).

Suffix:

<range>   1...20
                           range

Parameters:

<State>   ON | OFF

                           *RST: OFF
Example: `ESP:RANG3:INP:GAIN:STATe ON`
                           Switches the preamplifier for range 3 on or off.
Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:INSert <Mode>

This command inserts a new range before or after the specified range. The range numbers are updated accordingly.

Suffix:

<range>   1...20
                           range

Parameters:

<Mode>   AFTer | BEFore

Example: `ESP:RANG3:INS BEF`
                           Inserts a new range before range 3.
                           `ESP:RANG1:INS AFT`
                           Inserts a new range after range 1.
Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:ABSolute:STARt <Level>

This command sets an absolute limit value at the start frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

Suffix:

<range>	1...20
	range

Parameters:

<Level>	-400 to in 400 dBm

	*RST: 13 dBm
Example:	ESP:RANG1:LIM:ABS:STAR 10
	Sets an absolute limit of 10 dBm at the start frequency of the range.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:ABSolute:STOP <Level>

This command sets an absolute limit value at the stop frequency of the specified range. Different from manual operation, this setting is independent of the defined limit check type.

Suffix:

<range>	1...20
	range

Parameters:

<Level>	-400 to in 400 dBm

	*RST: 13 dBm
Example:	ESP:RANG1:LIM:ABS:STOP 20
	Sets an absolute limit of 20 dBm at the stop frequency of the range.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:RELative:STARt <Limit>

This command sets a relative limit value at the start frequency of the specified range. Different from manual operation, this setting is independent of the defined limit check type.

Suffix:

<range>	1...20
	range

Parameters:

<Limit>	-400 to in 400 dBc

	*RST: -50 dBc
Example:	ESP:RANG3:LIM:REL:STAR -20
	Sets a relative limit of -20 dBc at the start frequency of the range.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:RELative:STOP <Limit>

This command sets a relative limit value at the stop frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

Suffix:	
<range>	1...20
	range

Parameters:	
<Limit>	-400 to in 400 dBc
	*RST: -50 dBc

Example:	ESP:RANG3:LIM:REL:STOP 20
	Sets a relative limit of 20 dBc at the stop frequency of the range.

Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:LIMit<source>:STATe <State>

This command sets the type of limit check for all ranges.

Suffix:	
<range>	irrelevant

Parameters:	
<State>	ABSolute | RELative | AND | OR

> **ABSolute**
> Checks only the absolute limits defined.

> **RELative**
> Checks only the relative limits. Relative limits are defined as relative to the measured power in the reference range.

> **AND**
> Combines the absolute and relative limit. The limit check fails when both limits are violated.

> **OR**
> Combines the absolute and relative limit. The limit check fails when one of the limits is violated.

> *RST: REL

Example:	ESP:RANG3:LIM:STAT AND
	Sets for all ranges the combined absolute/relative limit check.

Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:RLEVel <Value>

This command sets the reference level for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see [SENSe:]ESPectrum:HighSPeed on page 591).

Suffix:	
<range>	1...20
	range

Parameters:	
<Value>	Refer to the data sheet.
	*RST: -20 dBm

Example:	ESP:RANG2:RLEV 0
	Sets the reference level of range 2 to 0 dBm.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME <SweepTime>

This command sets the sweep time for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see [SENSe:]ESPectrum:HighSPeed on page 591).

Suffix:

| <range> | 1...20 |
| | range |

Parameters:

<SweepTime>	Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.
	*RST: 0.27 s
Example:	ESP:RANG1:SWE:TIME 1
	Sets the sweep time for range 1 to 1 s.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:SWEep:TIME:AUTO <State>

This command activates or deactivates the automatic sweep time setting for the specified range.

Note that this parameter can not be set for all ranges if "Fast SEM" mode is activated (see [SENSe:]ESPectrum:HighSPeed on page 591).

Suffix:

| <range> | 1...20 |
| | range |

Parameters:

<State>	ON	OFF
	*RST: ON
Example:	ESP:RANG3:SWE:TIME:AUTO OFF
	Deactivates the sweep time auto mode for range 3.
Mode:	A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RANGe<range>:TRANsducer <TransducerName>

This command sets a transducer for the specified range. You can only choose a transducer that fulfills the following conditions:

- The transducer overlaps or equals the span of the range.
- The x-axis is linear.
- The unit is dB.

Suffix:

<range>	1...20
	range

Parameters:

<TransducerName> 'string' = name of the transducer

Example: `ESP:RANG1:TRAN 'test'`

Sets the transducer called test for range 1.

Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RRANge

This command returns the current position (number) of the reference range.

Example: `ESP:RRAN?`

Returns the current position (number) of the reference range.

Mode: A, CDMA, EVDO, TDS

[SENSe:]ESPectrum:RTYPe <Type>

This command sets the power reference type.

Parameters:

<Type> PEAK | CPOWer

PEAK
Measures the highest peak within the reference range.

CPOWer
Measures the channel power within the reference range (integral bandwidth method).

*RST: CPOWer

Example: `ESP:RTYP PEAK`

Sets the peak power reference type.

Mode: A, CDMA, EVDO, TDS

SENSe:FREQuency Subsystem

The SENSe:FREQuency subsystem defines the frequency axis of the active display. The frequency axis can either be defined via the start/stop frequency or via the center frequency and span.

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency of the analyzer or the measuring frequency for span = 0.

Parameters:

<Frequency>   <numeric_value>

           Range: 0 to fmax
           *RST: fmax/2
           Default unit: Hz
           f_{max} is specified in the data sheet. min span is 10 Hz

           (SEM and Spurious: min span = 20 Hz)

Example: FREQ:CENT 100 MHz

Mode: all

[SENSe:]FREQuency:CENTer:STEP[:VALue] <StepSize>

This command defines the step size of the center frequency.

Parameters:

<StepSize>   <numeric_value>

           Range: 1 to 1000000000
           *RST: - (AUTO 0.1 × SPAN is switched on)
           Default unit: Hz

Example: FREQ:CENT:STEP 120 MHz

Mode: all

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples the step size of the center frequency to the span (ON) or sets the value of the center frequency entered via [SENSe:]FREQuency:CENTer (OFF).

Parameters:

<State>   ON | OFF

           *RST: ON

Example: FREQ:CENT:STEP:AUTO ON
           Activates the coupling of the step size to the span.

Mode: all

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

This command couples the step size of the center frequency to span (span >0) or to the resolution bandwidth (span = 0) or cancels the couplings.

Parameters:

<CouplingType>	OFF | SPAN | RBW

SPAN
coupling to frequency display range (for span > 0)

RBW
coupling to resolution bandwidth (for span = 0)

OFF
manual input, no coupling

*RST: SPAN

Example: FREQ:CENT:STEP:LINK SPAN

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Value>

This command couples the step size of the center frequency with a factor to the span (span >0) or to the resolution bandwidth (span = 0).

Parameters:

<Value>	1 to 100 PCT

*RST: (AUTO 0.1 × SPAN is switched on)

Example: FREQ:CENT:STEP:LINK:FACT 20PCT

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

[SENSe:]FREQuency:MODE <Mode>

This command switches between span > 0 and zero span in the "Spectrum" mode.

Parameters:

<Mode>	CW | FIXed | SWEep

CW
zero span; the frequency setting is via the [SENSe:]FREQuency:CENTer command.

FIXed
zero span; the frequency setting is via the [SENSe:]FREQuency:CENTer command.

SWEep
span > 0; the setting is via the [SENSe:]FREQuency:STARt, [SENSe:]FREQuency:STOP, [SENSe:]FREQuency:CENTer, and [SENSe:]FREQuency:SPAN commands.

*RST: SWEep

Example: FREQ:MODE SWE

Usage: SCPI conform

Mode: A, CDMA, TDS

[SENSe:]FREQuency:OFFSet <Offset>

This command defines the frequency offset of the instrument.

Parameters:

<Offset>   <numeric_value>

                            Range: -100 GHz to 100 GHz
                            *RST: 0 Hz
Example: FREQ:OFFS 1GHZ

Mode: all

[SENSe:]FREQuency:SPAN <Span>

This command defines the frequency span.

Parameters:

<Span>   min span to fmax

                            *RST: fmax
                            f$_{max}$ is specified in the data sheet. min span is 10 Hz

                            (SEM and Spurious: min span = 20 Hz)
Example: FREQ:SPAN 10MHz

Mode: A, CDMA, EVDO, RT, TDS, NF, WCDMA

[SENSe:]FREQuency:SPAN:FULL

This command sets the frequency span to its maximum.

Example: FREQ:SPAN:FULL

Mode: A, CDMA, EVDO, RT, TDS, NF, WCDMA

[SENSe:]FREQuency:STARt <Frequency>

This command defines the start frequency of the analyzer. This command is only available with span > 0.

Parameters:

<Frequency>   0 to (fmax - min span)

                            *RST: 0
                            f$_{max}$ is specified in the data sheet. min span is 10 Hz

                            (SEM and Spurious: min span = 20 Hz)
Example: FREQ:STAR 20MHz

Mode: A-F, CDMA, EVDO, RT, TDS, NF, PHN, WCDMA

[SENSe:]FREQuency:STOP <Frequency>

This command defines the stop frequency of the analyzer. This command is only available with span > 0.

Parameters:

<Frequency>	min span to fmax

$\qquad$ *RST: $\qquad$ fmax

f_{max} is specified in the data sheet. min span is 10 Hz

(SEM and Spurious: min span = 20 Hz)

Example: $\qquad$ FREQ:STOP 2000 MHz

Mode: $\qquad$ A-F, CDMA, EVDO, RT, TDS, NF, PHN, WCDMA

SENSe:LIST Subsystem

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in zero span. A new trigger event is required for each test point (exception: trigger "FREE RUN").

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average). The number of frequencies is limited to 200 entries.

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is performed via a configuration command ([SENSe:]LIST:POWer:SET). This also includes the setting for trigger and gate parameters.

Settings that are not directly included in commands of this subsystem can be configured by sending the corresponding commands prior to the SENSe:LIST Subsystem commands.

Please note that changes to the trigger level have to be executed in zero span in order to take effect for the SENSe:LIST Subsystem commands.

The following subsystem is included:

"SENSe:LIST:RANGe Subsystem", on page 610

Further information

● "SENSe:LIST Subsystem", on page 604

More details on the SENSe:LIST Subsystem

The following setting parameters can be selected independently for each frequency point:

● analyzer frequency
● reference level
● resolution filter
● resolution bandwidth
● video bandwidth
● measurement time
● detector

The commands of this subsystem can be used in two different ways:

- Instrument setup, measurement and querying of the results in a single command line. With this method, there is the least delay between the measurement and the result output. However, it requires the control computer to wait for the response from the instrument.

- Instrument setup and querying of the result list at the end of the measurement: With this method, the control computer may be used for other activities while the measurement is being performed. However, more time is needed for synchronization via service request.

[SENSe:]LIST:POWer[:SEQuence]
　　　　<AnalyzerFreq>,<RefLevel>,<RfAtt>,<ElAtt>,<FilterType>,<RBW>,<VBW>,<MeasTime>,<TriggerLevel>

This command configures the list of settings (max. 200 entries) for the multiple power measurement and starts a measurement sequence.

When synchronizing the command with *OPC, a service request is generated as soon as all frequency points are processed and the defined number of individual measurements is reached.

To reduce the setting time, all indicated parameters are set up simultaneously at each test point.

The query form of the command processes the list and immediately returns the result list.

The measurement is performed in zero span and therefore the span is set to 0 Hz. If the span > 0 is set, the function is automatically switched off.

The measurement is not compatible with other measurements, especially as far as marker, adjacent channel power measurement or statistics are concerned. The corresponding commands thus automatically deactivate the function.

The function is only available in REMOTE operation. It is deactivated when switching the instrument back to LOCAL.

The following parameters are the settings for an individual frequency point. They are repeated for each other frequency point.

Return values:

<Result>	List of comma-separated values (CSV) which contains the power measurement results in floating-point format. The unit depends on the setting with CALCulate<n>:UNIT:POWer. The number of results per test point depends on the setting of the [SENSe:]LIST:POWer:SET command.

Setting parameters:

<AnalyzerFreq>	Receive frequency for the signal to be measured (= center frequency in manual operation)	
	Range:	0 Hz to maximum frequency

<RefLevel>	Reference level
	Range: +30 dBm to -130 dBm in 0.01 dB steps
<RfAtt>	RF input attenuation
	Range: 0 dB to 70 dB in 5 dB steps; with option B25: 0 dB to 75 dB in 1 dB steps
<ElAtt>	Electronic input attenuation Requires option R&S FSV-B25; **dB value or "OFF"**
	Range: 0 dB to 30 dB in 1 dB steps
<FilterType>	Filter type for the resolution bandwidth, see `[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE` on page 581.
<RBW>	Resolution bandwidth For the range of values refer to "Res BW Manual" on page 116. Refer to chapter 3.2.6.3, "Selecting the Appropriate Filter Type", on page 121 for possible combinations of filter type and filter bandwidth for the <filter type> = CFILter and <filter type> = RRC.
<VBW>	Video bandwidth The value is ignored for <filter type> = "CFILter" or "RRC"
	Range: 1 Hz to 10 MHz in 1, 3, 10 steps
<MeasTime>	Measurement time For details refer to "Sweeptime Manual" on page 117.
	Range: 1us to 16000s
<TriggerLevel>	Reserved. Must be set to 0.

Example:	`SENSe:LIST:POWer?`
	`935.2 MHz,0 dBm,10 dB,OFF,NORM,1 MHz,3 MHz,`
	`440us,0,`
	`935.4 MHz,0dBm,10dB,10dB,NORM,30 kHz,100 kHz,`
	`440us,0,`
	`935.6 MHz,0dBm,10dB,20dB,NORM,30 kHz,100 kHz,`
	`440us,0`
	Result list:
	-28.3,-30.6,-38.1

Example:	`SENSe:LIST:POWer:SET ON,ON,ON,IMM,POS,0,0`
	Activates the power measurement of the peak, RMS and average values.
	`SENSe:LIST:POWer?`
	`935.2 MHz,0dBm,10dB,OFF,NORM,1 MHz,3 MHz,440us,`
	`0,`
	`935.4 MHz,0dBm,10dB,10dB,NORM,30 kHz,100 kHz,`
	`440us,0,`
	`935.6 MHz,0dBm,10dB,20dB,NORM,30 kHz,100 kHz,`
	`440us,0`
	Result list (3 results per frequency point):
	-28.3, -29.6, 1.5, -30.6, -31.9, 0.9, -38.1, -40.0, 2.3

Example: SENSe:LIST:POWer
                    935.2 MHz,0dBm,10dB,OFF,NORM,1 MHz,3 MHz,440us,
                    0,
                    935.4 MHz,0dBm,10dB,10dB,CFIL,30 kHz,100 kHz,
                    440us,0,
                    935.6 MHz,0dBm,10dB,20dB,CFIL,30 kHz,100 kHz,
                    440us,0

                    Performs a measurement sequence with the settings described in
                    table 4-16.

                    SENSe:LIST:POWer?
                    935.2 MHz,0dBm,10dB,OFF,NORM,1 MHz,3 MHz,440us,
                    0,
                    935.4 MHz,0dBm,10dB,10dB,CFIL,30 kHz,100 kHz,
                    440us,0,
                    935.6 MHz,0dBm,10dB,20dB,CFIL,30 kHz,100 kHz,
                    440us,0

                    Performs the same measurement and returns the result list imme-
                    diately after the last frequency point.

Mode: A-F, A-T

Table 4-16: Settings for power list example

Step	Freq. [MHz]	Ref Level [dBm]	RF Att [dB]	el Att [dB]	Filter type	RBW	VBW	Meas Time [us]	TRG Level (reserved)
1	935.2	0	10	OFF	Normal	1 MHz	3 MHz	440	0
2	935.4	0	10	10	Channel	30 kHz	100 kHz	440	0
3	935.6	0	10	20	Channel	30 kHz	100 kHz	440	0

[SENSe:]LIST:POWer:RESult

This command queries the result of a previous list measurement as configured and ini-
tiated with [SENSe:]LIST:POWer[:SEQuence] on page 605. The measured results
are output in a list of floating point values separated by commas. The unit of the results
depends on the setting made with the CALCulate<n>:UNIT:POWer command.

This command may be used to obtain measurement results in an asynchronous way,
using the service request mechanism for synchronization with the end of the measure-
ment.

If no measurement results are available, the command returns a query error.

Example: `*ESE 1`
                     `*SRE 32`
                     Configuration of the status reporting system for the generation of
                     an SRQ on operation complete
                     `SENSe:LIST:POWer`
                     `935.2 MHz,-20dBm,10dB,OFF,NORM,1 MHz,3 MHz,`
                     `434us,0,`
                     `935.4 MHz,-20dBm,10dB,10dB,NORM,30 kHz,100 kHz,`
                     `434us,0,`
                     `935.6 MHz,-20dBm,10dB,20dB,NORM,30 kHz,100 kHz,`
                     `434us,0;`
                     `*OPC`
                     Configuring and starting the measurement
                     `...`
                     Further actions of the control computer during measurement
                     `On SRQ:`
                     `SENSe:LIST:POWer:RESult?`
                     Response to service request

Mode: A-F, A-T

[SENSe:]LIST:POWer:SET

<PeakMeas>,<RMSMeas>,<AVGMeas>,<TriggerSource>,<TriggerSlope>,<TriggerOffset>,<GateLength>

This command defines the constant settings for the list during multiple power measurement.

Parameters <PEAKMeas>, <RMSMeas> and <AVGMeas> define which measurements are to be performed at the same time at the frequency point. Correspondingly, one, two or three results per frequency point are returned for the `[SENSe:]LIST:POWer[:SEQuence]` command. If all three parameters are set to OFF, the command generates an execution error.

Note: the trigger level must be set *after* the `SENS:LIST:POW:SET` command.

Parameters:

<PeakMeas>   **ON**
                     activates the measurement of the peak power (peak detector)

                     OFF
                     deactivates the measurement of the peak power

                     *RST: ON

<RMSMeas>   **ON**
                     activates the measurement of the RMS power (RMS detector)

                     OFF
                     deactivates the measurement of the RMS power

                     *RST: OFF

<AVGMeas>	**ON** activates the measurement of the average power (average detector) **OFF** deactivates the measurement of the average power *RST: OFF
<TriggerSource>	IMMediate | EXTernal | VIDeo | IFPower | RFPower Selection of the trigger source used for the list measurement *RST: IMM
<TriggerSlope>	**POSitive** Positive trigger slope used **NEGative** Negative trigger slope used *RST: POS
<TriggerOffset>	Offset between the detection of the trigger signal and the start of the measurement at the next frequency point. Range: span = 0 Hz: (-sweep time) to 30 s; span > 10 Hz: 31.25 ns to 30 s *RST: 0 s
<GateLength>	Gate length with gated sweep The value 0 s deactivates the use of gated trigger; other values activate the gated trigger function. Values <> 0 s are only possible if <TriggerMode> is different from "IMMediate". Otherwise, an execution error is triggered. Range: 31.25 ns to 30 s *RST: 0 s
Return values:	
Return values	<PeakMeas>,<RMSMeas>,<AVGMeas>,<TriggerSource>,<TriggerSlope>,<TriggerOffset>,<GateLength> The query command returns a list of comma-separated values (CSV) of the settings described above.
Example:	SENSe:LIST:POWer:SET ON,OFF,OFF,EXT,POS,10US, 434US
Mode:	A-F, A-T

[SENSe:]LIST:POWer:STATe <State>

This command deactivates the list measurement.

Parameters:

<State>	ON | OFF
Example:	SENSe:LIST:POWer:STATe OFF
Mode:	A-F, A-T

SENSe:LIST:RANGe Subsystem

The SENSe:LIST:RANGe Subsystem contains the remote commands to configure Spurious Emissions measurements.

[SENSe:]LIST:RANGe<range>:BANDwidth[:RESolution] <Value>

This command sets the RBW value for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<Value>	Refer to the data sheet.
	*RST: 30.0 kHz
Example:	LIST:RANG2:BAND:RES 5000
	Sets the RBW for range 2 to 5 kHz.
Mode:	A

[SENSe:]LIST:RANGe<range>:BANDwidth:VIDeo

This command sets the VBW value for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<Value>	Refer to the data sheet.
	*RST: 10.0 MHz

Example: LIST:RANG1:BAND:VID 5000000
                     Sets the VBW for range 1 to 5 MHz.

Mode: A

[SENSe:]LIST:RANGe<range>:BREak <State>

This command configures the sweep behavior.

The suffixes are irrelevant.
Suffix:
<range>   1...20
                     range

Parameters:
<State>   **ON**
                     The analyzer stops after one range is swept and continues only if
                     you confirm (a message box is displayed).

                     OFF
                     The analyzer sweeps all ranges in one go.

                     *RST: OFF
Example: LIST:RANG:BRE ON
                     Configures a stop after each range.

Mode: A

[SENSe:]LIST:RANGe<range>:COUNt

This command returns the number of defined ranges.
Suffix:
<range>   1...20
                     range

Example: LIST:RANG:COUNt?
                     Returns the number of defined ranges.

Mode: A, CDMA, EVDO, TDS

[SENSe:]LIST:RANGe<range>:DELete

This command deletes the specified range. The range numbers are updated accordingly.
The reference range cannot be deleted. A minimum of three ranges is mandatory.
Suffix:
<range>   1...20
                     range

Example: LIST:RANG4:DEL
                     Deletes range 4.

Mode: A

[SENSe:]LIST:RANGe<range>:DETector <Detector>

This command sets the detector for the specified range. For details refer to "Detector" on page 234.

Suffix:

<range>   1...20
                          range

Parameters:

<Detector>   NEGative | POSitive | SAMPle | RMS | AVERage

                          NEGative
                          minimum peak detector

                          POSitive
                          peak detector

                          SAMPle
                          sample detector

                          RMS
                          RMS detector

                          AVERage
                          average detector

                          *RST: RMS

Example: LIST:RANGe3:DET SAMP
                          Sets the sample detector for range 3.

Mode: A

[SENSe:]LIST:RANGe<range>[:FREQuency]:STARt <Frequency>

This command sets the start frequency for the specified range.

In order to change the start/stop frequency of the first/last range, select the appropriate span. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last range are adapted to the given span as long as the minimum span of 20 Hz is not violated.

Suffix:

<range>   1...20
                          range

Parameters:

<Frequency>   see rules in chapter 4, "Ranges and settings"

                          *RST: -250.0 MHz (range 1), -2.52 MHz (range 2), 2.52 MHz
                                       (range 3)

Example: LIST:RANG1:STAR 100000000
                          Sets the start frequency for range 1 to 100 MHz.

Mode: A

[SENSe:]LIST:RANGe<range>[:FREQuency]:STOP <Frequency>

This command sets the stop frequency for the specified range. See also `[SENSe:]LIST:RANGe<range>[:FREQuency]:STARt` on page 612.

Suffix:

<range>   1...20
                           range

Parameters:

<Frequency>   see rules in chapter 4, "Ranges and settings"

                           *RST: -2.52 MHz (range 1), 2.52 MHz (range 2), 250.0 MHz
                                        (range 3)

Example: `LIST:RANG3:STOP 10000000`
                           Sets the stop frequency for range 2 to 10 MHz.

Mode: A

[SENSe:]LIST:RANGe<range>:FILTer:TYPE <Type>

This command sets the filter type for the specified range.

Suffix:

<range>   1...20
                           range

Parameters:

<Type>   **NORMal**
                           Gaussian filters

                           CFILter
                           channel filters

                           RRC
                           RRC filters

                           PULSe
                           EMI (6dB) filters

                           P5
                           5 Pole filters

                           *RST: NORM
                           The available bandwidths of the filters are specified in the data
                           sheet.

Example: `LIST:RANG1:FILT:TYPE RRC`
                           Sets the RRC filter type for range 1.

Mode: A

[SENSe:]LIST:RANGe<range>:INPut:ATTenuation <Value>

This command sets the attenuation for the specified range.

Suffix:

<range>   1...20
                           range

Parameters:

<Value>	Refer to the data sheet.

	*RST: 0 dB
Example:	LIST:RANG3:INP:ATT 10
	Sets the attenuation of range 3 to 10 dB.
Mode:	A

[SENSe:]LIST:RANGe<range>:INPut:ATTenuation:AUTO <State>

This command activates or deactivates the automatic RF attenuation setting for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<State>	ON | OFF

	*RST: ON
Example:	LIST:RANG2:INP:ATT:AUTO OFF
	Deactivates the RF attenuation auto mode for range 2.
Mode:	A

[SENSe:]LIST:RANGe<range>:INPut:GAIN:STATe <State>

This command switches the preamplifier on or off for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<State>	ON | OFF

	*RST: OFF
Example:	LIST:RANG3:INP:GAIN:STATe ON
	Switches the preamplifier for range 3 on or off.
Mode:	A

[SENSe:]LIST:RANGe<range>:LIMit:STARt <Limit>

This command sets an absolute limit value at the start frequency of the specified range. Different from manual operation, this setting is independent of the defined limit check type.

Suffix:

<range>	1...20
	range

Parameters:

<Limit>	-400 to in 400 dBm

	*RST:	13 dBm
Example:	LIST:RANG1:LIM:ABS:STAR 10	
	Sets an absolute limit of 10 dBm at the start frequency of the range.	

Mode:　　　　A

[SENSe:]LIST:RANGe<range>:LIMit:STATe

This command activates or deactivates the limit check for all ranges.

Suffix:

<range>	irrelevant

Parameters:

<State>	ON	OFF

	*RST:	OFF
Example:	LIST:RANG3:LIM:STAT ON	
	Activates a limit check for all ranges.	

Mode:　　　　A

[SENSe:]LIST:RANGe<range>:LIMit:STOP <Limit>

This command sets an absolute limit value at the stop frequency of the specified range. Different from manual operation, this setting is independent of the defined limit check type.

Suffix:

<range>	1...20
	range

Parameters:

<Limit>	-400 to in 400 dBm

	*RST:	13 dBm
Example:	LIST:RANG1:LIM:STOP 20	
	Sets an absolute limit of 20 dBm at the stop frequency of the range.	

Mode:　　　　A

[SENSe:]LIST:RANGe<range>:POINts <Value>

This command sets the number of sweep points for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<Value>	For details on possible values refer to chapter 4, **Sweep Points** softkey of the "Sweep" menu.
	*RST: 691

Example:	`LIST:RANG3:POIN 601`
	Sets 601 sweep points for range 3.
Mode:	A

[SENSe:]LIST:RANGe<range>:RLEVel <Value>

This command sets the reference level for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<Value>	Refer to the data sheet.
	*RST: -20 dBm
Example:	`LIST:RANG2:RLEV 0`
	Sets the reference level of range 2 to 0 dBm.
Mode:	A

[SENSe:]LIST:RANGe<range>:SWEep:TIME

This command sets the sweep time for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<SweepTime>	Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.
	*RST: 0.27 s
Example:	`LIST:RANG1:SWE:TIME 1`
	Sets the sweep time for range 1 to 1 s.
Mode:	A

[SENSe:]LIST:RANGe<range>:SWEep:TIME:AUTO

This command activates or deactivates the automatic sweep time setting for the specified range.

Suffix:

<range>	1...20
	range

Parameters:

<State>	ON	OFF
	*RST: ON
Example:	`LIST:RANG3:SWE:TIME:AUTO OFF`
	Deactivates the sweep time auto mode for range 3.
Mode:	A

[SENSe:]LIST:RANGe<range>:TRANsducer <TransducerName>

This command sets a transducer for the specified range. You can only choose a transducer that fulfills the following conditions:

● The transducer overlaps or equals the span of the range.
● The x-axis is linear.
● The unit is dB.

Suffix:

<range>   1...20
                           range

Parameters:

<TransducerName>   'string' = name of the transducer

Example: SENS:LIST:RANG1:TRAN 'test'
                       Sets the transducer called "test" for range 1.

Mode: A

SENSe:MIXer Subsystem

The MIXer subsystem controls the external mixer settings. These commands are only available if the R&S FSV-B21 (Exeternal Mixer) option is installed.

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

This command activates the external mixer.

Parameters:

<State>	**ON | OFF**
	*RST: OFF
Example:	MIX ON
Mode:	all

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

This command defines the bias current for the high range (see also chapter 3.8.2.2, "Bias Current", on page 353).

This command is only available if the external mixer is active (see [SENSe:]MIXer[: STATe] on page 617).

Parameters:

<BiasSetting>

	*RST: 0.0 A
	Default unit: A
Example:	MIX ON
	Activates the external mixer.
	MIX:BIAS:HIGH 2A
	Sets the bias for the high range to 2 A.
Mode:	all

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

This command defines the bias current for the low range (see also chapter 3.8.2.2, "Bias Current", on page 353).

This command is only available if the external mixer is active (see [SENSe:]MIXer[: STATe] on page 617).

Parameters:

<BiasSetting>

	*RST: 0.0 A
	Default unit: A
Example:	MIX ON
	Activates the external mixer.
	MIX:BIAS:LOW 2A
	Sets the bias for the low range to 2 A.
Mode:	all

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

This command specifies whether the frequencies beyond the defined band limits are to be used.

This command is only available if the external mixer is active (see [SENSe:]MIXer[: STATe] on page 617).

Parameters:

<State>   **ON | OFF**

                  *RST: OFF

Example: MIX:RFOV ON

Mode: all

[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 617).

Parameters:

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

Mode: all

[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

Mode: all

[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

Mode: all

[SENSe:]MIXer:HARMonic:BAND <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 617).

Parameters:

<Band>	A | Q | U | V | E | W | F | D | G | Y | J | USER
	Standard waveguide band or user-defined band.
	*RST: F (90 GHz - 140 GHz)
Example:	MIX ON
	Activates the external mixer.
	MIX:HARM:BAND A
	Sets the band to A (26.5 GHz - 40 GHz).
Mode:	all

[SENSe:]MIXer:HARMonic:BAND:PRESet

This command restores the preset frequency ranges for the standard waveguide bands.

Example:	MIX:HARM:BAND:PRES
	Presets the waveguide bands.
Usage:	Event
Mode:	all

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

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

Parameters:

<State>	**ON | OFF**
	*RST: OFF
Example:	MIX:HARM:HIGH:STAT ON
Mode:	all

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

This command specifies the harmonic order to be used for the high range.

Parameters:

<HarmOrder>	**<numeric value>**
	Range: 2 to 100 (USER band); for other bands: see band definition
Example:	MIX:HARM:HIGH 2
Mode:	all

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

This command specifies the harmonic order to be used for the LOW range.

Parameters:

<HarmOrder>	**<numeric value>**
	Range: 2 to 100 (USER band); for other bands: see band definition
	*RST: 2 (for band F)
Example:	MIX:HARM 3
Mode:	all

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

This command specifies whether the harmonic order to be used should be odd, even, or both.

Parameters:

<OddEven>	**ODD	EVEN	EODD**
	*RST: EVEN
Example:	MIX:HARM:TYPE ODD
Mode:	all

[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
Mode:	all

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

This command defines the average conversion loss to be used for the entire high range.

Parameters:

<Average>	**<numeric value>**
	Range: 0 to 100
	*RST: 40.0 dB
	Default unit: dB
Example:	MIX:LOSS:HIGH 20dB
Mode:	all

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

This command defines the file name of the conversion loss table to be used for the high range.

Parameters:

<FileName>	**<file name>**
Example:	MIX:LOSS:HIGH 20dB
Mode:	all

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

This command defines the file name of the conversion loss table to be used for the low range.

Parameters:

<FileName>	**<file name>**
Example:	MIX:LOSS:TABL mix_1_4
	Specifies the conversion loss table *mix_1_4*.
Mode:	all

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

This command defines the average conversion loss to be used for the entire low range.

Parameters:

<Average>	**<numeric value>**
	Range: 0 to 100
	*RST: 40.0 dB
	Default unit: dB
Example:	MIX:LOSS 20dB
Mode:	all

[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
Mode:	all

[SENSe:]MIXer:SIGNal <State>

This command specifies whether automatic signal detection is active or not.

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

Example:	MIX:SIGN AUTO
Mode:	all

[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 622).

Parameters:

<Value>	**<numeric value>**

Range: 30 dBm to -130 dBm
*RST: 0.0 dBm

Example:	MIX:PORT 3
Mode:	all

SENSe:MPOWer Subsystem

The commands of this subsystem are used to determine the mean burst power or peak burst power for a given number of signal bursts, and for outputting the results in a list. Since all the settings required for a measurement are combined in a single command, the measurement speed is considerably higher than when using individual commands.

For measuring the signal bursts, the gated sweep function is used in zero span. The gate is controlled either by an external trigger signal or by the video signal. An individual trigger event is required for each burst to be measured. If an external trigger signal is used, the threshold is fixed to TTL level, while with a video signal the threshold can be set as desired.

More Details on the SENSe:MPOWer Subsystem

The following graphics shows the relation between trigger time, trigger offset (for delayed gate opening) and measurement time.
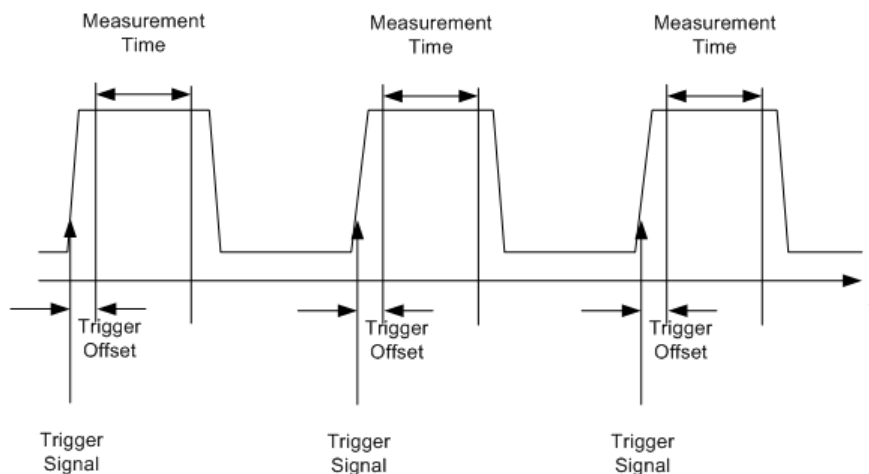
Depending on the settings made, the measurements are performed with the RMS detector for RMS power or the PEAK detector for peak power. For all these measurements, trace 1 of the selected system is used.

The setting parameters for this measurement are:

- analyzer frequency
- resolution bandwidth
- measurement time used for a single burst
- trigger source
- trigger level
- trigger offset
- type of power measurement (PEAK, MEAN)
- number of bursts to be measured
  The commands of this subsystem can be used in two different ways:
- Setting up the instrument and at the same time querying the result list: This method ensures the smallest delay between measurement and the output of the measured values, but requires the control computer to wait actively for the response of the instrument.
- Setting up the instrument and querying the result list after synchronization to the end of measurement: With this method the control computer can be used for other activities while the instrument is performing the measurement at the cost of additional time needed for synchronization via service request.

[SENSe:]MPOWer[:SEQuence] <Settings>

This command configures the instrument setup for multiple burst power measurement and starts a measurement sequence. When synchronizing the command with *OPC, a service request is generated as soon as the defined number of individual measurements (# of meas) is reached.

To reduce the setting time, the setup is performed simultaneously for all selected parameters.

The query adapts the instrument settings, performs the defined number of measurements and outputs the measurement results list.

The measurement function always uses trace 1.

Repeated use of the command without changes to its parameters (i.e. using the same settings again) speeds up the measurement since the previous hardware settings are cached and therefore additional hardware settling times are avoided. This is also true if only part of the parameters (e.g. only the trigger delay) are changed, as in this case the rest of the parameters are cached.

This measurement is not compatible with other measurements, especially as far as marker functions, adjacent-channel measurement or statistics are concerned. The corresponding functions are therefore automatically switched off. In return, incompatible commands automatically deactivate the multi burst power function.

The function is only available in the REMOTE operation. It is deactivated on switching back to LOCAL.

Parameters:

<analyzer freq>	Receive frequency for the burst signals to be measured (= center frequency in manual operation)
	Range: 0 Hz to max. frequency, depending on instrument model
<rbw>	resolution bandwidth for the measurement
	Range: 10 Hz to 10 MHz in steps of 1, 3, 10
<meas time>	Time span during which measurement samples are sampled for RMS/peak measurement. The type of measurement is selected by <type of meas>.
	Range: 1us to 30s
<trigger source>	trigger signal source **EXTernal** The trigger signal is fed from the "Ext. Trigger/Gate" input on the rear of the unit. **VIDeo** The internal video signal is used as trigger signal.
<trigger level>	Signal level at which the trigger becomes active. For <trigger source> = VIDeo this is the level of the video signal as a percentage of the diagram height. If <trigger source> = EXTernal is selected, the value entered here is ignored, as in this case the trigger input uses TTL levels.
	Range: 0 – 100PCT(<trigger source> = VIDeo)
<trigger offset>	Offset between the detection of the trigger signal and the start of the measurement.
	Range: see data sheet

<type of meas>	MEAN | PEAK
	Determines whether mean power (RMS) or peak power (PEAK) is to be measured. The detector is selected accordingly.
<# of meas>	Number of individual bursts to be measured.
	Range: 1 to 32001

Return values:

<Result>	The query command returns a list separated by commas (comma separated values = CSV), which contains the power measurement results in floating-point format. The unit used for the Return values is always dBm.

Example:	Sample setting:
	`SENSe:MPOWer 935.2MHz,1MHz,434us,VIDEO,50PCT,`
	`5us,MEAN,20`
	Performs a measurement sequence with the following settings:
	Frequency = 935.2 MHz,
	Resolution bandwidth = 1 MHz
	Measurement time = 434 µs
	Trigger source = VIDEO
	Trigger threshold = 50 %
	Trigger offset = 5 µs
	Type of measurement = MEAN power
	No. of measurements = 20
	Sample query:
	`SENSe:MPOWer? 935.2MHz, 1MHz, 434us, VIDEO,`
	`50PCT, 5us, MEAN, 20`
	Performs the same measurement and in addition returns the results list immediately after completion of the last measurement.
	Sample result:
	18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9
Mode:	A

[SENSe:]MPOWer:FTYPe <FilterType>

This command defines the filter type for the measurement.

Parameters:

<FilterType>	NORMal | CFILter | RRC

Example:	`SENSe:MPOWer:FTYPe CFILter`
Mode:	A

[SENSe:]MPOWer:RESult[:LIST]?

This command queries the results of a multiple burst power measurement as configured and initiated with `[SENSe:]MPOWer[:SEQuence]` on page 624 ". The results are output in a comma-separated list of floating point values. The unit used for the Return values is always dBm.

This command may be used to obtain measurement results in an asynchronous way using the service request mechanism for synchronization with the end of the measurement.

If no measurement results are available, the command returns a query error.

Example:	`*ESE 1`
	`*SRE 32`
	Configuration of status reporting systems for the generation of an SRQ on operation complete
	`SENSe:MPOWer 935.2MHz,1MHz,434us,VIDEO,50PCT,`
	`5us,MEAN,20;*OPC`
	Configuring and starting the measurement
	…
	Further actions of the control computer during measurement
	`On SRQ:`
	Response to service request
	`SENSe:MPOWer:RESult?`
Usage:	Query only
Mode:	A

[SENSe:]MPOWer:RESult:MIN?

This command queries the minimum power value in a multiple burst power measurement as configured and initiated with `[SENSe:]MPOWer[:SEQuence]` on page 624 ". The unit used for the Return values is always dBm.

If no measurement result is available, the command returns a query error.

Example:	`*ESE 1`
	`*SRE 32`
	Configuration of status reporting systems for the generation of an SRQ on operation complete
	`SENSe:MPOWer 935.2MHz,1MHz,434us,VIDEO,50PCT,`
	`5us,MEAN,20;*OPC`
	Configuring and starting the measurement
	…
	Further actions of the control computer during measurement
	`On SRQ:`
	Response to service request
	`SENSe:MPOWer:RESult:MIN?`
Usage:	Query only
Mode:	A

SENSe:PMETer<p> Subsystem (Power Sensor, R&S FSV-K9)

This subsystem controls the device settings for power sensor measurements. It is only available if the R&S FSV-K9 Power Sensor option is installed.

For details see chapter 3.9, "Instrument Functions - Power Sensor (R&S FSV-K9)", on page 361.

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

This command switches the power sensor measurement for the selected power sensor on or off.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	PMET1 ON
	Switches the power sensor measurements on.
Mode:	PSM

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

This command activates the duty cycle correction for the selected power sensor.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<State>	**ON	OFF**
	*RST: OFF
Example:	PMET2:DCYC:STAT ON
Mode:	PSM

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

This command sets the duty cycle for the selected power sensor to a percent value for the correction of pulse modulated signals. With the correction activated, the sensor calculates the signal pulse power from this value and the mean power.

Suffix:

<p>	1...4
	Power sensor index

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%.	
Mode:	PSM	

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

This command sets the frequency of the selected power sensor. The limits f_{min} and f_{max} are defined by the power sensor.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<Frequency>	fmin ... fmax	
	*RST:	50 MHz
Example:	`PMET2:FREQ 1GHZ`	
	Sets the frequency of the power sensor to 1 GHz.	
Mode:	PSM	

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

This command sets the frequency coupling of the selected power sensor.

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

Mode: PSM

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

This command sets the measurement duration of the selected power sensor.
Suffix:

<p>   1...4
                   Power sensor index

Parameters:

<Duration>   SHORt | NORMal | LONG

                   *RST: NORM
Example: PMET2:MTIM SHOR
                   Sets a short measurement duration for measurements of station-
                   ary high power signals for the selected power sensor.

Mode: PSM

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

This command activates or deactivates manual averaging for the selected power sensor.
The average count is set with the [SENSe:]PMETer<p>:MTIMe:AVERage:COUNt
command.
Suffix:

<p>   1...4
                   Power sensor index

Parameters:

<State>   ON | OFF

                   *RST: OFF
Example: PMET2:MTIM:AVER ON
                   Activates manual averaging.

Mode: PSM

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

This command defines the number of readings (averagings) to be performed after a single sweep has been started for the selected power sensor. This command is only available if the `[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe]` command is set to ON.

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 meter measurement.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<NumberReadings>	0 to 256 in binary steps (1, 2, 4, 8,…)
	For average count = 0 or 1, one reading is performed.
Example:	`PMET2:MTIM:AVER ON`
	Activates manual averaging.
	`PMET2:MTIM:AVER:COUN 8`
	Sets the number of readings to 8.
Mode:	PSM

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

This command defines whether the reference level offset set for the analyzer is taken into account for the measured power or not for the selected power sensor.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<State>	**ON**
	Adds the offset defined by the `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` command to the measured level.
	OFF
	Takes no offset into account.
	*RST: ON
Example:	`PMET2:ROFF OFF`
	Takes no offset into account for the measured power.
Mode:	PSM

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

This command switches the external power trigger on or off for the selected power sensor.

This command is only available in conjunction with a 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
Mode:	PSM

[SENSe:]PMETer<p>:TRIGger:LEVel <Value>

This command sets the power level for the external power trigger for the selected power sensor.

This command is only available in conjunction with a NRP-Z81 power sensor.

Suffix:

<p>	1...4
	Power sensor index

Parameters:

<Value>	-20 to +20 dBm
	*RST: -10 dBm
Example:	PMET2:TRIG:LEV –10 dBm
	Sets the level of the trigger
Mode:	PSM

SENSe:POWer Subsystem

This subsystem controls the setting of the instruments channel and adjacent channel power measurements.

[SENSe:]POWer:ACHannel:ACPairs <Value>

This command sets the number of adjacent channels (upper and lower channel in pairs).The figure 0 stands for pure channel power measurement.

Parameters:

<Value>   0 to 12 (WCDMA: 0 to 3)

                              *RST: 1

Example: POW:ACH:ACP 3

                    Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

Mode: A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]
    <Bandwidth>

This command sets the channel bandwidth of the specified TX channel in the radio communication system. The bandwidths of adjacent channels are not influenced by this modification.

With [SENSe<source>:]POWer:HSPeed set to ON, steep-edged channel filters are available. For further information on filters refer to chapter 3.2.6.4, "List of Available RRC and Channel Filters", on page 122.

Parameters:

<Bandwidth>   100 Hz to 1000 MHz

                              *RST: 14 kHz

Example: POW:ACH:BWID:CHAN2 30 kHz

                    Sets the bandwidth of the TX channel 2 to 30 kHz.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel <Bandwidth>

This command defines the channel bandwidth of the adjacent channel of the radio transmission system. If the bandwidth of the adjacent channel is changed, the bandwidths of all alternate adjacent channels are automatically set to the same value.

With `[SENSe<source>:]POWer:HSPeed` set to ON, steep-edged channel filters are available. For further information on filters refer to .

Parameters:

<Bandwidth>	100 Hz to 1000 MHz
	*RST: 14 kHz
Example:	POW:ACH:BWID:ACH 30 kHz
	Sets the bandwidth of all adjacent channels to 30 kHz.
Mode:	A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<channel> <Bandwidth>

This command defines the channel bandwidth of the specified alternate adjacent channels of the radio transmission system. If the channel bandwidth of one alternate adjacent channel is changed (e.g. channel 3), the bandwidth of all subsequent alternate adjacent channels (e.g. 4–11) is automatically set to the same value.

With `[SENSe<source>:]POWer:HSPeed` set to ON, steep-edged channel filters are available. For further information on filters refer to .

Suffix:

<channel>	1...11
	the alternate adjacent channel

Parameters:

<Bandwidth>	100 Hz to 1000 MHz
	*RST: 14 kHz
Example:	POW:ACH:BWID:ALT2 30 kHz
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:FILTer:ALPHa[:ALL] <Value>

This command defines the alpha value for the weighting filter for all channels.

Parameters:

<Value>	<numeric value>
	*RST: 0,22
Example:	POW:ACH:FILT:ALPH:ALL 0,35
Mode:	A-F

[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel <Value>

This command defines the alpha value for the weighting filter for the adjacent channel.

Parameters:

<Value>	<numeric value>

	*RST: 0,22
Example:	POW:ACH:FILT:ALPH:ACH 0,35
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTernate<channel> <Value>

This command defines the alpha value for the weighting filter for the specified alternate channel.

Suffix:

<channel>	1...11
	the alternate channel

Parameters:

<Value>	<numeric value>

	*RST: 0,22
Example:	POW:ACH:FILT:ALPH:ALT3 0,35
	Sets the alpha value for the weighting filter for the alternate channel 3 to 0,35.
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<channel> <Value>

This command defines the alpha value for the weighting filter for the specified TX channel.

Suffix:

<channel>	1...11
	the TX channel

Parameters:

<Value>	<numeric value>

	*RST: 0,22
Example:	POW:ACH:FILT:ALPH:CHAN3 0,35
	Sets the alpha value for the weighting filter for the TX channel 3 to 0,35.
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALL <State>

This command activates the weighting filter for all channels.

Parameters:

<State>	ON	OFF

	*RST: OFF
Example:	POW:ACH:FILT ON
Mode:	A-F

[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel <State>

This command activates the weighting filter for the adjacent channel.

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	POW:ACH:FILT:ACH ON
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTernate<channel> <State>

This command activates the weighting filter for the specified alternate channel.

Suffix:

<channel>	1...11
	the alternate adjacent channel

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	POW:ACH:FILT:ALT3 ON
	Activates the weighting filter for alternate channel 3.
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel<channel> <State>

This command activates the weighting filter for the specified TX channel.

Suffix:

<channel>	1...18
	the TX channel

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	POW:ACH:FILT:CHA3 ON
	Activates the weighting filter for TX channel 3.
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:MODE <Mode>

This command switches between absolute and relative adjacent channel measurement. The command is only available with span > 0 and if the number of adjacent channels is greater than 0.

For the relative measurement the reference value is set to the currently measured channel power using the command [SENSe:]POWer:ACHannel:REFerence:AUTO ONCE.

Parameters:

<Mode>	ABSolute | RELative

ABSolute
absolute adjacent channel measurement

RELative
relative adjacent channel measurement

> *RST: RELative

Example: POW:ACH:MODE REL
Sets the adjacent channel measurement mode to relative.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, WCDMA, TDS

[SENSe:]POWer:ACHannel:NAME:ACHannel <Name>

This command defines a name for the adjacent channel. The name is displayed in the result diagram and the result table.

Parameters:

<Name>	'<string>'

> *RST: TX<1...12>

Example: POW:ACH:NAME:ACH 'XYZ'
Defines the name of the adjacent channel as 'XYZ'.

Mode: A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:NAME:ALTernate<channel> <Name>

This command defines a name for the specified alternate channel. The name is displayed in the result diagram and the result table.

Suffix:

<channel>	1...11
	the alternate channel

Parameters:

<Name>	'<string>'

> *RST: ALT<1...11>

Example: POW:ACH:NAME:ALT3 'XYZ'
Defines the name of the third alternate channel as 'XYZ'.

Mode: A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:NAME:CHANnel<channel> <Name>

This command defines a name for the specified TX channel. The name is displayed in the result diagram and the result table.

Suffix:

<channel>	1...12
	the TX channel

Parameters:

<Name>	'<string>'

	*RST: TX<1...12>
Example:	POW:ACH:NAME:CHAN3 'XYZ'
	Defines the name of the third transmission channel as 'XYZ'.
Mode:	A-F, EVDO, TDS

[SENSe:]POWer:ACHannel:PRESet <Setting>

This command adjusts the frequency span, the measurement bandwidths and the detector as required for the number of channels, the channel bandwidths and the channel spacings selected in the active power measurement. If necessary, adjacent-channel power measurement is switched on prior to the adjustment.

To obtain correct results, a complete sweep with synchronization to the end of the sweep must be performed after the adjustment. Synchronization is possible only in the single sweep mode.

The result is queried with the CALCulate<n>:MARKer<m>:FUNCtion:POWer: RESult command.

Parameters:

<Setting>	ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0

Example:	POW:ACH:PRES ACP
	Sets the frequency span, the measurement bandwidths and the detector as required for the ACLR measurement.
	INIT:CONT OFF
	Switches over to single sweep mode.
	INIT;*WAI
	Starts a sweep and waits for the end of the sweep.
	CALC:MARK:FUNC:POW:RES? ACP
	Queries the result of the adjacent-channel power measurement.
Mode:	A-F, CDMA, EVDO, TDS

[SENSe:]POWer:ACHannel:PRESet:RLEVel

This command adapts the reference level to the measured channel power and – if required – switches on previously the adjacent channel power measurement. This ensures that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded.

Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.

Example:	POW:ACH:PRES:RLEV;*WAI
	Adapts the reference level to the measured channel power.

Mode: A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:REFerence:AUTO ONCE

This command sets the reference value to the currently measured channel power for the relative measurement.

Example: `POW:ACH:REF:AUTO ONCE`

Mode: A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO <Channel>

This command activates the automatic selection of a transmission channel to be used as a reference channel in relative adjacent-channel power measurements.

The transmission channel with the highest power, the transmission channel with the lowest power, or the transmission channel nearest to the adjacent channels can be defined as a reference channel.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0 (`CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect` on page 507).

Parameters:

<Channel>   MINimum | MAXimum | LHIGhest

                             MINimum
                             Transmission channel with the lowest power

                             MAXimum
                             Transmission channel with the highest power

                             LHIGhest
                             Lowermost transmission channel for the lower adjacent channels, uppermost transmission channel for the upper adjacent channels

Example: `POW:ACH:REF:TXCH:AUTO MAX`
                             The transmission channel with the highest power is used as a reference channel.

Mode: A-F, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual <ChannelNumber>

This command selects a transmission channel to be used as a reference channel in relative adjacent-channel power measurements.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0 (`CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect` on page 507).

Parameters:

<ChannelNumber>   1 to 18 (WCDMA: number of TX channels)

                             *RST: 1

Example:	POW:ACH:REF:TXCH:MAN 3
	Transmission channel 3 is used as a reference channel.
Mode:	A-F, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <Value>

This command defines the spacing between the carrier signal and the adjacent channel (ADJ). The modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, ...): they are all multiplied by the same factor (new spacing value/old spacing value).

Parameters:

<Value>	100 Hz to 2000 MHz
	*RST: 14 kHz
Example:	POW:ACH:SPAC 33kHz
	Sets the spacing between the carrier signal and the adjacent channel to 33 kHz, the alternate adjacent channel 1 to 66 kHz, the alternate adjacent channel 2 to 99 kHz, and so on.
Mode:	A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:SPACing:ALTernate<channel> <Spacing>

This command defines the spacing between the alternate adjacent channels and the TX channel (ALT1, ALT2, ...). A modification of a higher adjacent-channel spacing causes a change by the same factor (new spacing value/old spacing value) in all higher adjacent-channel spacings, while the lower adjacent-channel spacings remain unchanged.

Suffix:

| <channel> | 1...11 |
| | the alternate adjacent channel |

Parameters:

<Spacing>	100 Hz to 2000 MHz
	*RST: 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...
Example:	POW:ACH:SPAC:ALT1 100 kHz
	Sets the spacing between TX channel and alternate adjacent channel 1 (ALT1) from 40 kHz to 100 kHz. In consequence, the spacing between the TX channel and all higher alternate adjacent channels is increased by the factor 100/40 = 2.5: ALT2 = 150 kHz, ALT3 = 200 kHz, ALT4 = 250 kHz.
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:SPACing:CHANnel<channel> <Value>

This command defines the channel spacing for the carrier signals.

Suffix:

| <channel> | 1...11 |
| | the TX channel |

Parameters:

<Value>	14 kHz to 2000 MHz
	*RST: 20 kHz
Example:	POW:ACH:SPAC:CHAN 25kHz
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:TXCHannel:COUNt <Number>

This command selects the number of carrier signals.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0 (see CALCulate<n>:MARKer<m>:FUNCtion:POWer: SELect on page 507).

Parameters:

<Number>	1 to 18
	*RST: 1
Example:	POW:ACH:TXCH:COUN 3
Mode:	A, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:BANDwidth|BWIDth <Percentage>

This command defines the percentage of the power with respect to the total power.

This value is the basis for the occupied bandwidth measurement (see [SENSe:]POWer:ACHannel:PRESet on page 638).

Parameters:

<Percentage>	10 to 99.9PCT
	*RST: 99PCT
Example:	POW:BWID 95PCT
Mode:	A-F, CDMA, EVDO, TDS

[SENSe:]POWer:HSPeed <State>

This command switches on or off the high-speed channel/adjacent channel power measurement. The measurement itself is performed in zero span on the center frequencies of the individual channels. The command automatically switches to zero span and back.

Depending on the selected mobile radio standard, weighting filters with characteristic or very steep-sided channel filters are used for band limitation.

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	POW:HSP ON
Mode:	A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:NCORrection

When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined.

Parameters:

	*RST:	OFF
Example:	POW:NCOR ON	
Mode:	A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA	

[SENSe:]POWer:TRACe <TraceNumber>

This command assigns the channel/adjacent channel power measurement to the indicated trace. The corresponding trace must be active, i.e. its state must be different from blank.

Note: The measurement of the occupied bandwidth (OBW) is performed on the trace on which marker 1 is positioned. To evaluate another trace, marker 1 must be positioned to another trace with CALCulate<n>:MARKer<m>:TRACe.

Parameters:

<TraceNumber>   1 to 6

Example:	POW:TRAC 2
	Assigns the measurement to trace 2.
Mode:	A, CDMA, EVDO, TDS, WCDMA

SENSe:SWEep Subsystem

The SENSe:SWEep subsystem controls the sweep parameters.

[SENSe:]SWEep:COUNt <NumberSweeps>

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

Parameters:

<NumberSweeps>   0 to 32767

	*RST: 0 (GSM: 200)
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.
Mode:	A, ADEMOD, BT, CDMA, EVDO, PHN, TDS, WCDMA, GSM, NF

[SENSe:]SWEep:COUNt:CURRent

This query command returns the current number of started sweeps. A sweep count value should be set and the device should be in single sweep mode.

Parameters:

	*RST: 0
Example:	SWE:COUNt 64
	Sets sweep count to 64
	INIT:CONT OFF
	Switches to single sweep mode
	INIT
	Starts a sweep (without waiting for the sweep end!)
	SWE:COUN:CURR?
	Queries the number of started sweeps
Mode:	A, BT, ADEMOD, TDS

[SENSe:]SWEep:EGATe <State>

This command switches on/off the sweep control by an external gate signal. If the external gate is selected the trigger source is automatically switched to EXTernal as well.

In case of measurement with external gate, the measured values are recorded as long as the gate is opened. During a sweep the gate can be opened and closed several times. The synchronization mechanisms with *OPC, *OPC? and *WAI remain completely unaffected.

The sweep end is detected when the required number of measurement points (691 in "Spectrum" mode) has been recorded.

Parameters:

<State>   ON | OFF

*RST: OFF

Example: `SWE:EGAT ON`
                     Switches on the external gate mode.
                     `SWE:EGAT:TYPE EDGE`
                     Switches on the edge-triggered mode.
                     `SWE:EGAT:HOLD 100US`
                     Sets the gate delay to 100 μs.
                     `SWE:EGAT:LEN 500US`
                     Sets the gate opening time to 500 μs.
                     `INIT;*WAI`
                     Starts a sweep and waits for its end.

Mode: A, BT, EVDO, TDS, WLAN, OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:HOLDoff <DelayTime>

This command defines the delay time between the external gate signal and the continuation of the sweep.

Note: Using gate mode "level" (see `[SENSe:]SWEep:EGATe:TYPE` on page 647) and an IFP trigger (see `TRIGger<n>[:SEQuence]:SOURce` on page 692), the holdoff time for the IFP trigger is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

Parameters:

<DelayTime>   0 s to 30 s

                     *RST: 0s
Example: `SWE:EGAT:HOLD 100us`
Mode: A, ADEMOD, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:LENGth <TimeInterval>

In case of edge triggering, this command determines the time interval during which the instrument sweeps.

Parameters:

<TimeInterval>   125 ns to 30 s

                     *RST: 400μs
Example: `SWE:EGAT:LENG 10ms`
Mode: A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:POLarity <Polarity>

This command determines the polarity of the external gate signal. The setting applies both to the edge of an edge-triggered signal and the level of a level-triggered signal.

Parameters:

<Polarity>   POSitive | NEGative

                     *RST: POSitive
Example: `SWE:EGAT:POL POS`

Mode: A, ADEMOD, BT, EVDO, TDS, WCDMA

[SENSe:]SWEep:EGATe:SOURce <Source>

This command toggles between the available signal sources for the gate mode. If an IF power signal is used, the gate is opened as soon as a signal at > -20 dBm is detected within the IF path bandwidth (10 MHz).

For details see the "Trg/Gate Source" on page 146 softkey.

Parameters:

<Source>   EXTernal | IFPower | VIDeo | RFPower

                             *RST: IFPower

Example: SWE:EGAT:SOUR IFP

                             Switches the gate source to IF power.

Mode: A, ADEMOD, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TRACe<k>:COMMent <Comment>

Defines a comment for one of the traces for gated triggering.
Suffix:

<k>   1...6
                             trace

Parameters:

<Comment>   <string>

Example: SWE:EGAT:TRAC1:COMM "SlotA"

Mode: A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TRACe<k>[:STATe<range>] <State>

This command activates or deactivates tracing for a specific range using gated triggering.
Suffix:

<k>   1...6
                             trace

<range>   1...3
                             range

Parameters:

<State>   ON | OFF

                             *RST: OFF

Example: SWE:EGAT:TRAC1:STAT1 ON

                             Activates tracing for range 1 of trace 1.

Mode: A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TRACe\<k>:STARt\<range> \<Value>

This command defines the starting point for the range to be traced using gated triggering.
Suffix:

\<k>	1...6
	trace
\<range>	1...3
	range

Parameters:

\<Value>	\<numeric value>
	*RST: OFF
Example:	SWE:EGAT:TRAC1:STAR1 3ms
	Sets the Starting point for range 1 on trace 1 at 3 ms.
Mode:	A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TRACe\<k>: STOP\<range> \<Value>

This command defines the stopping point for the range to be traced using gated triggering
Suffix:

\<k>	1...6
	trace
\<range>	1...3
	range

Parameters:

\<Value>	\<numeric value>
	*RST: 1 µs
Example:	SWE:EGAT:TRAC1:STOP1 5ms
	Sets the stopping point for range 1 on trace 1 at 5 ms.
Mode:	A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TRACe\<k>: PERiod \<Value>

This command defines the length of the period to be traced using gated triggering.
Suffix:

\<k>	1...6
	trace

Parameters:

\<Value>	\<numeric value>
	*RST: 0 s
Example:	SWE:EGAT:TRAC1:PER 5ms
	Defines the period for gated triggering to 5 ms.
Mode:	A, BT, EVDO, TDS

[SENSe:]SWEep:EGATe:TYPE <Type>

This command sets the type of triggering by the external gate signal.

A delay between applying the gate signal and the start of recording measured values can be defined, see `[SENSe:]SWEep:EGATe:HOLDoff` on page 644.

Parameters:

<Type>   LEVel | EDGE

LEVel
The gate is level-triggered:
After detection of the gate signal, the gate remains open until the gate signal disappears. The gate opening time cannot be defined with the command `[SENSe:]SWEep:EGATe:HOLDoff`.
Note: Using gating with gate mode "level" and an IFP trigger (see `TRIGger<n>[:SEQuence]:SOURce` on page 692), the holdoff time for the IFP trigger is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

EDGE
The gate is edge-triggered:
After detection of the set gate signal edge, the gate remains open until the gate delay (`[SENSe:]SWEep:EGATe:HOLDoff`) has expired.

*RST: EDGE

Example: SWE:EGAT:TYPE EDGE

Mode: A, ADEMOD, BT, EVDO, TDS

[SENSe:]SWEep:MODE <Mode>

This command changes from "Spectrum" to "Spectrum Emission Mask" or "Spurious Emissions" measurement mode and back.

Parameters:

<Mode>   AUTO | ESPectrum | LIST

AUTO
Switches to "Spectrum" measurement mode or stays in the current mode if it is not ESP/LIST

ESPectrum
"Spectrum Emission Mask" measurement mode

LIST
"Spurious Emissions" measurement mode

*RST: AUTO

Example: SWE:MODE ESP
Sets the Spectrum Emission Mask measurement mode.

Mode: A, BT, CDMA, EVDO, PHN

[SENSe:]SWEep:POINts <NumberPoints>

This command defines the number of measurement points to be collected during one sweep.

Note: For Spurious Emissions measurements the maximum number of sweep points in all ranges is limited to 100001.

Parameters:

<NumberPoints>   101 to 32001 | NF (K30): 2 to 100

                        *RST: 691 (NF: 11)

Example: SWE:POIN 251

Mode: A, ADEMOD, BT, CDMA, EVDO, TDS, NF, PHN, WCDMA

[SENSe:]SWEep:TIME <Time>

This command defines the sweep time.

The range depends on the frequency span.

If this command is used in analyzer mode, automatic coupling to resolution bandwidth and video bandwidth is switched off.

Parameters:

<Time>   refer to data sheet

                        *RST: (AUTO is set to ON)

Example: SWE:TIME 10s

Mode: ALL

[SENSe:]SWEep:TIME:AUTO <State>

In realtime mode, this command automatically sets the sweep time to 32 ms.

In analyzer mode, this command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings. If [SENSe:]SWEep:TIME is used, automatic coupling is switched off.

Parameters:

<State>   ON | OFF

                        *RST: ON

Example: SWE:TIME:AUTO ON
                        Activates automatic sweep time.

Mode: A, BT, CDMA, EVDO, RT, TDS, NF, WCDMA

[SENSe:]SWEep:TYPE <Type>

Parameters:

<Type>   SWE | AUTO | FFT

                            SWE
                            Sweep list

                            AUTO
                            Automatic selection of the sweep type.

                            FFT
                            FFT mode

                            *RST: AUTO
                            Sets the sweep type.

Example: `SWE:TYPE FFT`

Mode: all

[SENSe:]SWEep:TYPE:USED

Returns the used sweep type. This command is useful if `[SENSe:]SWEep:TYPE` is set to "AUTO" (default).

Parameters:

<Type>   SWE | FFT

                            SWE
                            Sweep list

                            FFT
                            FFT mode

                            *RST: SWE

Example: `SWE:TYPE:USED?`

Mode: A, ADEMOD

SENSe:[WINDow:]DETector Subsystem

The SENSe:DETector subsystem controls the acquisition of measurement data via the selection of the detector for the corresponding trace.

[SENSe:][WINDow:]DETector<trace>[:FUNCtion] <Function>

This command switches on the detector for the data acquisition in the selected trace in the specified window.

Suffix:

<trace>   1...6
                            trace

Parameters:

<Function>	APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak

*RST: APEak

For details on detectors refer to chapter 3.2.8.6, "Detector Overview", on page 143.

Example: `DET POS`

Sets the detector to "positive peak".

Mode: A, ADEMOD

[SENSe:][WINDow:]DETector<trace>[:FUNCtion]:AUTO <State>

This command either couples the detector to the current trace setting or turns coupling off in the specified window.

Suffix:

<trace>	1...6
	trace

Parameters:

<State>	ON | OFF

*RST: ON

Example: `DET:AUTO OFF`

Mode: A, ADEMOD

4.2.3.15   SOURce Subsystem

The SOURce subsystem controls the output signals of the instrument.

The following functions are included:

SOURce Subsystem commands

SOURce\<n>:AM:STATe \<State>

This command switches on or off the external amplitude modulation of the tracking generator in the selected measurement window.

External I/Q modulation is switched off, if active. This command is only valid in conjunction with the tracking generator option R&S FSV-B9.

Suffix:

\<n>	1...4
	window

Parameters:

\<State>	ON | OFF
	*RST: OFF
Example:	SOUR2:AM:STAT ON
	Switches on the external amplitude modulation of the tracking generator for screen B.
Usage:	SCPI conform
Mode:	A

SOURce\<n>:DM:STATe \<State>

This command switches on or off the external I/Q modulation of the tracking generator in the selected measurement window.

External AM and external FM are switched off, if active. This command is only valid in conjunction with the tracking generator option R&S FSV-B9.

Suffix:

\<n>	1...4
	window

Parameters:

\<State>	ON | OFF
	*RST: OFF
Example:	SOUR2:DM:STAT ON
	Switches on the external I/Q modulation of the tracking generator for screen B.
Usage:	SCPI conform
Mode:	A

SOURce\<n>:EXTernal\<generator>[:STATe] \<State>

This command activates or deactivates the external generator indicated by the suffix \<generator>.

This command is only valid for analyzer External Tracking Generator option (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	external generator

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	SYST:COMM:RDEV:GEN1:TYPE 'SMP02'
	Selects SMP02 as generator 1.
	"SYST:COMM:RDEV:GEN1:LINK TTL"
	Selects GPIB + TTL link as interface.
	"SYST:COMM:RDEV:GEN1:ADDR 28"
	Sets the generator address to 28.
	"SOUR:EXT1:FREQ:SWE ON"
	Activates the frequency sweep for generator 1.
	"SOUR:EXT ON"
	Activates the external generator
Mode:	A

SOURce<n>:EXTernal<m>:FREQuency <Frequency>

This command defines a fixed source frequency for the external tracking generator (requires option R&S FSV-B10).

Suffix:

<n>	1...4
	window
<m>	1 | 2
	tracking generator

Parameters:

<Frequency>	Source frequency of the external tracking generator.
	*RST: RST value
Example:	SOUR:EXT2:FREQ 10MHz
Mode:	Mode

SOURce<n>:EXTernal<m>:FREQuency:COUPling[:STATe] <State>

This command couples the external tracking generator to (requires option R&S FSV-B10).

Suffix:

<n>	1...4
	window
<m>	1 | 2
	tracking generator

Parameters:

<State>	ON | OFF
	ON
	OFF
	The fixed frequency defined using `SOURce<n>:EXTernal<m>:FREQuency` is used as a source frequency.
	*RST: OFF
Example:	SOUR:EXT2:FREQ:COUP ON
Mode:	Mode

SOURce<n>:EXTernal<generator>: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.

This command is only valid for analyzer option External Tracking Generator (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Value>	<numeric value>
	*RST: 1
	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:
	$F_{Generator} = \left\| F_{Analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right\|$
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.
Mode:	A, NF

SOURce<n>:EXTernal<generator>: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.

This command is only valid for analyzer option External Tracking Generator (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Value>	<numeric value>

　　　　　　　　　　　*RST:　　　1

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:

$$F_{Generator} = \left| F_{analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

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.
Mode:	A, NF

SOURce<n>:EXTernal<generator>:FREQuency:OFFSet<m> <Offset>

This command defines the frequency offset of the selected generator with reference to the receive frequency.

This command is only valid for analyzer option External Tracking Generator (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only
<m>	1 | 2
	offset (for Noise Figure measurements (K30) only)

Parameters:

<Offset>	<numeric value>, specified in Hz, kHz, MHz or GHz, rounded to the nearest Hz

　　　　　　　　　　　*RST:　　　0 Hz

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:

$$F_{Generator} = \left| F_{analyzer} * \frac{Numerator}{Denominator} + F_{Offset} \right|$$

For Noise Figure measurements (R&S FSV-K30), the following formula applies:

Generator Frequency = [(LO + Offset 1) * Factor 1 / Factor 2)] + Offset 2

Example:	SOUR:EXT:FREQ:OFFS 1GHZ
	Sets a frequency offset of the generator transmit frequency compared to the analyzer receive frequency of 1 GHz.
Mode:	A, NF

SOURce<n>:EXTernal<generator>:FREQuency:SWEep[:STATe] <State>

This command activates or deactivates the frequency sweep for the selected generator.

This command is only valid for analyzer option External Tracking Generator (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	external generator

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	SOUR:EXT1:FREQ:SWE ON
	Activates the frequency sweep for external generator 1.
Mode:	A

SOURce<n>:EXTernal<generator>:POWer[:LEVel] <Level>

This command sets the output power of the selected generator.

This command is only valid for analyzer option External Tracking Generator (R&S FSV-B10).

Suffix:

<n>	irrelevant
<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Level>	<numeric value>
	*RST: -20 dBm
Example:	SOUR:EXT:POW -30dBm
	Sets the generator level to -30 dBm
Mode:	A, NF

SOURce<n>:EXTernal<generator>:ROSCillator[:SOURce] <Source>

This command controls selection of the reference oscillator for the external tracking generator (requires option R&S FSV-B10).

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Suffix:

<n>	irrelevant
<generator>	1 | 2 tracking generator For Noise Figure measurements (K30): 1 only

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
	EAUTo the external reference is used as long as it is available, then the instrument switches to the internal reference (Spectrum mode only)
	*RST: INT
Example:	SOUR:EXT:ROSC EXT Switches to external reference oscillator
Mode:	A, NF

SOURce<n>:FM:STATe <State>

This command switches on or off the external frequency modulation of the tracking generator in the selected measurement window.

External I/Q modulation is switched off, if active. This command is only valid in conjunction with the tracking generator option R&S FSV-B9.

Suffix:

<n>	1...4 window

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	SOUR2:FM:STAT ON Switches on the external frequency modulation of the tracking generator for screen B.
Usage:	SCPI conform
Mode:	A

SOURce<n>:FM:DEViation <Value>

This command defines the maximum frequency deviation at 1 V input voltage at the FM input of the tracking generator. This command is only valid in conjunction with the tracking generator option R&S FSV-B9.

Suffix:

<n>	1...4
	window

Parameters:

<Value> The possible value range is 100 Hz to 10 MHz in steps of 10 Hz.

	*RST: 100 Hz
Example:	SOUR1:FM:DEV 1 MHz
	Sets the maximum frequency deviation of the tracking generator for screen A to 1 MHz.
Usage:	SCPI conform
Mode:	A

SOURce<n>:FREQuency:OFFSet <Offset>

This command defines a frequency offset of the tracking generator for the indicated measurement window. Frequency-converting DUTs can be measured with this setting.

External I/Q modulation is switched off, if active. This command is only valid in conjunction with the tracking generator option R&S FSV-B9.

Suffix:

<n>	1...4
	window

Parameters:

<Offset> The possible value range is -200 MHz to 200 MHz. Note that the values (start frequency – tracking frequency offset) and (stop frequency – tracking frequency offset) are both > 1 kHz or both < –1 kHz.

	*RST: 0 Hz
Example:	SOUR:FREQ:OFFS 10MHz
	Switches on the frequency offset of the tracking generator for screen A to 10 MHz.
Usage:	SCPI conform
Mode:	A

SOURce:POWer Subsystem

The SOURce:POWer subsystem controls the power of the tracking generator signal (only with analyzer option B9 or B10).

SOURce\<n\>:POWer[:LEVel][:IMMediate][:AMPLitude] \<Level\>

This command defines the output level of the tracking generator.

Parameters:

\<Level\>	\<numeric_value\> in dBm, range specified in data sheet;
	*RST: -20 dBm
Example:	SOUR:POW –20dBm
	Sets the tracking generator level to -20 dBm.
Usage:	SCPI conform
Mode:	A

SOURce\<n\>:POWer[:LEVel][:IMMediate]:OFFSet \<Offset\>

This command defines a level offset for the tracking generator level. Thus, for example, attenuators or amplifiers at the output of the tracking generator can be taken into account for the setting.

Parameters:

\<Offset\>	-200 dB to +200 dB
	*RST: 0dB
Example:	SOUR:POW:OFFS –10dB
	Sets the level offset of the tracking generator to – 20 dBm.
Usage:	SCPI conform
Mode:	A

SOURce\<n\>:POWer:MODE \<Mode\>

This command activates or deactivates the power sweep. If the power sweep is on, the analyzer is set to zero span mode (span = 0Hz). During the sweep time of the zero span, the power at the internal tracking generator is changed linearly from start power to stop power. The Start and stop power for the power sweep are displayed in the diagram header ("INT TG \<start power\>… \<stop power\>").

Suffix:

\<n\>	1...4
	window

Parameters:

\<Mode\>	FIXed | SWEep
	*RST: FIX
Example:	SOUR:POW:MODE SWE
	Activates power sweep.
Usage:	SCPI conform
Mode:	A

SOURce<n>:POWer:STARt <Power>

Defines the Start power of the power sweep.

Suffix:

<n>   1...4
                        window

Parameters:

<Power>   -30 dBm to +5 dBm

                        *RST: 0 dBm

Example: SOUR:POW:STAR –20dBm

Usage: SCPI conform

Mode: A

SOURce<n>:POWer:STOP <Power>

Defines the stop power of the power sweep. The stop value can be smaller than the start value.

Suffix:

<n>   1...4
                        window

Parameters:

<Power>   -30 dBm to +5 dBm

                        *RST: 0 dBm

Example: SOUR:POW:STOP –20dBm

Usage: SCPI conform

Mode: A

4.2.3.16 STATus Subsystem

The STATus subsystem contains the commands for the status reporting system (for details refer to the Operating Manual on the CD-ROM, chapter 5 "Remote Control – Basics", section "Status Reporting System"). *RST does not influence the status registers.

STATus:QUEStionable Subsystem

The STATus:QUEStionable subsystem contains information about the observance of limits during adjacent power measurements, the reference and local oscillator, the observance of limit lines and limit margins and possible overloads of the unit.

STATus:QUEStionable:ACPLimit[:EVENt]?

This command queries the contents of the "EVENt" section of the
STATus:QUEStionable:ACPLimit register. Readout deletes the contents of the
"EVENt" section.

Example:	STAT:QUES:ACPL?
Usage:	Query only
Mode:	all

STATus:QUEStionable:ACPLimit:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:ACPLimit register (see "STATus:QUEStionable:ACPLimit
Register", on page 405). Readout does not delete the contents of the "CONDition" sec-
tion.

Example:	STAT:QUES:ACPL:COND?
Usage:	Query only
Mode:	all

STATus:QUEStionable:ACPLimit:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the
STATus:QUEStionable:ACPLimit register. The "ENABle" register selectively ena-
bles the individual events of the associated "EVENt" section for the summary bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:ACPL:ENAB 65535

Mode: all

STATus:QUEStionable:ACPLimit:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:ACPLimit register from 1 to 0 for the transitions of the
"CONDition" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:ACPL:NTR 65535

Mode: all

STATus:QUEStionable:ACPLimit:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:ACPLimit register from 0 to 1 for the transitions of the
"CONDition" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:ACPL:PTR 65535

Mode: all

STATus:QUEStionable:DIQ:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:DIQ register for IQ measurements (see chapter 3.5.6, "STA-
Tus:QUEStionable:DIQ Register", on page 300). Readout does not delete the contents
of the "CONDition" section.

Example: STAT:QUES:DIQ:COND?

Usage: Query only

Mode: IQ

STATus:QUEStionable:DIQ[:EVENt]?

This command queries the contents of the "EVENt" section of the
STATus:QUEStionable:DIQ register for IQ measurements.

Readout deletes the contents of the "EVENt" section.

Example: STAT:QUES:DIQ?

Usage: Query only

Mode: IQ

STATus:QUEStionable:DIQ:ENABle <Enable>

Setting parameters:

<Enable>
Usage: SCPI conform

Mode: all

STATus:QUEStionable:DIQ:NTRansition <NTransition>

Setting parameters:

<NTransition>
Usage: SCPI conform

Mode: all

STATus:QUEStionable:DIQ:PTRansition <PTranstion>

Setting parameters:

<PTranstion>
Usage: SCPI conform

Mode: all

STATus:QUEStionable:FREQuency:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:FREQuency register (see "STATus:QUEStionable:FRE-
Quency Register", on page 405). Readout does not delete the contents of the "CONDi-
tion" section.

Example: STAT:QUES:FREQ:COND?

Usage: Query only

Mode: all

STATus:QUEStionable:FREQuency:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the
STATus:QUEStionable:FREQuency register. The "ENABle" register selectively ena-
bles the individual events of the associated "EVENt" section for the summary bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:FREQ:ENAB 65535

Mode: all

STATus:QUEStionable:FREQuency[:EVENt]?

This command queries the contents of the "EVENt" section of the STATus:QUEStionable:FREQuency register.

Readout deletes the contents of the "EVENt" section.

Example: STAT:QUES:FREQ?

Usage: Query only

Mode: all

STATus:QUEStionable:FREQuency:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the STATus:QUEStionable:FREQuency register from 1 to 0 for the transitions of the "CONDition" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:FREQ:NTR 65535

Mode: all, except NF

STATus:QUEStionable:FREQuency:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the STATus:QUEStionable:FREQuency register from 0 to 1 for the transitions of the "CONDition" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:FREQ:PTR 65535

Mode: all, except NF

STATus:QUEStionable:LIMit<m> [:EVENt]?

This command queries the contents of the "EVENt" section of the STATus:QUEStionable:LIMit register. Readout deletes the contents of the "EVENt" section.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix <1...4> is irrelevant.
Example:	STAT:QUES:LIM?
Usage:	Query only
Mode:	all

STATus:QUEStionable:LIMit<m>:CONDition?

This command queries the contents of the "CONDition" section of the STATus:QUEStionable:LIMit register (see "STATus:QUEStionable:LIMit Register", on page 406).

Readout does not delete the contents of the "CONDition" section.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix <1...4> is irrelevant.
Example:	STAT:QUES:LIM:COND?
Usage:	Query only
Mode:	all

STATus:QUEStionable:LIMit<m>:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the STATus:QUEStionable register. The "ENABle" register selectively enables the individual events of the associated "EVENt" section for the summary bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix <1...4> is irrelevant.

Parameters:

<BitDefinition>	0 to 65535
Example:	STAT:QUES:LIM:ENAB 65535
Mode:	all

STATus:QUEStionable:LIMit<m>:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the STATus:QUEStionable:LIMit register from 1 to 0 for the transitions of the "CONDition" bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement
	window, the suffix is irrelevant.

Parameters:

<BitDefinition>	0 to 65535

Example: STAT:QUES:LIM:NTR 65535

Mode: all, except NF

STATus:QUEStionable:LIMit<m>:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:LIMit register from 0 to 1 for the transitions of the "CONDi-
tion" bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement
	window, the suffix is irrelevant.

Parameters:

<BitDefinition>	0 to 65535

Example: STAT:QUES:LIM:PTR 65535

Mode: all, except NF

STATus:QUEStionable:LMARgin<m>[:EVENt]?

This command queries the contents of the "EVENt" section of the
STATus:QUEStionable:LMARgin register. Readout deletes the contents of the
"EVENt" section.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement
	window, the suffix is irrelevant.

Example: STAT:QUES:LMAR?

Usage: Query only

Mode: all

STATus:QUEStionable:LMARgin<m>:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:LMARgin register (see). Readout does not delete the contents of the "CONDition" sec-
tion.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix is irrelevant.

Example:	STAT:QUES:LMAR:COND?
Usage:	Query only
Mode:	all

STATus:QUEStionable:LMARgin<m>:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the
STATus:QUEStionable:LMARgin register. The "ENABle" register selectively enables the individual events of the associated "EVENt" section for the summary bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix is irrelevant.

Parameters:

<BitDefinition>	0 to 65535

Example:	STAT:QUES:LMAR:ENAB 65535
Mode:	all

STATus:QUEStionable:LMARgin<m>:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:LMARgin register from 1 to 0 for the transitions of the "CON-Dition" bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement window, the suffix is irrelevant.

Parameters:

<BitDefinition>	0 to 65535

Example:	STAT:QUES:LMAR:NTR 65535
Mode:	all

STATus:QUEStionable:LMARgin<m>:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:LMARgin register from 0 to 1 for the transitions of the "CON-Dition" bit.

Suffix:

<m>	1...4
	window
	For applications that do not have more than one measurement
	window, the suffix is irrelevant.

Parameters:

<BitDefinition>	0 to 65535

Example:	STAT:QUES:LMAR:PTR 65535
Mode:	all

STATus:QUEStionable:POWer[:EVENt]?

This command queries the contents of the "EVENt" section of the
STATus:QUEStionable:POWer register. Readout deletes the contents of the
"EVENt" section.

Example:	STAT:QUES:POW?
Usage:	Query only
	SCPI conform
Mode:	all

STATus:QUEStionable:POWer:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:POWer register (see "STATus:QUEStionable:POWer Regis-
ter", on page 407). Readout does not delete the contents of the "CONDition" section.

Example:	STAT:QUES:POW:COND?
Usage:	Query only
	SCPI conform
Mode:	all

STATus:QUEStionable:POWer:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the
STATus:QUEStionable:POWer register. The "ENABle" register selectively enables
the individual events of the associated "EVENt" section for the summary bit.

Parameters:

<BitDefinition>	0 to 65535

Example:	STAT:QUES:POW:ENAB 65535
Usage:	SCPI conform
Mode:	all

STATus:QUEStionable:POWer:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:POWer register from 1 to 0 for the transitions of the "CONDi-
tion" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUE:POWS:NTR 65535

Usage: SCPI conform

Mode: all

STATus:QUEStionable:POWer:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
STATus:QUEStionable:POWer register from 0 to 1 for the transitions of the "CONDi-
tion" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: STAT:QUES:POW:PTR 65535

Usage: SCPI conform

Mode: all

STATus:QUEStionable:SYNC[:EVENt]?

This command queries the contents of the "EVENt" section of the
STATus:QUEStionable:SYNC register. For details see the description for the individ-
ual firmware applications.

Readout deletes the contents of the "EVENt" section.

Example: STAT:QUES:SYNC?

Usage: Query only

Mode: This command is required by the firmware applications only.

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the "CONDition" section of the
STATus:QUEStionable:SYNC register. For details see the description for the individ-
ual firmware applications.

Readout does not delete the contents of the "CONDition" section.

Example: STAT:QUES:SYNC:COND?

Usage: Query only

Mode: This command is required by the firmware applications only.

STATus:QUEStionable:SYNC:ENABle <BitDefinition>

This command sets the bits of the "ENABle" section of the
`STATus:QUEStionable:SYNC` register. The "ENABle" register selectively enables the
individual events of the associated "EVENt" section for the summary bit.

Parameters:

<BitDefinition>   0 to 65535

Example: `STAT:QUES:SYNC:ENAB 65535`

Mode: This command is required by the firmware applications only.

STATus:QUEStionable:SYNC:NTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
`STATus:QUEStionable:SYNC` register from 1 to 0 for the transitions of the "CONDi-
tion" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: `STAT:QUES:SYNC:NTR 65535`

Mode: This command is required by the firmware applications only.

STATus:QUEStionable:SYNC:PTRansition <BitDefinition>

This command sets the edge detectors of all bits of the
`STATus:QUEStionable:SYNC` register from 0 to 1 for the transitions of the "CONDi-
tion" bit.

Parameters:

<BitDefinition>   0 to 65535

Example: `STAT:QUES:SYNC:PTR 65535`

Mode: This command is required by the firmware applications only.

4.2.3.17 SYSTem Subsystem

SYSTem:COMMunicate:GPIB:RDEVice:COMMand <GPIBAddress>, <Command>

.This command sends a command or query string to the external generator connected via the GPIB interface.

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Parameters:

<GPIBAddress>, <Command>	<0…30>: GPIB address of the external generator connected via the GPIB interface.
	<command>: String with the command. Only basic I/O is possible.
Example:	`"SYST:COMM:GPIB:RDEF:COMM 18,'*RST'"`
	Resets generator.
	`"SYST:COMM:GPIB:RDEF:COMM 18,'SOURCE:FREQ:CW 2E9'"`
	Sets generator frequency to 2 GHz.
	`"SYST:COMM:GPIB:RDEF:COMM 18,'SOUR:POW 0'"`
	Sets generator power to 0dBm.
	`"SYST:COMM:GPIB:RDEF:COMM? 18,'SENS:POW?'"`
	Queries the generator power.
Mode:	A

SYSTem:COMMunicate:GPIB:RDEVice:GENerator<generator>:ADDRess <Number>

Changes the IEC/IEEE-bus address of the external tracking generator.

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Suffix:

<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Number>

	Range:	0 to 30
	*RST:	28
Example:	`SYST:COMM:GPIB:RDEV:GEN1:ADDR 15`	
Mode:	A, NF	

SYSTem:COMMunicate:RDEVice:GENerator<generator>:INTerface <Type>

Defines the interface used for the connection to the external tracking generator.

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Suffix:

<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Type>	GPIB |TCPip
	*RST: GPIB
Example:	SYST:COMM:RDEV:GEN1:INT TCP
Mode:	A, NF

SYSTem:COMMunicate:RDEVice:GENerator<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.

Notes: Only one of the two generators can be operated via the TTL interface at a time. The other generator must be configured via GPIB.

For Noise Figure measurements (K30), TTL synchronization has no effect.

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Suffix:

<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

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.
Mode:	A, NF

SYSTem:COMMunicate:RDEVice:GENerator<generator>:TYPE <Name>

This command selects the type of external generator. For a list of the available generator types including the associated interface, see chapter 3.6.2.1, "Overview of Generators Supported by the analyzer", on page 308.

If no external generator type is currently configured, the query returns "NONE".

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Suffix:

<generator>	1 | 2
	tracking generator
	For Noise Figure measurements (K30): 1 only

Parameters:

<Name>	Generator name | NONE
	*RST:　　　NONE
Example:	SYST:COMM:RDEV:GEN2:TYPE 'SME02'
	Selects SME02 as generator 2
Mode:	A, NF

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 |

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

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 |

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".
Mode:	all

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

This command defines whether the selected power sensor index is automatically assigned to a subsequently connected power sensor. See also "Power Sensor Assignment" on page 369.

Suffix:

| \<p> | 1...4 |
| | Power sensor index |

Parameters:

\<State>	**ON	OFF**
	*RST: ON
Example:	`SYST:COMM:RDEV:PMET:CONF:AUTO OFF`
Mode:	ALL

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

This command queries the number of power sensors currently connected to the analyzer.

Suffix:

\<p>	1...4
	irrelevant
Example:	`SYST:COMM:RDEV:PMET:COUN?`
Usage:	Query only
Mode:	ALL

SYSTem:COMMunicate:TCPip:RDEVice:GENerator\<generator>:ADDRess \<Address>

Configures the TCP/IP address for the external tracking generator 1 or 2.

This command is only available if the analyzer option B10 (External Tracking Generator) is installed.

Suffix:

\<generator>	1	2
	tracking generator
	For Noise Figure measurements (K30): 1 only

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:GEN1:ADDR 130.094.122.195

Mode: A

SYSTem:SPEaker:VOLume <Level>

This command sets the volume of the built-in loudspeaker for demodulated signals (see
CALCulate<n>:MARKer<m>:FUNCtion:DEModulation[:STATe] on page 488). It
is only available with the audio demodulator option (R&S FSV-B3) and only for zero span
measurements in Spectrum mode.

Parameters:

                          Range: 0 to 1
                          *RST: 0.5
Example: SYST:SPE:VOL 0
                          Switches the loudspeaker to mute.

Mode: A

SYSTem:TIME:TSTamp?

Returns the time and date from the internal real time clock.

Parameters:

                          *RST: 0
Example: SYST:TIME:TSTamp?

Usage: Query only

Mode: all

4.2.3.18   TRACe Subsystem

The TRACe subsystem controls access to the instruments internal trace memory.

Some applications offer up to four measurement windows. For those, the suffix <n> for
TRACe selects the measurement window. For all other applications, the suffix is irrele-
vant.

The TRACe subsystem contains the following subsystem:

● "TRACe:IQ Subsystem", on page 678

Some further information on working with IQ data is provided here:

● chapter 3.2.10, "Working with I/Q Data", on page 153
● chapter 3.2.10.2, "I/Q Gating", on page 156

Commands of the TRACe subsystem

TRACe<n>[:DATA]? <ResultType>

This command returns the current trace data or measurement results. In case of several result displays, you have to use specific parameters to query the results.

The data format is variable. You can set it with `FORMat[:DATA]` on page 710. For more information on data formats see chapter 4.2.3.21, "Formats for Returned Values: ASCII Format and Binary Format", on page 695.

For details on saving and recalling data refer to chapter 4.2.4.7, "MMEMory Subsystem", on page 717.

Suffix:

<n>	1...4
	window; For applications that have only one measurement screen, the suffix is irrelevant.

Query parameters:

<ResultType>	TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6 | SPECtrogram | SGRam | LIST | SPURious
	Selects the type of result to be returned.
	TRACe1 | ...| TRACe6
	The query returns a list of results with one value for each sweep point in the currently set level unit.
	For details see table 4-17
	LIST
	Returns the results of the list evaluation of the Spectrum Emission Mask and Spurious Emissions measurement (Spectrum mode only). For a description of the syntax see table 4-18 below.
	SPURious
	Returns the peak list of the Spurious Emissions measurement (Spectrum mode only)
	SPECtrogram | SGRam
	Returns the complete spectogram trace data (requires R&S FSV-K14 option).
	For details see table 4-19.

Example:	`TRAC? TRACe1`
	Returns the trace data for Trace 1.

Usage:	Query only
Mode:	A, ADEMOD, BT, NF, PHN, TDS

Table 4-17: Results for <TRACe...> ResultTypes

> The query returns a list of results with one value for each sweep point in the currently set level unit. By default, the list contains 691 values. The currently used number of sweep points can be determined using SWE:POIN?, see `[SENSe:]SWEep:POINts` on page 648.
>
> `FORMat REAL,32` is used as format for binary transmission, and `FORMat ASCii` for ASCII transmission.
>
> For details on formats refer to chapter 4.2.3.21, "Formats for Returned Values: ASCII Format and Binary Format", on page 695.
>
> With the auto peak detector, only positive peak values can be read out.
>
> In **IQ Analyzer mode**, if the result display configuration "Real/Imag (I/Q)" is selected, this query returns the I values of each trace point first, then the Q values:
>
> <result>= $I_1, I_2, ..., I_n, Q_1, Q_2, ..., Q_n$

Table 4-18: Results for <LIST> ResultType

> Using the LIST parameter, the query returns the results of the list evaluation of the Spectrum Emission Mask and Spurious Emissions measurement (Spectrum mode only) with the following syntax:
>
> <no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>
>
> where:

<no>:	peak number
<start>:	start frequency of range
<stop>:	stop frequency of range
<rbw>:	resolution bandwidth of range
<freq>:	frequency of peak
<power abs>:	absolute power in dBm of peak
<power rel>:	relative power in dBc (related to the channel power) of peak
<delta>:	distance to the limit line in dB (positive indicates value above the limit, fail)
<limit check>:	limit fail (pass = 0, fail =1)
<unused1>:	reserved (0.0)
<unused2>:	reserved (0.0)

Table 4-19: Results for Spectrogram measurements

> For spectrogram measurements, the query returns the complete spectogram trace data (requires R&S FSV-K14 option). For each frame, the trace data is returned as a comma-separated list in the following order:
>
> <TraceData_Frame0>, <TraceData_Frame1>, ...<TraceData_FrameMinX>
>
> where <FrameMinX> is determined by CALC:SGR:FRAM:SEL MIN (see also example below)
>
> The trace data for each frame corresponds to the syntax described for the <TRACe> result type.
>
> To calculate the amount of returned values for <SPECtrogram> results:
>
> `CALC:SGR:FRAM:SEL MIN`
>
> `CALC:SGR:FRAM:SEL?` //returns value <FrameMinX>, e.g. -34
>
> `SWE:POIN?` //returns number of sweep points, e.g. 691
>
> `TRACE:DATA? SGR`

```
//returns 34*691 = 25494 comma separated values for the spectrogram
```

TRACe<n>[:DATA] <Trace>, <Data>

The command transfers trace data from a control computer to the analyzer. The transfer of trace data into the analyzer memory is available only in spectrum analyzer mode.

The data format is variable. You can set it with FORMat[:DATA] on page 710. For more information on data formats see chapter 4.2.3.21, "Formats for Returned Values: ASCII Format and Binary Format", on page 695.

For details on saving and recalling data refer to chapter 4.2.4.7, "MMEMory Subsystem", on page 717.

Suffix:

<n>   Sets the screen number you want to apply the command to.
                            For applications that have only one measurement screen, the suffix is irrelevant.

Parameters:

<Trace>   TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6

                            Selects the trace you want to write data to.

Setting parameters:

<Data>   <block> | <numeric_value>

                            Defines the data you want to transfer.

Example: TRAC TRACe1, +A$
                            A$ is a placeholder for the data list in the current format.

Usage: Setting only

Mode: A

TRACe<n>:COPY <TraceNumber>, <TraceNumber>

This command copies data from one trace to another in the specified window.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

Parameters:

<TraceNumber>,   TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6,
<TraceNumber>
                            TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6

                            The first argument is the destination of the data to be copied, the second argument describes the source.

Example: TRAC:COPY TRACe1,TRACe2

Mode: A

TRACe:IQ Subsystem

The commands of this subsystem are used for acquisition and output of measured IQ data. For more information see chapter 3.2.10, "Working with I/Q Data", on page 153.

Different remote modes available

In previous analyzer versions, the `TRACe:IQ` subsystem was already available and provided functions to record IQ data. Visualization and analysis, however, were not yet possible. Now these evaluation functions are available and can be accessed either via the "IQ Analyzer" softkey in the MODE menu, or by enabling a special `TRACe:IQ` mode for remote control (see `TRACe<n>:IQ:EVAL`). If IQ data acquisition is enabled in the traditional mode (see `TRACe<n>:IQ[:STATe]`), the new visualization functions are not available; however, performance is slightly improved.

The trigger sources "EXT" (external trigger), "IFP" (IF Power Trigger) and "BBP" (Baseband power, for digital input) can be used for triggering, additionally "IMM" (Free Run). The number of complex samples to be recorded prior to the trigger event can be selected (see `TRACe<n>:IQ:SET` on page 686) for all available trigger sources, except for "Free Run".

The measurement results are output in the form of a list, three different formats can be selected for this list (`TRACe<n>:IQ:DATA:FORMat` command).

The `FORMat` command can be used to select between binary output (32 bit IEEE 754 floating-point values) and output in ASCII format.

For details on formats refer to Formats for Returned Values: ASCII Format and Binary Format.

The commands of this subsystem can be used in two ways:

- Measurement and result query with one command:
  This method causes the least delay between measurement and output of the result data, but it requires the control computer to wait actively for the response data.

- Setting up the instrument, start of the measurement via INIT and query of the result list at the end of the measurement:
  With this method, the control computer can be used for other activities during the measurement. However, the additional time needed for synchronization via service request must be taken into account.

TRACe<n>:IQ[:STATe] <State>

This command switches the I/Q data acquisition on or off.

I/Q data acquisition is not compatible with other measurement functions. Therefore, all other measurement functions are switched off as soon as the I/Q measurement function is switched on. The trace display is also switched off by this command. Therefore, all traces are set to "BLANK".

To switch trace display back on, use the `TRACe<n>:IQ:EVAL` command.

Note: to enable the evaluation functions of the IQ Analyzer, you must also execute the command `TRACe<n>:IQ:EVAL`.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                          *RST: OFF
Example: TRAC:IQ ON
                          Switches on I/Q data acquisition
Mode: A-T, IQ, VSA, CDMA, EVDO, WCDMA

TRACe<n>:IQ:AVERage[:STATe] <State>

The command enables averaging of the recorded I/Q data, provided that I/Q data acquisition was previously enabled with `TRACe<n>:IQ[:STATe]` on page 679.

With I/Q data averaging enabled, the maximum amount of I/Q data is limited to 512kS (524288 complex samples).

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                          *RST: OFF
Example: TRAC:IQ ON
                          Switches on acquisition of I/Q data.
                          TRAC:IQ:AVER ON
                          Enables averaging of the I/Q measurement data.
                          TRAC:IQ:AVER:COUN 10
                          Selects averaging over 10 data sets.
                          TRAC:IQ:DATA?
                          Starts the measurement and reads out the averaged data.

Mode: A-T, IQ

TRACe<n>:IQ:AVERage:COUNt <NumberSets>

This command defines the number of I/Q data sets that are to serve as a basis for averaging.

Suffix:

<n>   irrelevant

Parameters:

<NumberSets>   0 to 32767

	*RST: 0
Example:	`TRAC:IQ ON`
	Switches on acquisition of I/Q data.
	`TRAC:IQ:AVER ON`
	Enables averaging of the I/Q measurement data
	`TRAC:IQ:AVER:COUN 10`
	Selects averaging over 10 data sets
	`TRAC:IQ:DATA?`
	Starts the measurement and reads out the averaged data.
Usage:	SCPI conform
Mode:	all

TRACe<n>:IQ:BWIDth

This command queries the flat, usable filter bandwidth of the final IQ data, which is dependent on the defined user sample rate and the defined signal source (RF/Digital IQ), see also figure 3-26. This value can not be changed by the user.

Suffix:

<n>   irrelevant

Example: TRAC:IQ:BWID?

Mode: IQ, VSA, ADEMOD, CDMA, EVDO, WCDMA

TRACe<n>:IQ:DATA

This command starts a measurement with the settings defined via `TRACe<n>:IQ:SET` and returns the list of measurement results (I/Q samples) immediately after they are corrected in terms of frequency response. The number of measurement results depends on the settings defined with `TRACe<n>:IQ:SET`, the output format depends on the settings of the FORMat subsystem. The format of the data list is defined by the command `TRACe<n>:IQ:DATA:FORMat`.

The command requires all response data to be read out completely before the instrument accepts further commands.

The result values are scaled linear in unit Volt and correspond to the voltage at the RF or digital input of the instrument. The number of the returned values is 2 * the number of samples.

Note: Using the command with the *RST values for the `TRACe<n>:IQ:SET` command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, binary format: 2 kBytes

Suffix:

<n>	irrelevant

Example:	`TRAC:IQ:STAT ON`
	Enables acquisition of I/Q data
	`TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,4096`
	Measurement configuration:
	Sample Rate = 32 MHz
	Trigger Source = External
	Trigger Slope = Positive
	Pretrigger Samples = 0
	Number of Samples = 4096
	`FORMat REAL,32`
	Selects format of response data
	`TRAC:IQ:DATA?`
	Starts measurement and reads results
Mode:	A-T, IQ

TRACe<n>:IQ:DATA:FORMat <Format>

This command defines the transfer format of the I/Q data.
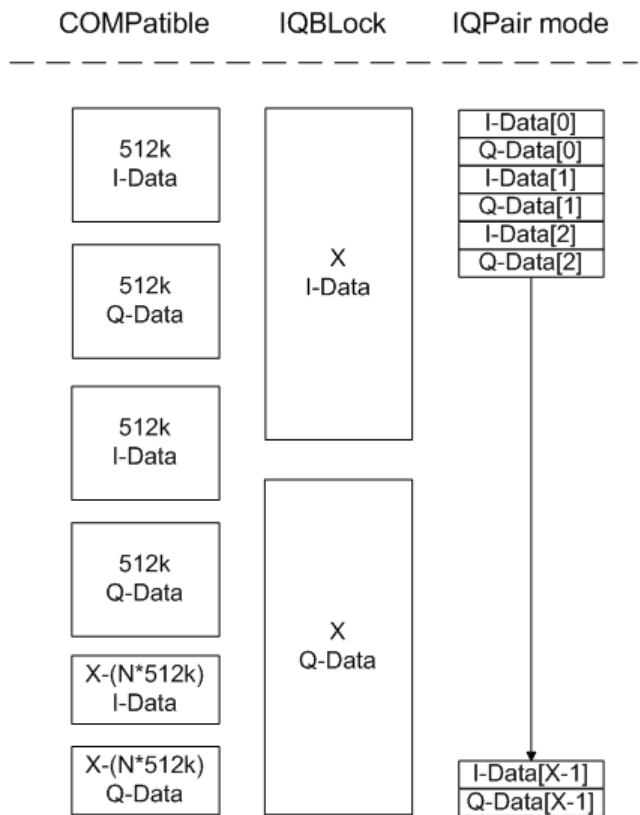
Fig. 4-4: IQ data formats

$$\# \, of \, I - Data \;\; = \;\; \# \, of \, Q - Data \;\; = \;\; \frac{\# \, of \, DataBytes}{8}$$

$$Q - Data - Offset \;\; = \;\; \frac{(\# \, of \, DataBytes)}{2} + LengthIndicatorDigits$$

Suffix:

\<n>	irrelevant

Parameters:

\<Format>	COMPatible | IQBLock | IQPair
	*RST: IQBL For maximum performance, the formats "Compatible" or "IQPair" should be used. Furthermore, for large amounts of data, the data should be in binary format to improve performance.
	For further details on formats refer to chapter 4.2.3.21, "Formats for Returned Values: ASCII Format and Binary Format", on page 695 .
Mode:	A-T, IQ, CDMA, WCDMA, EVDO, VSA

TRACe\<n>:IQ:DATA:MEMory? \<OffsetSamples>,\<NoOfSamples>

This command reads out previously acquired (and frequency response corrected) I/Q data from the memory. Furthermore, the offset related to the start of measurement and the number of I/Q samples are given. Thus, a previously acquired data set can be read out in smaller portions. If no parameters are given, all data is read from the memory. The maximum amount of available data depends on the settings of the TRACe\<n>:IQ:SET command, the output format on the settings in the FORMat subsystem.

The returned values are scaled linear in unit Volt and correspond to the voltage at the RF or digital input of the instrument.

The format of the output buffer corresponds to the TRACe\<n>:IQ:DATA command.

The command requires all response data to be read out completely before the instrument accepts further commands.

If no I/Q data is available in memory because the corresponding measurement was not started, the command causes a query error.

Suffix:

\<n>	irrelevant

Parameters:

\<OffsetSamples>	\<numeric_value>
	Offset of the values to be read, in relation to the start of the acquired data.
	Range: 0 to \<# of samples> – 1, with \<# of samples> being the value set by the "TRACe:IQ:SET" command
	*RST: 0

<NoOfSamples>	Number of measurement values to be read.
	Range: 1 to <# of samples> - <offset samples> with <# of samples> being the value set by the "TRACe:IQ:SET" command
	*RST: <# of samples>

Example: `TRAC:IQ:STAT ON`

Enables acquisition of I/Q data

`TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,100,4096`

Measurement configuration:

Sample Rate = 32 MHz

Trigger Source = External

Trigger Slope = Positive

Pretrigger Samples = 100

Number of Samples = 4096

`INIT;*WAI`

Starts measurement and wait for sync

`FORMat REAL,32`

Determines output format

To read the results:

`TRAC:IQ:DATA:MEM?`

Reads all 4096 I/Q data

`TRAC:IQ:DATA:MEM? 0,2048`

Reads 2048 I/Q data starting at the beginning of data acquisition

`TRAC:IQ:DATA:MEM? 2048,1024`

Reads 1024 I/Q data from half of the recorded data

`TRAC:IQ:DATA:MEM? 100,512`

Reads 512 I/Q data starting at the trigger point (<Pretrigger Samples> was 100)

Usage:	Query only
Mode:	A-T, IQ, WLAN, OFDM, OFDMA/WiBro

TRACe<n>:IQ:EGATe <State>

Activates or deactivates the gate function for IQ data measurements. This command is only valid for TRAC:IQ ON and trigger modes "EXT" and "IFP". The gate trigger is specified using `TRACe<n>:IQ:SET` on page 686. For details see chapter 3.2.10.2, "I/Q Gating", on page 156.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Suffix:

<n>	irrelevant

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	`TRAC:IQ:EGAT: ON`
Mode:	A

TRACe<n>:IQ:EGATe:TYPE <Type>

Specifies the gate trigger type used for data collection. For details see chapter 3.2.10.2, "I/Q Gating", on page 156.

Note: Using gating with gate mode "level" and an IFP trigger (`TRIGger<n>[:` `SEQuence]:SOURce`), the holdoff time for the IFP trigger (see `TRIGger<n>[:` `SEQuence]:IFPower:HOLDoff` on page 690) is ignored.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.
Suffix:

<n>	irrelevant

Parameters:

<Type>	LEVel | EDGE
	*RST: EDGE
Example:	`TRAC:IQ:EGAT:TYPE LEV`
Mode:	A

TRACe<n>:IQ:EGATe:LENGth <GateLength>

Defines the gate length in samples in edge mode. For details see chapter 3.2.10.2, "I/Q Gating", on page 156.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.
Suffix:

<n>	irrelevant

Parameters:

<GateLength>	<numeric value>
	Max = MaxPreTriggerSamples * 128 MHz/sample rate pretrigger samples defined by `TRACe<n>:IQ:SET`; sample rate defined by `TRACe<n>:IQ:SRATe`)
	Range: 1...Max (samples)
	*RST: 100
Example:	`TRAC:IQ:EGAT:LENG 2000`
Mode:	A

TRACe<n>:IQ:EGATe:GAP <Samples>

Defines the interval between several gate periods in samples. For details see chapter 3.2.10.2, "I/Q Gating", on page 156.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.
Suffix:

<n>	irrelevant

Parameters:

<Samples>	<numeric value>
	Max = MaxPreTriggerSamples * 128 MHz/sample rate pretrigger samples defined by `TRACe<n>:IQ:SET`; sample rate defined by `TRACe<n>:IQ:SRATe`)
	Range: 1...Max (samples)
	*RST: 100
Example:	`TRAC:IQ:EGAT:GAP 2`
Mode:	A

TRACe<n>:IQ:EGATe:NOFgateperiods <Number>

Defines the number of gate periods after a trigger signal. For details see chapter 3.2.10.2, "I/Q Gating", on page 156.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Suffix:

<n>	irrelevant

Parameters:

<Number>	1...1023
	*RST: 1
Example:	`TRAC:IQ:EGAT:NOF 2`
Mode:	A

TRACe<n>:IQ:EVAL <State>

This command enables or disables the IQ data evaluation mode and is a prerequisite for the IQ Analyzer functions.

Before this command can be executed, IQ data acquistion must be enabled (see `TRACe<n>:IQ[:STATe]` on page 679). This command automatically disables the IQ data evaluation mode to provide optimum performance for IQ-data acquisition.

If you start the IQ Analyzer manually by selecting the "IQ Analyzer" mode in the analyzer, or use the `CALCulate<n>:FORMat` command, the IQ data evaluation mode is automatically activated.

The maximum number of samples for RF input is 200 MS. For details see chapter 3.2.10, "Working with I/Q Data", on page 153.

For digital input see table 3-13.

Suffix:

<n>	irrelevant

Parameters:

<State>   ON | OFF

                       ON
                       all functions of the IQ Analyzer are available

                       OFF
                       no traces or marker operations are available; IQ data can only be
                       captured, but with a better performance than in active IQ data
                       evaluation mode

                       *RST: OFF
Example: TRAC:IQ ON
                       Enables IQ data acquisition
                       TRAC:IQ:EVAL ON
                       Enables the IQ data evaluation mode.

Mode: A, ADEMOD, VSA, CDMA, EVDO, WCDMA

TRACe<n>:IQ:RLENgth <NoOfSamples>

This command sets the record length for the acquired I/Q data. Increasing the record
length automatically also increases the measurement time.

Note: Alternatively, you can define the measurement time using the SENS:SWE:TIME
command.

Suffix:

<n>   irrelevant

Parameters:

<NoOfSamples>   Number of measurement values to record.
                       For digital input via the Digital Baseband Interface (analyzerB17)
                       the valid number of samples is described in table 3-13.

                       Range: 1 ... 209715200(= 200*1024*1024);
                       *RST: 691
Example: TRAC:IQ:RLEN 256
Mode: IQ

TRACe<n>:IQ:SET NORM,<Placeholder>, <SampleRate>, <TriggerMode>,
        <TriggerSlope>, <PretriggerSamp>, <NumberSamples>

This command defines the settings of the analyzer hardware for the measurement of I/
Q data. This allows setting the sample rate, trigger conditions and the record length.

If this command is omitted, the current instrument settings are used for the corresponding
parameters.

This command switches to IQ mode automatically (see also TRACe<n>:IQ[:STATe]
on page 679).

The trigger level can be set using the TRIGger<n>[:SEQuence]:SOURce command.

Note: When using the default settings with the `TRACe<n>:IQ:DATA` command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, Binary format 2 kBytes.

Tip: To determine the trigger point in the sample (for "External" or "IF Power" trigger mode), use the `TRACe<n>:IQ:TPISample` command.

Parameters:

NORM	is not evaluated, but must be inserted
<Placeholder>	numeric value
	is not evaluated, but must be inserted
<SampleRate>	Sample rate of the I/Q data (user sample rate). For digital input via the Digital Baseband Interface (analyzerB17) the valid sample rates are described in table 3-13

<table>
<tr><td></td><td>Range:</td><td>100 Hz to 45 MHz (for option B70 128MHz, for R&S FSV40 model 1307.9002K39: 12.5 MHz), continuously adjustable;</td></tr>
<tr><td></td><td>*RST:</td><td>32MHz (for R&S FSV40 model 1307.9002K39: 12.5 MHz)</td></tr>
</table>

<TriggerMode>	IMMediate | EXTernal | IFPower | BBPower
	Selection of the trigger source used for the measurement. For details on trigger sources, see "Trg/Gate Source" on page 146. For IMM mode, gating is automatically deactivated.

<table>
<tr><td></td><td>*RST:</td><td>IMM</td></tr>
</table>

<TriggerSlope>	POSitive | NEGative
	Used trigger slope.

<table>
<tr><td></td><td>*RST:</td><td>POS</td></tr>
</table>

<PretriggerSamp>	Number of measurement values to be recorded before the trigger point. Negative values correspond to a trigger delay. This value also defines the interval between the trigger signal and the gate edge in samples. Range: RF input without gating: 0 to (200 MS - 1) RF input with gating: 0 to [(200 MS * SR/128 MHz)-1] Digital input: 0 to (MaxNofSamples -1); MaxNofSamples as defined in table 3-14

<table>
<tr><td></td><td>Range:</td><td>0 to (MaxPreTriggerSamples * 128 MHz/sample rate).</td></tr>
<tr><td></td><td>*RST:</td><td>0</td></tr>
</table>

<NumberSamples>	Number of measurement values to record. For digital input via the Digital Baseband Interface (analyzerB17) the valid number of samples is described in table 3-13.

<table>
<tr><td></td><td>Range:</td><td>1 ... 209715200(= 200*1024*1024);</td></tr>
<tr><td></td><td>*RST:</td><td>128</td></tr>
</table>

Example:	TRAC:IQ:SET NORM,10 MHz,32 MHz,EXT,POS,0,2048
	Reads 2048 I/Q-values starting at the trigger point.
	sample rate = 32 MHz
	trigger = External
	slope = Positive
	TRAC:IQ:SET NORM,10 MHz,4 MHz,EXT,POS,1024,512
	Reads 512 I/Q-values from 1024 measurement points before the
	trigger point.
	sample rate = 4 MHz
	trigger = External
	slope = Positive
Mode:	A-T, IQ, VSA, CDMA, EVDO, WCDMA

TRACe<n>:IQ:SRATe <SampleRate>

This command sets the final user sample rate for the acquired I/Q data. Thus, the sample rate can be modified without affecting the other settings.

Note: The smaller the user sample rate, the smaller the usable I/Q bandwidth, see TRACe<n>:IQ:BWIDth on page 680.

Suffix:

<n>   irrelevant

Parameters:

<SampleRate>   For digital input via the Digital Baseband Interface (analyzerB17) the valid sample rates are described in "Sample rates, bandwidths and other limitations" in the description of the B17 option in the base unit.

	Range:	100 Hz to 45 MHz (for option B70 128MHz, for R&S FSV40 model 1307.9002K39: 12.5 MHz), continuously adjustable;
	*RST:	32 MHz (for R&S FSV40 model 1307.9002K39: 12.5 MHz)

Example:	TRAC:IQ:SRAT 4 MHZ
Mode:	A-T, IQ, ADEMOD, CDMA, EVDO, TDS, VSA

TRACe<n>:IQ:TPISample?

This command determines the time offset of the trigger in the sample (trigger position in sample = TPIS). This value can only be determined in triggered measurements using external or IFPower triggers, otherwise the value is 0. The value is not user-definable.

This command is not available if the digital baseband interface (R&S FSV-B17 option) is active.

Suffix:

<n>   irrelevant

Example:	TRAC:IQ:TPIS?
Usage:	Query only
Mode:	IQ

4.2.3.19   TRIGger Subsystem

The TRIGger subsystem is used to synchronize instrument actions with events. It is thus possible to control and synchronize the start of a sweep.

TRIGger<n>[:SEQuence]:HOLDoff[:TIME] <Delay>

This command defines the length of the trigger delay.

A negative delay time (pretrigger) can be set in zero span only.

Suffix:

<n>   irrelevant

Parameters:

<Delay>

	Range:	zero span: -sweeptime (see data sheet) to 30 s; span: 0 to 30 s
	*RST:	0 s

Example: `TRIG:HOLD 500us`

Mode: All

TRIGger<n>[:SEQuence]:BBPower:HOLDoff <Value>

This command sets the holding time before the next BB power trigger event (for digital input via the Digital Baseband Interface, R&S FSV-B17).

Suffix:

<n>   irrelevant

Parameters:

<Value>   <numeric_value> in s: 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.

Mode: all

TRIGger\<n>[:SEQuence]:IFPower:HOLDoff \<Value>

This command sets the holding time before the next IF power trigger event.

Note: Using gating with gate mode "level" (see `TRACe<n>:IQ:EGATe:TYPE` on page 684) and an IFP trigger (see `TRIGger<n>[:SEQuence]:LEVel:IFPower` on page 691), the holdoff time for the IFP trigger is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

Suffix:

\<n>   irrelevant

Parameters:

\<Value>   \<numeric_value> in s: 150 ns to 1000 s

                             *RST: 150 ns
Example: `TRIG:SOUR IFP`
                             Sets the IF power trigger source.
                             `TRIG:IFP:HOLD 200 ns`
                             Sets the holding time to 200 ns.
Mode: A-F, ADEMOD, CDMA, EVDO, GSM, VSA, OFDM, OFDMA/
                             WiBro, TDS, WCDMA

TRIGger\<n>[:SEQuence]:IFPower:HYSTeresis \<Value>

This command sets the limit that the hysteresis value for the IF power trigger has to fall below in order to trigger the next measurement.

Suffix:

\<n>   irrelevant

Parameters:

\<Value>   \<numeric_value> in dB: 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.
Mode: ALL

TRIGger\<n>[:SEQuence]:LEVel:BBPower \<Level>

This command sets the level of the baseband power trigger source (for digital input via the Digital Baseband Interface, R&S FSV-B17).

Suffix:

\<n>   irrelevant

Parameters:

                             Range: -50 dBm to +20 dBm
                             *RST: -20 DBM
Example: `TRIG:LEV:BB -30DBM`

Mode: All

TRIGger<n>[:SEQuence]:LEVel[:EXTernal] <TriggerLevel>

This command sets the level of the external trigger source in Volt.

Suffix:

<n>   irrelevant

Parameters:

<TriggerLevel>

                     Range: 0.5 V to 3.5 V
                     *RST: 1.4 V

Example: TRIG:LEV 2V

Mode: All

TRIGger<n>[:SEQuence]:LEVel:IFPower <TriggerLevel>

This command sets the level of the IF power trigger source.

Suffix:

<n>   irrelevant

Parameters:

<TriggerLevel>   -50 to +20 DBM

                     *RST: -20 DBM

Example: TRIG:LEV:IFP -30DBM

Mode: All

TRIGger<n>[:SEQuence]:LEVel:RFPower <TriggerLevel>

This command sets the level of the RF power trigger source.

Suffix:

<n>   irrelevant

Parameters:

<TriggerLevel>

                     Range: -50 to -10 dBm
                     *RST: -20 dBm

Example: TRIG:LEV:RFP -30dBm

Mode: A, ADEMOD, FMS, OFDM, OFDM/WiBro, WLAN

TRIGger<n>[:SEQuence]:LEVel:VIDeo <Value>

This command sets the level of the video trigger source.

Suffix:

<n>   irrelevant

Parameters:

<Value>   0 to 100 PCT

                     *RST: 50 PCT

Example: TRIG:LEV:VID 50PCT

Mode: all, except ADEMOD

TRIGger<n>[:SEQuence]:SLOPe <Type>

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Suffix:

<n>   irrelevant

Parameters:

<Type>   POSitive | NEGative

                       *RST: POSitive

Example: TRIG:SLOP NEG

Mode: all

TRIGger<n>[:SEQuence]:SOURce <Source>

This command selects the trigger source for the start of a sweep.

Note: Using gating with gate mode "level" (TRACe<n>:IQ:EGATe:TYPE/[SENSe:]SWEep:EGATe:TYPE) and an IFP trigger, the holdoff time for the IFP trigger (see TRIGger<n>[:SEQuence]:HOLDoff[:TIME] on page 689) is ignored for frequency sweep, FFT sweep, zero span and IQ mode measurements.

For details on trigger modes refer to "Trg/Gate Source" on page 146.

Suffix:

<n>   irrelevant

Parameters:

<Source>   IMMediate | EXTern | IFPower | TIME | VIDeo | BBPower | For
               Analog Demodulation (K7) and FM Stereo (K7S), additionally: AF
               | FM | AM | AMRelative | PM

IMMediate
Free Run

EXTern
External trigger

RFPower
First intermediate frequency
For Spectrum mode and options R&S FSV-K7, -K7s, -K91, -K93,
-K100 only

IFPower
Second intermediate frequency

TIME
Time interval

VIDeo
Video mode is only available in the time domain and only in
Spectrum mode.

BBPower
Baseband power (for digital input via the Digital Baseband
Interface, R&S FSV-B17)

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

*RST: IMMediate

Example: TRIG:SOUR EXT
               Selects the external trigger input as source of the trigger signal

Mode: ALL

TRIGger<n>[:SEQuence]:TIME:RINTerval <Interval>

This command sets the repetition interval for the time trigger source.
Suffix:
<n>   irrelevant

Parameters:

<Interval>	2.0 ms to 5000

	*RST: 1.0
Example:	`TRIG:SOUR TIME`
	Selects the time trigger input for triggering.
	`TRIG:TIME:RINT 50`
	The sweep starts every 50 s.
Mode:	All

4.2.3.20 UNIT Subsystem

The UNIT subsystem sets the basic unit of the setting parameters.

UNIT<n>:POWer <Unit>

This command selects the default unit.

The unit is defined globally for all windows.

Suffix:

<n>	irrelevant

Parameters:

<Unit>	DBM | V | A | W | DBPW | WATT | DBPT | DBUV | DBMV | VOLT | DBUA | AMPere

	*RST: DBM
Example:	`UNIT:POW DBUV`
	Sets the power unit to dBm.
Usage:	SCPI conform
Mode:	A

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

This command selects the unit for absolute power sensor measurement for the selected sensor.

Suffix:

<n>	irrelevant
<p>	1...4
	Power sensor index

Parameters:

<Unit>	DBM | WATT | W

	*RST: DBM
Example:	`UNIT:PMET:POW DBM`
Usage:	SCPI conform
Mode:	PSM

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

This command selects the unit for relative power sensor measurement for the selected sensor.

Suffix:

<n>	irrelevant
<p>	1...4 Power sensor index

Parameters:

<Unit>	DB | PCT
	*RST: DB
Example:	UNIT:PMET:POW:RAT DB
Usage:	SCPI conform
Mode:	PSM

UNIT:THD <Mode>

Selects the unit for THD measurements.

Parameters:

<Mode>	DB | PCT
	*RST: DB
Example:	UNIT:THD PCT
Mode:	ADEMOD, SFM

4.2.3.21 Formats for Returned Values: ASCII Format and Binary Format

ASCII Format (FORMat ASCII)

The command reads out a list of comma separated values (CSV) of the measured values in floating point format.

> Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

Binary Format (FORMat REAL,32)

The command reads out binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format.

Depending on the number of samples to be transferred, 2 different kinds of syntax are used:

For <10^{10} samples:

The schema of the result string is as follows:

`#<NoOfDigits><NoOfDataBytes><value1><value2>…<value n>`, **with**

#	Header prefix, 1 byte
<NoOfDigits>	Number of digits of the following number of data bytes (= 4 in the example), 1 byte
<NoOfDataBytes>	Number of following data bytes in decimal form (= 1024 in the example), 1...9 bytes
<Value>	Data values, each one is a 4-byte floating point value

Example:

`#41024<value1><value2>…<value 256>`

4: the following number of data bytes has 4 digits

1024: 1024 Bytes of following data; float: 4 Bytes / value => 1024 / 4 = 256 values (128 I and 128 Q values)

<value x>: 4 Byte values, must be interpreted as float

For ≧10^{10} samples:

The schema of the result string is as follows:

`#(<NoOfDataBytes>)<value1><value2>…<value n>`, **with**

#	Header prefix, 1 byte
(	1 byte
<NoOfDataBytes>	number of following data bytes (= 1024 in the example), 10 bytes
)	1 byte
<Value>	Data values, each one is a 4-byte floating point value

Example:

`#(1677721600)<value 1><value 2> ... <value 419430400>`

(1677721600): 1677721600 Bytes of following data; float: 4 Bytes / value ==> 1677721600/ 4 = 419430400 values (200Ms I and 200Ms Q values)

<value x>: 4 Byte values, must be interpreted as float

4.2.4 Remote Control – Description of Basic Settings Commands

In this section all remote control commands for basic settings are described in detail. For details on analyzer commands refer to chapter 4.2.3, "Remote Control – Description of Analyzer Commands", on page 419.

4.2.4.1 CALibration Subsystem

The commands of the CALibration subsystem determine the data for system error correction in the instrument.

CALibration:ABORt

This command aborts the current calibration process.

Example:	CAL:ABORt
	Sets up the instrument to ignore the calibration data.
Usage:	SCPI conform
Mode:	all

CALibration[:ALL]?

This command initiates the acquisition of system error correction data. A "0" is returned if the acquisition was successful.

During the acquisition of correction data the instrument does not accept any remote control commands.

In order to recognize when the acquisition of correction data is completed, the MAV bit in the status byte can be used. If the associated bit is set in the Service Request Enable Register, the instrument generates a service request after the acquisition of correction data has been completed.

Example:	`*CLS`
	Resets the status management.
	`*SRE 16`
	Enables MAV bit in the Service Request Enable Register.
	`*CAL?`
	Starts the correction data recording, and then a service request is generated.
Usage:	Query only
	SCPI conform
Mode:	all

CALibration:RESult?

This command outputs the results of the correction data acquisition. The lines of the result table are output as string data separated by commas:

```
Total Calibration Status: PASSED, Date (dd/mm/yyyy): 12/07/2004,

Time: 16:24:54,Runtime: 00.06
```

Example:	`CAL:RES?`
Usage:	Query only
Mode:	all

CALibration:STATe <State>

This command determines whether the current calibration data are taken into account by the instrument (ON) or not (OFF).

Parameters:

<State>	ON | OFF
Example:	`CAL:STAT OFF`
	Sets up the instrument to ignore the calibration data.
Usage:	SCPI conform
Mode:	All

4.2.4.2   DIAGnostic Subsystem

The DIAGnostic subsystem contains the commands which support instrument diagnostics for maintenance, service and repair. In accordance with the SCPI standard, all of these commands are device-specific.

DIAGnostic<n>:SERVice:BIOSinfo?

This command reads the CPU board BIOS version and returns it as ASCII string.

Suffix:

<n>	irrelevant

Return values:

Return values (example)	47.11
Example:	DIAG:SERV:BIOS?
	Returns the BIOS version.
Usage:	Query only
Mode:	all

DIAGnostic<n>:SERVice:HWINfo?

This command queries the hardware information.

Suffix:

<n>	irrelevant

Return values:

Return values	"<component 1>|<serial #>|<order #>|<model>| <hardware code>|<revision>|<subrevision>",
	"<component 2>|<serial #>|<order #>|<model>| <hardware code>|<revision>|<subrevision>",
	...
	Table lines are output as string data and are separated by commas. The individual columns of the table are separated from each other by |.
Example:	DIAG:SERV:HWIN?
	Queries the hardware information.
	"FRONTEND|100001/003|1300.3009|03|01|00|00",
	"MOTHERBOARD|123456/002|1300.3080|02|00|00|00",
	...
Usage:	Query only
Mode:	all

DIAGnostic<n>:SERVice:INPut[:SELect] <Input>

This command toggles between the RF input on the front panel and a calibration signal.

Suffix:

<n>	irrelevant

Parameters:

<Input>	CALibration | RF | MCALibration
	CALibration Calibration
	MCALibration Microwave calibration (for analyzer 13 and 30 only)
	RF RF input
	*RST: RF
Example:	DIAG:SERV:INP CAL
Mode:	all

DIAGnostic<n>:SERVice:INPut:PULSed:CFRequency <Frequency>

This command sets the calibration frequency. This command only takes effect if a calibration signal is selected for input (DIAGnostic<n>:SERVice:INPut[:SELect] on page 699).

Suffix:

<n>	irrelevant

Parameters:

<Frequency>	**<numeric value>**
	*RST: 64 MHz
Example:	DIAG:SERV:INP:PULS:CFR 128 MHz
Usage:	SCPI conform
Mode:	all

DIAGnostic<n>:SERVice:INPut:PULSed:MCFRequency <Frequency>

This command sets the calibration frequency for frequencies greater than 7 GHz. This command only takes effect if a microwave calibration signal is selected for input (DIAGnostic<n>:SERVice:INPut[:SELect] on page 699).

Suffix:

<n>	irrelevant

Parameters:

<Frequency>	**<numeric value>**
	*RST: 7 GHz
Example:	DIAG:SERV:INP:PULS:MCFR 7,1 GHz
Usage:	SCPI conform
Mode:	all

DIAGnostic<n>:SERVice:NSOurce <State>

This command switches the 28 V supply of the noise source on the front panel on or off.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                                 *RST: OFF

Example: DIAG:SERV:NSO ON

Mode: all

DIAGnostic<n>:SERVice:SFUNction <ServiceFunction>

This command activates a service function which can be selected by indicating the five parameters: function group number, board number, function number, parameter 1 and parameter 2 (see service manual). The contents of the parameter string are identical to the code to be entered in the edit dialog box of manual operation.

The entry of a service function is accepted only if the system password level 1 or level 2 has been entered previously (SYSTem:PASSword[:CENable] on page 747).

Suffix:

<n>   irrelevant

Parameters:

<ServiceFunction>   '<string>'

Example: DIAG:SERV:SFUN '2.0.2.12.1'

Mode: all

DIAGnostic<n>:SERVice:SFUNction:LASTresult?

This command returns the results for the most recently performed service function.

Suffix:

<n>   irrelevant

Example: DIAG:SERV:SFUN:LAST?

Usage: Query only

Mode: all

DIAGnostic<n>:SERVice:SFUNction:RESults:DELete

This command clears the results of the most recently performed service function.

Suffix:

<n>   irrelevant

Example: DIAG:SERV:SFUN:RES:DEL

Mode: all

DIAGnostic\<n\>:SERVice:SFUNction:RESults:SAVE \<FileName\>

This command stores the results of the most recently performed service function in the specified file.

Suffix:

\<n\>   irrelevant

Parameters:

\<FileName\>   \<string\> (file name for results)

Example: `DIAG:SERV:SFUN:RES:SAVE "C:\diag"`

Mode: all

DIAGnostic\<n\>:SERVice:STESt:RESult?

This command reads the results of the self test out of the instrument. The lines of the result table are output as string data separated by commas:

"Total Selftest Status: PASSED", "Date (dd/mm/yyyy): 09/07/2004

TIME: 16:24:54", "Runtime: 00:06", "...

Suffix:

\<n\>   irrelevant

Example: `DIAG:SERV:STES:RES?`

Usage: Query only

Mode: all

DIAGnostic\<n\>:SERVice:TEMPerature:FRONt?

This command queries the frontend temperature of the instrument.

Example: `DIAG:SERV:TEMP:FRON?`

Usage: Query only

Mode: all

DIAGnostic\<n\>:SERVice:VERSinfo?

This command queries the version information.

Suffix:

\<n\>   irrelevant

Example:	DIAG:SERV:VERS?
	Queries the version information.
	Response:
	Instrument Firmware 1.10a 04, Image Version 1.0.1, BIOS 47.1
	Additional Interfaces, B17:
	Digital Baseband I/O, B3:
	Audio Demodulator, B10:
	Ext. Generator Control, B4:
	OCXO Reference Frequency, K7: AM/FM/PM, K9:
	Power Sensor Support, B22:
	RF Preamplifier, K100:
	EUTRA/LTE Downlink, K101:
	EUTRA/LTE Uplink, B25:
	Electronic Attenuator, B29:
	Frequency Extension 20Hz, B70:
	40MHz Bandwidth, K72: 3GPP Base Station 1.05
Usage:	Query only
	SCPI conform
Mode:	all

4.2.4.3 DISPlay Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

Some applications offer up to four measurement windows. For those, the suffix <1....4> for WINDow selects the measurement window. For all other applications, the suffix is irrelevant.

Further Information

DISPlay:ANNotation:FREQuency <State>

This command switches the x-axis annotation on or off.

Parameters:

<State>	ON | OFF

	*RST: ON
Example:	DISP:ANN:FREQ OFF
Usage:	SCPI conform
Mode:	all

DISPlay:CMAP<m>:DEFault <Setting>

This command resets the screen colors of all display items to their default settings.

Suffix:

<m>	irrelevant

Parameters:

<Setting>	1 | 2
	Default settings DEFault1 and DEFault2
Example:	DISP:CMAP:DEF2
	Selects default setting 2 for setting the colors.
Usage:	Event
	SCPI conform
Mode:	all

DISPlay:CMAP<m>:HSL <ColorTable>

This command defines the color table of the instrument.

The set values are not changed by *RST.

Suffix:

<m>	color map; refer to chapter 4.2.4.4, "CMAP Suffix Assignment", on page 709

Parameters:

<ColorTable>	hue | sat | lum
	hue TINT
	sat SATURATION
	lum BRIGHTNESS
	The value range is 0 to 1 for all parameters.

Example:	`DISP:CMAP2:HSL 0.3,0.8,1.0`
	Changes the grid color.
Usage:	SCPI conform
Mode:	all

DISPlay:CMAP<m>:PDEFined <Color>

This command defines the color table of the instrument using predefined color values. Each suffix of CMAP is assigned to one or several graphical elements which can be modified by varying the corresponding color setting.

The values set are not changed by *RST.

Suffix:

| <m> | color map; refer to |

Parameters:

| <Color> | BLACk \| BLUE \| BROWn \| GREen \| CYAN \| RED \| MAGenta \| YELLow \| WHITe \| DGRAy \| LGRAy \| LBLUe \| LGREen \| LCYan \| LRED \| LMAGenta |

Example:	`DISP:CMAP2:PDEF GRE`
Usage:	SCPI conform
Mode:	all

DISPlay:FORMat <Format>

This command switches the measurement result display between FULL SCREEN and SPLIT SCREEN.

Parameters:

<Format>	SINGle | SPLit
	SPLit
	Show 2 or more screens on the display
	SINGle
	Show only 1 screen on the display
	*RST: SPL
Example:	`DISP:FORM:SING`
Mode:	all

DISPlay:LOGO <State>

This command switches the company logo on the screen on or off.

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	`DISP:LOGO OFF`

Mode: all

DISPlay:PSAVe[:STATe] <State>

This command switches on or off the power-save mode of the display. With the power-save mode activated the display including backlight is completely switched off after the elapse of the response time (see `DISPlay:PSAVe:HOLDoff` on page 706 command).

This mode is recommended to protect the display, especially if the instrument is operated exclusively via remote control.

Parameters:

<State>   ON | OFF

                  *RST: OFF

Example: `DISP:PSAVe ON`

                  Switches on the power-save mode.

Mode: all

DISPlay:PSAVe:HOLDoff <Minutes>

This command sets the holdoff time for the power-save mode of the display. The available value range is 1 to 60 minutes, the resolution 1 minute. The entry is dimensionless.

Parameters:

<Minutes>   1 to 60

                  *RST: 15

Example: `DISP:PSAV:HOLD 30`

Mode: all

DISPlay:SBAR[:STATe] <State>

.

Parameters:

<State>   ON | OFF

                  *RST: ON

Example: DISP:SBAR:OFF

Mode: all

DISPlay:SKEYs[:STATe] <State>

.

Parameters:

<State>   ON | OFF

                  *RST: ON

Example: DISP:SKEY:OFF

Mode: all

DISPlay:TBAR[STATe] <State>

This command switches the toolbar above the diagram on or off.

Parameters:

<State>   ON | OFF

                         *RST: OFF
Example: DISP:TOOL ON
Mode: all

DISPlay:THEMe:CATalog?

Displays the selection list of available themes for the screen display.

Example: DISP:THEMe:CAT?

Usage: Query only

Mode: all

DISPlay:THEMe:SELect <Theme>

Selects a theme for the screen display. The theme defines the colors used for keys and screen elements, for example.

Parameters:

<Theme>   <string>

                         *RST: SPL
Example: DISP:THEM:SEL "OceanBlue"
Mode: all

DISPlay:TOUChscreen:STATe <State>

Switches the touch screen functionality on, off, or partially on.

Parameters:

<State>   ON | OFF | FRAMe

                         ON
                         Touch screen function is active for entire screen

                         OFF
                         Touch screen is deactivated for entire screen

                         FRAMe
                         Touch screen is deactivated for the diagram area of the screen, but active for the surrounding softkeys, toolbars and menus.

                         *RST: ON
Example: DISP:TOUC:STAT ON

Mode: all

DISPlay[:WINDow<n>]:TEXT[:DATA] <Comment>

This command defines a comment (max. 20 characters) which can be displayed in the window specified by the suffix <n>.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

Parameters:

<Comment>   <string>

                           *RST: (empty)

Example: DISP:WIND:TEXT 'Noise Measurement'
                           Defines the screen title.

Mode: all

DISPlay[:WINDow<n>]:TEXT:STATe <State>

This command switches on or off the display of the comment (screen title) in the window specified by the suffix <n>.

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

Parameters:

<State>   ON | OFF

                           *RST: OFF

Example: DISP:TEXT:STAT ON
                           Switches on the title.

Mode: all

DISPlay[:WINDow<n>]:TIME <State>

This command switches on or off the screen display of date and time.

Suffix:

<n>   irrelevant

Parameters:

<State>   ON | OFF

                           *RST: OFF

Example: DISP:TIME ON

Mode: all

DISPlay[:WINDow<n>]:TIME:FORMat <Format>

This command switches the format of the date and time displayed on the screen between German and US.

Suffix:

<n>	irrelevant

Parameters:

<Format>	US | DE
	*RST: DE
Example:	DISP:TIME ON
	Switches the screen display of date and time on.
	DISP:TIME:FORM US
	Switches the date and time format to US.
Mode:	all

4.2.4.4 CMAP Suffix Assignment

Each suffix of CMAP is assigned one or several graphical elements which can be modified by varying the corresponding color setting. The following assignment applies:

Suffix	Description
CMAP1	Background
CMAP2	Grid
CMAP3 *)	Common Text
CMAP4 *)	Check Status OK
CMAP5 *)	Check Status Error
CMAP6 *)	Text Special 1
CMAP7 *)	Text Special 2
CMAP8	Trace 1
CMAP9	Trace 2
CMAP10	Trace 3
CMAP11	Marker Info Text
CMAP12	Limit Lines
CMAP13	Limit and Margin Check – "Pass"
CMAP14	Limit and Margin Check – "Fail"
CMAP15 *)	Softkey Text
CMAP16 *)	Softkey Background
CMAP17 *)	Selected Field Text
CMAP18 *)	Selected Field Background
CMAP19 *)	Softkey 3D Bright Part
CMAP20 *)	Softkey 3D Dark Part
CMAP21 *)	Softkey State "On"

Suffix	Description
CMAP22 *)	Softkey State "Dialog open"
CMAP23 *)	Softkey Text Disabled
CMAP24	Logo
CMAP25	Trace 4
CMAP26	Grid – Minorlines
CMAP27	Marker
CMAP28	Display Lines
CMAP29 *)	Sweepcount – Text
CMAP30	Limit and Margin Check – Text
CMAP31	Limit and Margin Check – \"Margin\"
CMAP32 *)	Table Overall – Title Text
CMAP33 *)	Table Overall – Title Background
CMAP34 *)	Table Overall – Text
CMAP35 *)	Table Overall – Background
CMAP36 *)	Table Value – Title Text
CMAP37 *)	Table Value – Title Background
CMAP38 *)	Table Value – Text
CMAP39 *)	Table Value – Background
CMAP40	Trace 5
CMAP41	Trace 6

*) these settings can only be defined via the theme, see `DISPlay:THEMe:SELect` on page 707, and are thus ignored in the SCPI command

4.2.4.5 FORMat Subsytem

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

FORMat[:DATA] <Format>

This command specifies the data format for the data transmitted from the instrument to the control PC. It is used for the transmission of trace data. The data format of trace data received by the instrument is automatically recognized, regardless of the format which is programmed.

In the "Spectrum" mode, the format setting REAL, 32 is used for the binary transmission of trace data.

(See also `TRACe<n>[:DATA]` on page 675).

Parameters:

<Format>	ASCii | REAL | UINT

ASCii
ASCII data are transmitted in plain text, separated by commas.

REAL
REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block format".

	*RST: ASCII
Example:	FORM REAL,32
	FORM ASC
Mode:	all

4.2.4.6 HCOPy Subsystem

The HCOPy subsystem controls the output of display information for documentation purposes on output devices or files. The instrument allows two independent printer configurations which can be set separately with the suffix <1|2>.

HCOPy:ABORt

This command aborts a running hardcopy output.

Example:	HCOP:ABOR
Usage:	Event
	SCPI conform
Mode:	all

HCOPy:CMAP<m>:DEFault <ColorSet>

This command sets the colors for a printout or hardcopy.
Suffix:

<m>	irrelevant

Parameters:

<ColorSet>	1 | 2 | 3 | 4

1

current screen colors with the background in white and the grid in black.

2

optimized color set

3

user defined color set

4

current screen colors without any changes (setting for hardcopies)

Example:	HCOP:CMAP:DEF2
	Selects the optimized color set for the color settings of a printout or a hardcopy.
Usage:	Event
	SCPI conform
Mode:	all

HCOPy:CMAP<m>:HSL

This command defines the color table in user defined colors.

To each suffix of CMAP is assigned one or several picture elements which can be modified by varying the corresponding color setting. For details on the CMAP assignment refer to chapter 4.2.4.4, "CMAP Suffix Assignment", on page 709.

The values set are not changed by *RST.

Suffix:

<m>	color map

Parameters:

hue \| sat \| lum

hue
tint

sat
saturation

lum
brightness

	The value range is 0 to 1 for all parameters.
Example:	HCOP:CMAP2:HSL 0.3,0.8,1.0
	Changes the grid color
Usage:	SCPI conform
Mode:	all

HCOPy:CMAP<m>:PDEFined <Color>

This command defines the color table in user defined colors using predefined color values. To each suffix of CMAP is assigned one or several picture elements which can be modified by varying the corresponding color setting. For details on the CMAP assignment refer to chapter 4.2.4.4, "CMAP Suffix Assignment", on page 709.

The values set are not changed by *RST.

Suffix:

<m>   color map

Parameters:

<Color>   BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta |
                         YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan |
                         LRED | LMAGenta

Example: HCOP:CMAP2:PDEF GRE

Usage: SCPI conform

Mode: all

HCOPy:DESTination<1|2> <Medium>

This command selects the printer output medium (Disk, Printer or Clipboard) associated with configuration 1 or 2.

The type of instrument is selected with SYSTem:COMMunicate:PRINter:SELect <1|2> on page 741, which automatically selects a default output medium. Therefore the HCOPy:DESTination<1|2> on page 713 command should always be sent after setting the device type.

Parameters:

<Medium>   MMEM | SYST:COMM:PRIN | SYST:COMM:CLIP

                         MMEM
                         Directs the hardcopy to a file. The MMEMory:NAME
                         on page 724 command defines the file name. All formats can be
                         selected for HCOPy:DEVice:LANGuage<1|2> on page 714.

                         SYST:COMM:PRIN
                         Directs the hardcopy to the printer. The printer is selected with the
                         SYSTem:COMMunicate:PRINter:SELect <1|2>
                         on page 741 command. GDI should be selected for HCOPy:
                         DEVice:LANGuage<1|2> on page 714.

                         SYST:COMM:CLIP
                         Directs the hardcopy to the clipboard. EWMF should be selected
                         for HCOPy:DEVice:LANGuage<1|2> on page 714.

                         *RST: SYST:COMM:CLIP

Example: SYST:COMM:PRIN:SEL2 'LASER on LPT1'
                         Selects the printer and output medium for device 2.
                         HCOP:DEST2 'SYST:COMM:PRIN'
                         Selects the printer interface as device 2.

Usage:	SCPI conform
Mode:	all

HCOPy:DEVice:COLor <State>

This command selects between color and monochrome hardcopy of the screen.

Parameters:

<State>	ON	OFF
	ON Color output
	OFF Black and white output
	*RST: OFF
Example:	HCOP:DEV:COL ON
Usage:	SCPI conform
Mode:	all

HCOPy:DEVice:LANGuage<1|2> <Format>

This command determines the data format of the printout.

Parameters:

<Format>	GDI	WMF, EWMF	BMP, JPG, PNG
	GDI Graphics Device Interface: Default format for the output to a printer configured under Windows. Must be selected for the output to the printer interface. Can be used for the output to a file. The printer driver configured under Windows is used in this case and a printer-specific file format is thus generated. (see also HCOPy:DESTination<1|2> on page 713 command)
	WMF, EWMF WINDOWS Metafile and Enhanced Metafile Format: Data formats for output files which can be integrated in corresponding programs for documentation purposes at a later time. WMF can only be used for output to a file and EWMF also for the output to the clipboard. (see also HCOPy:DESTination<1|2> on page 713 command)
	BMP, JPG, PNG Data format for output to files only.
Example:	HCOP:DEV:LANG WMF
Usage:	SCPI conform
Mode:	all

HCOPy[:IMMediate<1|2>]

This command starts a hardcopy output. The suffix selects which printer configuration (device 1 or 2) is to be used for the hardcopy output. If there is no suffix, configuration 1 is automatically selected.

Example:	`HCOP:DEV:LANG BMP`
	Selects the data format.
	`HCOP:DEST 'MMEM'`
	Directs the hardcopy to a file.
	`MMEM:NAME 'C:\R_S\instr\user\Print.bmp'`
	Selects the file name. If the file Print.bmp already exists, it is replaced.
	`HCOP`
	Saves the hardcopy output into the file Print.bmp.
Usage:	Event
	SCPI conform
Mode:	all

HCOPy[:IMMediate<1|2>]:NEXT

This command starts a hardcopy output. The suffix selects which printer configuration (device 1 or 2) is to be used for the hardcopy output. If there is no suffix, configuration 1 is automatically selected. If the output is printed to a file (see `HCOPy:DESTination<1|2>` on page 713 command), the file name used in the last saving process is automatically counted up to the next unused name.

Example:	`HCOP:DEV:LANG BMP`
	Selects the data format.
	`HCOP:DEST 'MMEM'`
	Directs the hardcopy to a file.
	`MMEM:NAME 'C:\R_S\instr\user\Print.bmp'`
	Selects the file name.
	`HCOP`
	Saves the hardcopy output into the file Print.bmp.
	`HCOP:NEXT`
	Saves the hardcopy output into the file Print_001.bmp.
	`HCOP:NEXT`
	Saves the hardcopy output into the file Print_002.bmp.
Usage:	Event
	SCPI conform
Mode:	all

HCOPy:ITEM:ALL

This command selects the complete screen to be output.

The hardcopy output is always provided with comments, title, time and date.

Example:	`HCOP:ITEM:ALL`

Usage: SCPI conform

Mode: all

HCOPy:ITEM:WINDow\<n>:TABle:STATe \<State>

This command defines whether the currently active table is printed.

Suffix:

\<n>   1

              irrelevant

Parameters:

\<State>   ON | OFF

              *RST: OFF

Example: HCOP:ITEM:WIND:TAB:STAT ON

Mode: all

HCOPy:ITEM:WINDow\<n>:TEXT \<Comment>

This command defines the comment text for the printout.

Suffix:

\<n>   1

              irrelevant

Parameters:

\<Comment>   \<string> with a maximum of 100 characters; line feed by means of character @

Example: HCOP:ITEM:WIND:TEXT 'comment'

Mode: all

HCOPy:PAGE:ORIentation\<1|2> \<Orientation>

The command selects the format of the output (portrait and landscape) (hardcopy unit 1 or 2).

The command is only available if the output device "printer" (HCOPy: DESTination\<1|2> on page 713) has been selected.

Parameters:

\<Orientation>   LANDscape | PORTrait

              *RST: PORT

Example: HCOP:PAGE:ORI LAND

Usage: SCPI conform

Mode: all

HCOPy:TDSTamp:STATe\<1|2> \<State>

This command includes or removes the time and date in the printout.

The suffixes <1|2> define the print device number.

Parameters:

<State>   ON | OFF

                           *RST: OFF
Example: HCOP:TDST:STAT OFF
Mode: all

4.2.4.7   MMEMory Subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings.

The various drives can be addressed via the "mass storage unit specifier" <msus> using the conventional DOS syntax. The internal hard disk is addressed by "C:". For details on drives refer to chapter 3.1.2, "Saving and Recalling Settings Files – SAVE/RCL Key", on page 79.

The file names <file_name> are indicated as string parameters with the commands being enclosed in quotation marks. They also comply with DOS conventions.

DOS file names consist of max. 8 ASCII characters and an extension of up to three characters separated from the file name by a dot ".". Both, the dot and the extension are optional. The dot is not part of the file name. DOS file names do not distinguish between uppercase and lowercase notation. All letters and digits are permitted as well as the special characters "_", "^", "$", "~", "!", "#", "%", "&", "-", "{", "}", "(", ")", "@" and "`". Reserved file names are CLOCK$, CON, AUX, COM1 to COM4, LPT1 to LPT3, NUL and PRN.

The two characters "*" and "?" have the function of so-called "wildcards", i.e., they are variables for selection of several files. The question mark "?" replaces exactly one character, the asterisk means any of the remaining characters in the file name. "*.*" thus means all files in a directory.

MMEMory:CATalog?

This command reads the indicated directory.

Return values:

Result	List of file names in the form of strings separated by commas

Query parameters:

<Path>	<path>
	DOS Path name
	The path name should be conform to DOS conventions and may also include the drive name. According to DOS convention, wildcard characters can be entered in order to query e.g. a list of all files of a certain type.
Example:	MMEM:CAT? 'C:\R_S\Instr\user*.DFL'
	Returns all files in C:\R_S\Instr\user with extension ".DFL"
	MMEM:CAT? 'C:\R_S\Instr\user\SPOOL?.WMF'
	Returns all files in C:\R_S\Instr\user whose names start with SPOOL, have 6 letters and the extension ".WMF".
	SPOOL1.WMF,SPOOL2.WMF,SPOOL3.WMF
Usage:	Query only
	SCPI conform
Mode:	all

MMEMory:CATalog:LONG?

Corresponds to MMEMory:CATalog on page 718, but displays extended information on the files contained in the current or specified directory.

This command is an event and therefore has no *RST value and no query.

Return values:

Result   <total number of bytes the directory contains>,"<File name1>, <suffix1>, <Length of file 2 in bytes>","<File name 2>, <suffix2>, <Length of file2 in bytes>",...,"<File name n>, <suffix n>, <Length of file n in bytes>"

The response value consists of a list of strings, separated by commas. It begins with the total number of bytes the directory contains. Then the information for each file is returned.
The <suffix> may be:
– ASCii
– BINary
– STAT

Query parameters:

<Path>   <path>

DOS Path name
The path name should be in conformance with DOS conventions and may also include the drive name.

Following this value, for each file, a string is listed according to the following syntax:

```
"<File name>, <suffix>, <Length of file in
bytes>"
```

Example: `MMEM:CAT:LONG? 'C:\R_S\Instr\user`
Returns all files in `C:\R_S\Instr\user`:
`1776,3331993600, "autolog.txt,ASC,1520",`
`"autologin.reg,BIN,144", "no_autologin.reg,BIN,`
`112"`
Query for the current directory:
`MMEM:CDIR?`
Response:
`C:\R_S\Instr\user`
`MMEM:CAT:LONG?`
Returns all files in C:\R_S\Instr\user.

Usage: Query only
SCPI conform

Mode: all

MMEMory:CDIRectory <Directory>

This command changes the current directory.

Parameters:

<Directory>	<directory_name>

<directory_name>
DOS path name

In addition to the path name, the indication of the directory may contain the drive name. The path name complies with the DOS conventions.

Example: `MMEM:CDIR 'C:\R_S\Instr\user'`

Selects the directory C:\R_S\Instr\user.

Usage: SCPI conform

Mode: all

MMEMory:CLEar:ALL

This command deletes all settings files in the current directory. The current directory can be selected with the `MMEMory:COMMent` command. The default directory is C:\R_S\instr\user.

Example: `MMEM:CLE:ALL`

Usage: Event

Mode: all

MMEMory:CLEar:STATe 1, <FileName>

This command deletes the instrument settings file selected by <file_name>. All associated files on the mass memory storage are cleared.

Parameters:

<FileName>	1,<file_name>

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.

Example: `MMEM:CLE:STAT 1,'TEST'`

Usage: Event

Mode: all

MMEMory:COMMent <Comment>

This command defines a comment for the stored settings.

Parameters:

<Comment>	<string>

Example:	MMEMory:COMMent "ACP measurement with Standard Tetra from 23.05."
	MMEMory::MMEMory:STORe1:STATe 1, "ACP_T"
	As a result, in the selection list for recall settings, the comment "ACP measurement with Standard Tetra from 23.05." is added to the ACP entry.
Usage:	SCPI conform
Mode:	all

MMEMory:COPY <FileSource>,<FileDestination>

This command copies the files indicated in <file_source> to the destination directory indicated with <file_destination> or to the destination file indicated by <file_destination> if <file_source> is just a file.

Parameters:

<FileSource>,<FileDe stination>	<file_source>,<file_destination> = <file_name>
	<file_source>,<file_destination> = <file_name>
	DOS file name
	The indication of the file name may include the path and the drive name. The file names and path information must be in accordance with the DOS conventions.
Example:	MMEM:COPY 'C:\R_S\Instr\user\SETUP.CFG','E:'
Usage:	Event
	SCPI conform
Mode:	all

MMEMory:DATA <FileName>, [<Block>]

This command writes the block data contained in <block> into the file characterized by <file_name>. The delimiter must be set to EOI to obtain error-free data transfer.

The associated query command reads the indicated file from the mass memory and transfers it to the remote control computer. It should be noted that the buffer memory of the control computer should be large enough to store the file. The setting of the delimiter is irrelevant in this case.

The command is useful for reading stored settings files or trace data from the instrument or for transferring them to the instrument.

Parameters:

<FileName>	'<file name>' (file name in single quotes)
	selects the file to be transferred
<Block>	binary data block with the following structure: #<digit for the length of the length information><length information (number of bytes) for the binary data><binary data>

Example:	MMEM:DATA 'TEST01.HCP',#216 This is the file
	where:
	#2: the next 2 characters are the length indication
	16: number of subsequent binary data bytes
	This is the file: 16 bytes stored as binary data in the file
	TEST01.HCP
	MMEM:DATA? 'TEST01.HCP'
	Transfers the file TEST01.HCP from the instrument to the control computer.
Usage:	SCPI conform
Mode:	all

MMEMory:DELete <FileName>

This command deletes the indicated files.

Parameters:

<FileName>	<file_name> = DOS file name
	The indication of the file name contains the path and, optionally, the drive name. Indication of the path complies with DOS conventions.
Example:	MMEM:DEL 'TEST01.HCP'
	The file TEST01.HCP is deleted.
Usage:	SCPI conform
Mode:	all

MMEMory:LOAD:AUTO <Mode>

This command defines which settings file is automatically loaded after the device is switched on. The contents of the file are read after switching on the device and used to define the new device state.

The settings file defined as auto recall set can also be restored by the *RST on page 418 command.

Parameters:

<Mode>	1,'FACTORY'	1,'<file_name>'	with <file_name>
	1,'FACTORY'
	deactivates the startup recall function
	1,'<file_name>'
	activates the startup recall function and defines the settings file to be loaded
	with <file_name>
	DOS file name with or without extension
	The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.
Example:	MMEM:LOAD:AUTO 1,'C:\R_S\Instr\user\TEST'

Usage:	Event
Mode:	all

MMEMory:LOAD:STATe 1, <FileName>

This command loads the device settings from *.dfl files. The contents of the file are loaded and set as the new device state.

Parameters:

<FileName>	1,<file_name> | with <file_name>
	with <file_name>
	DOS file name with or without extension
	The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.
Example:	MMEM:LOAD:STAT 1,'C:\R_S\Instr\user\TEST01'
Usage:	SCPI conform
Mode:	all

MMEMory:MDIRectory <Directory>

This command creates a new directory. The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

Parameters:

<Directory>	<directory_name> = DOS path name
Example:	MMEM:MDIR 'C:\R_S\Instr\user'
Usage:	Event
Mode:	all

MMEMory:MOVE <FileSource>,<FileDestination>

This command renames existing files, if <file_destination> contains no path indication. Otherwise the file is moved to the indicated path and stored under the file name specified there, if any.

Parameters:

<FileSource>,<FileDe stination>	<file_source>,<file_destination> = <file_name> = DOS file name
	The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.
Example:	MMEM:MOVE 'C:\TEST01.CFG','SETUP.CFG'
	Renames TEST01.CFG in SETUP.CFG in directory C:\.
	MMEM:MOVE 'C:\TEST01.CFG','C:\R_S\Instr\user
	Moves TEST01.CFG from C:\ to C:\R_S\Instr\user.
	MMEM:MOVE 'C:\TEST01.CFG','C:\R_S\Instr\user\SETUP.CFG'
	Moves TEST01.CFG from C:\ to C:\R_S\Instr\user and renames the file in SETUP.CFG.

Usage:	Event
	SCPI conform
Mode:	all

MMEMory:MSIS \<Device>

This command changes to the drive indicated. The drive may be the internal hard disk C:.

Parameters:

\<Device>	\<device> = A: | C: … Z:
	*RST: "C:
	The path name complies with DOS conventions.
Example:	`MMEM:MSIS 'C:'`
Usage:	SCPI conform
Mode:	all

MMEMory:NAME \<FileName>

This command defines a destination file for the printout started with the `HCOPy[:IMMediate<1|2>]` on page 715 command. In this case the printer output must be routed to a file as destination.

Parameters:

\<FileName>	\<file_name> = DOS file name
	The file name includes indication of the path and may also include the drive name. The file name and path information comply with DOS conventions.
Example:	`MMEM:NAME 'C:\R_S\instr\user\PRINT1.BMP'`
	Selects the file name.
Usage:	Event
	SCPI conform
Mode:	all

MMEMory:NETWork:MAP

This command maps a drive to a server or server folder of the network. As a prerequisite in Microsoft networks, sharing of this server or server folder must be enabled.

Parameters:

'<string>','<string>'[,'<string>','<string>'],[<Boolean>] | with = '<string>','<string>'

with = '<string>','<string>'
'<drive>','<\host name or IP address\share name>'

[,'<string>','<string>'],[<Boolean>]
'<user name>','<password>',

ON | OFF for connecting under a different user name, and enabling/disabling reconnect at logon.

The entry is optional. The Boolean parameter can be omitted.

Example:	`MMEM:NETW:MAP 'T:','\server\folder'`
	Maps drive T: to folder on server.
Usage:	Event
Mode:	all

MMEMory:NETWork:DISConnect <Drive>

This command disconnects the selected drive.

Parameters:

<Drive>	<drive name> = '<string>'
Example:	`MMEM:NETW:DISC 'T:'`
	Disconnects network drive T:
Usage:	Event
Mode:	all

MMEMory:NETWork:UNUSeddrives?

This command lists all unused network drive names.

This command is only a query and therefore has no *RST value.

Example:	`MMEM:NETW:UNUS?`
	Lists all unused network drive names.
Usage:	Query only
Mode:	all

MMEMory:NETWork:USEDdrives?

This command lists all mapped network drives.

Parameters:

ON | OFF

ON
Lists all mapped network drives including the folder information.

OFF
Lists all mapped network drive names.

*RST: OFF

Example: MMEM:NETW:USED ON
Lists all mapped network drives including the folder information.

Usage: Query only

Mode: all

MMEMory:RDIRectory <Directory>

This command deletes the indicated directory. The directory name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

Parameters:

<Directory>   <directory_name> = DOS path name

Example: MMEM:RDIR 'C:\TEST'

Usage: Event

Mode: all

MMEMory:SELect[:ITEM]:ALL

This command includes all data subsets in the list of device settings to be stored/loaded.

Example: MMEM:SEL:ALL

Usage: Event

Mode: all

MMEMory:SELect[:ITEM]:DEFault

This command includes the default list in the settings file to be stored/loaded. For details on hardware settings refer to the MMEMory:SELect[:ITEM]:HWSettings on page 726 command.

Example: MMEM:SEL:DEFault

Mode: all

MMEMory:SELect[:ITEM]:HWSettings <State>

This command includes the hardware settings in the settings file to be stored/loaded. The hardware settings include:

● current configuration of general device parameters (general setup)

- current setting of the measurement hardware including markers
- activated limit lines:

A settings file may include 8 limit lines at maximum. This number includes the activated limit lines and, if available, the de-activated limit lines last used.

Therefore the combination of the non-activated restored limit lines depends on the sequence of use with the MMEMory:LOAD:STATe 1, on page 723 command.

- user-defined color setting
- configuration for the hardcopy output

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	MMEM:SEL:HWS ON
Mode:	all

MMEMory:SELect[:ITEM]:LINes:ALL <State>

This command includes all limit lines (activated and de-activated) in the settings file to be stored/loaded.

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	MMEM:SEL:LIN:ALL ON
Mode:	all

MMEMory:SELect[:ITEM]:NONE

This command excludes all items from the settings file to be stored/loaded.

Example:	MMEM:SEL:NONE
Usage:	Event
Mode:	all

MMEMory:SELect[:ITEM]:SPECtrogram|SGRam <boolean>

This command adds the spectrogram data to the list of data subsets of a save/recall device setting.

Parameters:

<boolean>	**ON | OFF**
	*RST: OFF
Example:	MEM:SEL:SPEC ON
	Adds the spectrogram data to the list of data subsets.
Mode:	SPECM

MMEMory:SELect[:ITEM]:TRACe[:ACTive] <State>

This command includes the active traces in the settings file to be stored/loaded. Active traces are all traces whose state is not blank.

Parameters:

<State>   ON | OFF

                           *RST: OFF, i.e. no traces is stored
Example: MMEM:SEL:TRAC ON

Mode: all

MMEMory:SELect[:ITEM]:TRANsducer:ALL <State>

This command includes all transducer factors and sets in the settings file to be stored/ loaded.

Parameters:

<State>   ON | OFF

                           *RST: ON
Example: MMEM:SEL:TRAN:ALL ON

Mode: all

MMEMory:STORe<n>:STATe <State>

This command stores the current device settings in a *.dfl file.
Suffix:
<n>   irrelevant

Parameters:

<State>   1,<file_name>

                           with <file_name>
                           DOS file name with or without extension

                           The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.
Example: MMEM:STOR:STAT 1,'Save'
                           Saves the current device settings in the file Save.dfl.

Usage: Event
                           SCPI conform

Mode: all

MMEMory:STORe<n>:STATe:NEXT

This command stores the current device settings in a *.dfl file. The file name used in the last saving process is automatically counted up to the next unused name.
Suffix:
<n>   irrelevant

Example:	`MMEM:STOR:STAT 1,'Save'`
	Saves the current device settings in the file `Save.dfl`.
	`MMEM:STOR:STAT:NEXT`
	Saves the current device settings in the file `Save_001.dfl`
	`MMEM:STOR:STAT:NEXT`
	Saves the current device settings in the file `Save_002.dfl`
Usage:	Event
Mode:	all

4.2.4.8 OUTPut Subsystem (Option Additional Interfaces, B5)

The OUTPut subsystem controls the output features of the instrument.

OUTPut:IF[:SOURce] <Source>

This command switches the source of the IF output between the demodulated signal and the IF signal.

The AF output available at the frontpanel can only be used if the IF output source is set to video.

Parameters:

<Source>	IF	VIDeo
	IF
	intermediate frequency output
	VIDeo
	video output, 200 mV
	*RST: IF
Example:	`OUTP:IF VID`
	Selects the video signal for the IF output connector.
Mode:	A

OUTPut:TRIGger <PortLevel>

Sets the Trigger Out port in the Additional Interfaces (option B5 only) to low or high.Thus, you can trigger an additional device via the external trigger port, for example.

Parameters:

<PortLevel>	LOW	HIGH
	*RST: LOW
Example:	`OUTP:TRIG HIGH`
Mode:	A

4.2.4.9 SENSe Subsystem

The SENSe subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings; they do not refer to the signal characteristics of the measurement signal.

The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSe" is optional for this reason, which means that it is not necessary to include the SENSe node in command sequences.

SENSe:CORRection Subsystem

This subsystem controls calibration and normalization.

[SENSe:]CORRection:TRANsducer[:STATe] <State>

This command switches the selected transducer factor on or off. Up to 8 transducer factors can be active at the same time.

Prior to this command, the `[SENSe:]CORRection:TRANsducer:SELect` on page 732 command must be sent.

Parameters:

<State>   ON | OFF

       *RST: OFF

Example: `CORR:TRAN ON`

Mode: A

[SENSe:]CORRection:TRANsducer:ADJust:RLEVel[:STATe] <State>

This command switches the automatic adjustment of the reference level to the selected transducer factor on or off. For details refer to Ref Level Adjust (Man/Auto) softkey.

Prior to this command, the `[SENSe:]CORRection:TRANsducer:SELect` on page 732 command must be sent.

Parameters:

<State>   ON | OFF

       *RST: OFF

Example: CORR:TRAN:ADJ:RLEV ON

Mode: A

[SENSe:]CORRection:TRANsducer:COMMent <Comment>

This command defines the comment for the selected transducer factor.

Prior to this command, the [SENSe:]CORRection:TRANsducer:SELect on page 732 command must be sent.

Parameters:

<Comment>   <string>

                       *RST: (empty comment)
Example: CORR:TRAN:COMM 'FACTOR FOR ANTENNA'

Mode: A

[SENSe:]CORRection:TRANsducer:DATA <Freq>,<Level>

This command defines the reference values of the transducer factor selected. These values are entered as a sequence of frequency/level pairs. The frequencies must be sent in ascending order.Up to 625 reference values can be defined.

Prior to this command, the [SENSe:]CORRection:TRANsducer:SELect on page 732 command must be sent. The level values are sent as dimensionless numbers; the unit is specified by means of the [SENSe:]CORRection:TRANsducer: UNIT on page 732 command.

Parameters:

<Freq>   Frequency

                       Range: 200 dB < value < 200 dB
Example: SENS:CORR:TRAN:SEL 'TRAN_1'
                       Selects the transducer factor
                       CORR:TRAN:UNIT 'DB'
                       Selects the unit for the transducer.
                       CORR:TRAN:DATA 1MHZ,-30,2MHZ,-40
                       Defines the frequency/level pairs 1 MHz, -30 dB and 2 MHz, -40 dB.

Mode: A

[SENSe:]CORRection:TRANsducer:DELete

This command deletes the selected transducer factor.

Prior to this command, the [SENSe:]CORRection:TRANsducer:SELect on page 732 command must be sent.

Example: CORR:TRAN:DEL

Usage:	Event
Mode:	A

[SENSe:]CORRection:TRANsducer:SCALing <ScalingType>

This command defines whether the frequency scaling of the transducer factor is linear or logarithmic.

Prior to this command, the `[SENSe:]CORRection:TRANsducer:SELect` on page 732 command must be sent.

Parameters:

<ScalingType>	LINear | LOGarithmic
	*RST: LINear
Example:	CORR:TRAN:SCAL LOG
Mode:	A

[SENSe:]CORRection:TRANsducer:SELect <Name>

This command selects the transducer factor designated by <name>. If <name> does not exist yet, a new transducer factor is created.

This command must be sent prior to the subsequent commands for modifying/activating transducer factors.

Parameters:

<Name>	<name> = Name of the transducer factor in string data form with a maximum of 8 characters.
Example:	CORR:TRAN:SEL 'FACTOR1'
Mode:	A

[SENSe:]CORRection:TRANsducer:UNIT <Unit>

This command defines the unit of the transducer factor selected.

Note: If one factor has a different unit than "dB", all the other activated factors must have the unit "dB".

Prior to this command, the `[SENSe:]CORRection:TRANsducer:SELect` on page 732 command must be sent.

Parameters:

<Unit>	<string> = DB | DBM | DBMV | DBUV | DBUV/M | DBUA DBUA/M | DBPW | DBPT
	*RST: DB
Example:	CORR:TRAN:UNIT 'DBUV'
Mode:	A

[SENSe:]CORRection:TRANsducer:VIEW <State>

This command switches on the display of the active transducer factor or set.

Prior to this command, the `[SENSe:]CORRection:TRANsducer:SELect` on page 732 command must be sent.

Parameters:

<State>   ON | OFF

                          *RST: OFF

Example: `CORR:TRAN:VIEW ON`

Mode: A

SENSe:ROSCillator Subsystem

This subsystem controls the reference oscillator. The suffix in SENSe is irrelevant for the commands of this subsystem.

[SENSe:]ROSCillator:EXTernal:FREQuency
SOURce:EXTernal<1|2>:ROSCillator: EXTernal:FREQuency <Frequency>

This command controls the frequency of the external reference oscillator.

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Parameters:

<Frequency>   <numeric value>

Example: `ROSC:EXT:FREQ 13`
                          Sets the frequency to 13 MHz.
                          `SOUR:EXT:ROSC:EXT:FREQ 13`

Usage: SCPI conform

Mode: all

[SENSe:]ROSCillator:SOURce <Source>

This command controls selection of the reference oscillator.

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

EAUTo

the external reference is used as long as it is available, then the instrument switches to the internal reference

Example: ROSC:SOUR EXT

Usage: SCPI conform

Mode: all

[SENSe:]ROSCillator:SOURce:EAUTo?

This query returns the currently available type of reference. This is useful when the external reference is activated and set to switch to the internal reference automatically, if necessary (see "Auto select Reference" on page 59 softkey).

Example: SENS:ROSC:SOUR:EAUT?

Queries the currently available reference type.

Usage: Query only

Mode: all

4.2.4.10   SOURce Subsystem

The SOURce subsystem controls the output signals of the instrument.

SOURce:TEMPerature Subsystem

SOURce<n>:TEMPerature:APRobe

This command queries the sensor temperature.

Suffix:

<n>   irrelevant

Parameters:

1 (CPU)

Example: SOUR:TEMP:APR? 1

Queries the temperature of the CPU sensor.

Mode: all

SOURce:EXTernal Subsystem

The SOURce:EXTernal subsystem controls the operation of the unit with option External Generator Control (R&S FSV-B10). The commands are only valid for the selected window. The suffix <generator> specifies the external generator 1 or 2.

The commands of the SOURce:EXTernal subsystem assume that the addressed generator was correctly configured with the commands of subsystem `SYSTem:COMMunicate`.

If no external generator is selected, if the GPIB or TCP/IP address is not correct, or the generator is not ready for operation, an error message is displayed ("Ext. Generator GPIB Handshake Error!" or "Ext. Generator TCPIP Handshake Error!".

SOURce<n>:EXTernal<generator>:ROSCillator[:SOURce] <Source>

This command switches between external and internal reference oscillator.

Note: in Spectrum mode, this command defines the reference oscillator for the external tracking generator, see `SOURce<n>:EXTernal<generator>:ROSCillator[:SOURce]` on page 655.

Suffix:

<n>	irrelevant
<generator>	irrelevant

Parameters:

<Source>	INTernal | EXTernal
	*RST: INT
Example:	SOUR:EXT:ROSC EXT
	Switches to external reference oscillator
Mode:	all

4.2.4.11 STATus Subsystem

The STATus subsystem contains the commands for the status reporting system (see the Operating Manual on CD-ROM,chapter 5 "Remote Control – Basics"). *RST does not influence the status registers.

STATus:OPERation[:EVENt]

This command queries the contents of the EVENt section of the STATus:OPERation register. The contents of the EVENt section are deleted after readout.

Example: STAT:OPER?

Mode: all

STATus:OPERation:CONDition

This command queries the CONDition section of the STATus:OPERation register (see the base unit description of status registers in the Remote Control Basics chapter).

Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example: STAT:OPER:COND?

Mode: all

STATus:OPERation:ENABle

This command sets the bits of the ENABle section of the STATus:OPERation register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit in the status byte.

Parameters:
                     0 to 65535

Example: STAT:OPER:ENAB 65535

Usage: SCPI conform

Mode: all

STATus:OPERation:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Parameters:
                     0 to 65535

Example: STAT:OPER:PTR 65535

Usage: SCPI conform

Mode: all

STATus:OPERation:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameters:
                     0 to 65535

Example:	STAT:OPER:NTR 65535
Usage:	SCPI conform
Mode:	all

STATus:PRESet

This command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABle part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e. all events in these registers are not passed on.

Example:	STAT:PRES
Usage:	SCPI conform
Mode:	all

STATus:QUEStionable[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable register. The contents of the EVENt section are deleted after the readout.

Example:	STAT:QUES?
Usage:	Query only SCPI conform
Mode:	all

STATus:QUEStionable:CONDition?

This command queries the CONDition section of the STATus:QUEStionable register. Readout does not delete the contents of the CONDition section.

Example:	STAT:QUES:COND?
Usage:	Query only SCPI conform
Mode:	all

STATus:QUEStionable:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit in the status byte.

Parameters:

0 to 65535

Example:	STAT:QUES:ENAB 65535
Usage:	SCPI conform
Mode:	all

STATus:QUEStionable:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for the transitions of the CONDition bit.

Parameters:

0 to 65535

Example: STAT:QUES:PTR 65535

Usage: SCPI conform

Mode: all

STATus:QUEStionable:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameters:

0 to 65535

Example: STAT:QUES:NTR 65535

Usage: SCPI conform

Mode: all

STATus:QUEue[:NEXT?]?

This command queries the earliest error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned. This command is identical to the SYSTem:ERRor[:NEXT] on page 743 command.

Example: STAT:QUES?

Usage: Query only
                 SCPI conform

Mode: all

4.2.4.12 SYSTem Subsystem

This subsystem contains a series of commands for general functions.

SYSTem:APPLication:SRECovery[:STATe] <State>

Controls instrument behavior when switching between measurement applications, e.g. from "Spectrum" to "Analog Demod" and back.

If activated, the current instrument settings are stored when you switch to a different application. When you switch back to the previous application, the corresponding instrument settings are restored. Thus, the settings of the individual applications are independant of each other.

If deactivated (default), only a few parameters of the current instrument setting are passed between applications (e.g. center frequency, level settings).

Note that although the default value is "OFF", this parameter is not reset using the PRESET key. Thus it must be deactivated manually, if necessary.

Parameters:

<State>   ON | OFF

                    *RST: OFF (not restored using the "PRESET" function)

Example: SYST:APPL:SREC ON

Mode: all

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <Address>

This command changes the GPIB address of the unit.

Parameters:

<Address>   0 to 30

                          *RST: (no influence on this parameter, factory default 20)
Example: SYST:COMM:GPIB:ADDR 18

Usage: SCPI conform

Mode: all

SYSTem:COMMunicate:GPIB[:SELF]:RTERminator <Terminator>

This command changes the GPIB receive terminator.

According to the standard the terminator in ASCII is <LF> and/or <EOI>. For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code (0AH) used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by changing the receive terminator to EOI.

Output of binary data from the instrument to the control computer does not require such a terminator change.

Parameters:

<Terminator>   LFEOI | EOI

                          *RST: (no influence on this parameter, factory default
                                       LFEOI)
Example: SYST:COMM:GPIB:RTER EOI

Mode: all

SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]?

This command queries the name of the next printer installed under Windows XP. After all available printer names have been output, an empty string enclosed by quotation marks (") is output for the next query. Further queries are answered by a query error.

The SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt command should be sent previously to return to the beginning of the printer list and query the name of the first printer.

Example: SYST:COMM:PRIN:ENUM?

Usage: Query only

Mode: all

SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?

This command queries the name of the first printer (in the list of printers) available under Windows XP.

The names of other installed printers can be queried with the `SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]` on page 740 command.

If no printer is configured an empty string is output.

Parameters:

	*RST:	NONE
Example:	`SYST:COMM:PRIN:ENUM:FIRS?`	

Usage: Query only

Mode: all

SYSTem:COMMunicate:PRINter:SELect <1|2> <PrinterName>

This command selects one of the printers configured under Windows XP including the associated output destination.

The specified printer name must be a string (entered in quotes) as returned by the commands

`SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt` on page 740 or

`SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT]` on page 740

The `HCOPy:DESTination<1|2>` on page 713 command is used to select an output medium other than the default one.

Parameters:

<PrinterName>	"<printer_name>"	
	*RST:	NONE
Example:	`SYST:COMM:PRIN:SEL "LASER on LPT1"`	

Mode: all

SYSTem:COMMunicate:TCPip:CONTrol?

This command outputs the control port for the LAN socket connection. An error indicates that the socket connection is not supported.

Example: `SYST:COMM:TCP:CONT?`

Usage: Query only

Mode: all

SYSTem:COMPatible <Mode>

Sets the device in a state compatible to previous R&S signal analyzers, e.g. regarding the number of sweep points.

Parameters:

<Mode>	DEFault	FSU	FSP

Example: `SYST:COMP FSP`

Usage: SCPI conform

Mode: all

SYSTem:DATE \<Date\>

This command is used to enter the date for the internal calendar.

The sequence of entry is year, month, day.

Only user accounts with administrator rights can set the date.

Parameters:

\<Date\>   1980 to 2099, 1 to 12, 1 to 31

Example: `SYST:DATE 2000,6,1`

Usage: SCPI conform

Mode: all

SYSTem:DEVice:ID?/SYSTem:DID?

.Both commands are identical and return the unique ID of the analyzer device.

Example: `SYST:DEV:ID?`
`1307.9002K07-100123-aZ`

Usage: Query only
SCPI conform

Mode: all

SYSTem:DISPlay:FPANel \<State\>

This command activates or deactivates the display of the front panel keys on the screen.

With the display activated, the instrument can be operated on the screen using the mouse by pressing the corresponding buttons.

Parameters:

\<State\>   ON | OFF

                 *RST: OFF

Example: `SYST:DISP:FPAN ON`

Mode: all

SYSTem:DISPlay:UPDate \<State\>

In remote control mode, this command switches on or off the instrument display. If switched on, only the diagrams, traces and display fields are displayed and updated.

The best performance is obtained if the display output is switched off during remote control.

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	SYST:DISP:UPD ON
Mode:	all

SYSTem:ERRor[:NEXT]?

This command queries the earliest error queue entry and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example:	STAT:ERR?
Usage:	Query only
	SCPI conform
Mode:	all

SYSTem:ERRor:CLEar:ALL

This command deletes all entries in the table SYSTEM MESSAGES.

Example:	SYST:ERR:CLE:ALL
Usage:	Event
Mode:	all

SYSTem:ERRor:LIST?

This command reads all system messages and returns a list of comma separated strings. Each string corresponds to an entry in the table SYSTEM MESSAGES.

If the error list is empty, an empty string " is returned.

This command is a query and therefore has no *RST value.

Example:	SYST:ERR:LIST?
Usage:	Query only
Mode:	all

SYSTem:FIRMware:UPDate

This command starts a firmware update using the *.msi files in the selected directory. The default path is D:\FW_UPDATE. The path is changed via the MMEMory:COMMent on page 720 command. To store the update files the MMEMory:DATA on page 721 command is used.

Only user accounts with administrator rights can perform a firmware update.

Example:	SYST:FIRM:UPD 'D:\FW_UPDATE'
	Starts the firmware update from directory "D:\FW_UPDATE".
Usage:	Event
Mode:	all

SYSTem:FORMat:IDENt

This command defines the response format to the *IDN on page 416 command. This function is intended for re-use of existing control programs together with the analyzer.

Parameters:

FSL | LEGacy | NEW

LEGacy
Format is compatible to the R&S FSP/FSU/FSQ family

NEW
analyzer format

FSL
Format is compatible to the R&S FSL family

	*RST: NEW
Example:	SYST:FORM:IDEN LEG
	Adapts the return value of *IDN? to the R&S FSP/FSU/FSQ family.
Mode:	all

SYSTem:HPCoupling <CouplingType>

Controls the default coupling ratios in the HP emulation mode for:

- span and resolution bandwidth (Span/RBW) and
- resolution bandwidth and video bandwidth (RBW/VBW)

For FSP (=FSV), the standard parameter coupling of the instrument is used. As a result, in most cases a shorter sweeptime is used than in case of HP.

This command is only available if a HP language is selected using SYSTem:LANGuage on page 746

Parameters:
<CouplingType>	HP	FSP
	*RST: FSP
Example:	SYSTem:HPC HP
Usage:	SCPI conform
Mode:	A

SYSTem:IDENtify:FACTory

Resets the response to the *IDN? query to the default value, e.g. after a user string was defined using the ID String User softkey.

Example:	SYST:IDEN:FACT
	*IDN?
	Response:
	Rohde&Schwarz,analyzer-7,1307.9002K07/101768,
	1.05
Usage:	Event
	SCPI conform
Mode:	A

SYSTem:IDENtify[:STRing] <String>

Sets the response to the *IDN? query to the defined string, e.g. after the default value was reset using the ID String Factory softkey.

Parameters:

<String>   <string>

Example:	Set the response to 'MyDevice':
	SYST:IDEN:STR 'MyDevice'
	Query the response:
	SYST:IDEN:STR?
	Response:
	MyDevice
Usage:	SCPI conform
Mode:	A

SYSTem:IFGain:MODE <Mode>

Configures the internal IF gain settings in HP emulation mode due to the application needs. This setting is only taken into account for resolution bandwidth < 300 kHz and is only available if a HP language is selected using SYSTem:LANGuage on page 746.

Parameters:

<Mode>   NORM | PULS

NORM
Optimized for high dynamic range, overload limit is close to reference level.

PULS
Optimized for pulsed signals, overload limit up to 10 dB above reference level.

*RST: NORM

Example:	SYST:IFG:MODE PULS
Usage:	SCPI conform
Mode:	A

SYSTem:KLOCk <State>

This command activates the local lockout (remote control) or returns to the local mode.

Parameters:

<State>	**ON**
	LLO (local lockout)
	OFF
	GTL (go to local)
	*RST: OFF
Example:	SYST:KLOK ON
	Activates LLO (remote control)
Mode:	A

SYSTem:LANGuage <Language>

This command defines the system language. Default is SCPI which defines the standard remote control behavior of the instrument. The other parameters are to simulate the corresponding HP analyzer. The parameter "PSA89600" sets the device in a state in which it can be used for IQ capturing from the 89600 vector signal analyzer software.

Parameters:

<Language>	"SCPI" | "8560E" | "8561E" | "8562E" | "8563E" | "8564E" | "8565E" | "8566A" | "8566B" | "8568A" | "8568A_DC" | "8568B" | "8568B_DC" | "8591E" | "8594E" | "71100C" | "71200C" | "71209A" | "PSA89600"
	*RST: SCPI
Example:	SYST:LANG '8560E'
	Sets the system language to 8560E to simulate the HP analyzer.
Mode:	all

SYSTem:LXI:INFo?

This query returns the current parameters of the LXI class C.

Only user accounts with administrator rights are able to use LXI functionality.

Return values:

Return values (example)	<current version>|<LXI class>|<Computername>|<MAC adress>| <IP adress>|<Auto MDIX>
Usage:	Query only
Mode:	all

SYSTem:LXI:LANReset

This command resets the LAN configuration to the values required by the LXI standard. In addition, the password is reset to its initial state aas well as the LXI instrument description.

Only user accounts with administrator rights are able to use LXI functionality.

Example: SYST:LXI:LANR

Usage: Event

Mode: all

SYSTem:LXI:MDEScription <String>

This command shows the LXI instrument description. Also, the instrument description can be changed using this command.

Only user accounts with administrator rights are able to use LXI functionality.

Parameters:
<String>   <string>

Example: SYST:LXI:MDES

Mode: all

SYSTem:LXI:PASSword <Password>

This command shows or changes the LXI password.

Only user accounts with administrator rights are able to use LXI functionality.

Parameters:
<Password>   <password>

Example: SYST:LXI:PASS

Mode: all

SYSTem:PASSword[:CENable] <Password>

This command enables access to the service functions by means of the password.

Parameters:
<Password>   <password>

Example: SYST:PASS XXXX

Usage: Event
                      SCPI conform

Mode: all

SYSTem:PASSword:RESet

This command resets the service password.

Example: SYST:PASS:RES

Usage: Event
                      SCPI conform

Mode: all

SYSTem:PRESet

This command initiates an instrument reset.

The effect of this command corresponds to that of the **PRESET** key with manual operation or to the `*RST` command. For details on preset settings refer to chapter 3.2.1, "Initializing the Configuration – PRESET Key", on page 95.

Example:	`SYST:PRES`
Usage:	SCPI conform
Mode:	all

SYSTem:REVision[:STRing] <Name>

Sets the response to the `REV?` queryto the defined string (HP emulation only, see chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E", on page 750).

Parameters:

<Name>   <string>

Example: Define the system language:
                      `SYST:LANG '8563E'`
                      Query the revision:
                      `REV?`
                      Response:
                      `920528`
                      Set the response to 'NewRevision':
                      `SYST:REV:STR 'NewRevision'`
                      Query the response:
                      `SYST:REV:STR?`
                      Response:
                      `NewRevision`

Mode: A

SYSTem:REVision:FACTory

Resets the response to the REV? query to the default value, e.g. after a user string was defined using the `SYSTem:REVision[:STRing]` command. (REV? query available for HP emulation only, see chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E", on page 750.)

Example: Define the system language:
                      `SYST:LANG '8563E'`
                      Set the response back to factory setting:
                      `SYS:REV:FACT`
                      Query the revision:
                      `REV?`
                      Response:
                      `920528`

Usage:	Event
	SCPI conform
Mode:	A

SYSTem:RSW <State>

Controls a repeated sweep of the E1 and MKPK HI HP model commands (for details on the commands refer to chapter 4.2.5, "GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E", on page 750). If the repeated sweep is OFF, the marker is set without sweeping before.

This command is only available if a HP language is selected using SYSTem:LANGuage on page 746

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	SYSTem:RSW ON
Usage:	SCPI conform
Mode:	A

SYSTem:SHUTdown

This command shuts down the instrument.

Usage:	Event
Mode:	all

SYSTem:TIME <Time>

This command sets the internal clock. The sequence of entry is hour, minute, second.

Only user accounts with administrator rights are able to set the time.

Parameters:

<Time>	0 to 23, 0 to 59, 0 to 59
Example:	SYST:TIME 12,30,30
Usage:	SCPI conform
Mode:	all

SYSTem:VERSion?

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no *RST value.

Example:	SYST:VERS?

Usage:	Query only
	SCPI conform
Mode:	all

4.2.5 GPIB Commands of HP Models 856xE, 8566A/B, 8568A/B and 8594E

The analyzer analyzer family supports a subset of the GPIB commands of HP models 8560E, 8561E, 8562E, 8563E, 8564E, 8565E, 8566A, 8566B, 8568A, 8568B and 8594E.

Despite the differences in system architecture and device features, the supported commands have been implemented in a way to ensure a sufficiently high degree of correspondence with the original.

This includes the support of syntax rules for not only newer device families (B and E models) but for the previous A family as well.

In many cases the selection of commands supported by the analyzer is sufficient to run an existing GPIB program without adaptation.

After the introduction, this section includes the following topics:

4.2.5.1   GPIB Language and Other Settings

"GPIB Language" on page 67The device model to be emulated is selected manually using the key sequence "SETUP > General Setup > GPIB > Compatible Mode > GPIB Language". Via the GPIB interface using the SYSTem:LANGuage on page 746 command.

"ID String User" on page 66In order to emulate device models that are not part of the selection list of the "GPIB Language" softkey, you can modify the identification string received in response to the ID command (key sequence "SETUP – General Setup – GPIB – ID String User"). Thus, any device model whose command set is compatible with one of the supported device models can be emulated.

SYSTem:ERRor[:NEXT] on page 743Remote: SYST:LANG 8560E

Supported languages

Language	Comment
SCPI	
71100C	Compatible to 8566A/B
71200C	Compatible to 8566A/B
71209A	Compatible to 8566A/B
8560E	
8561E	
8562E	
8563E	
8564E	
8565E	
8566A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8566B	
8568A	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568A_DC	Uses DC input coupling by default if supported by the instrument
8568B	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.
8568B_DC	Uses DC input coupling by default if supported by the instrument
8591E	Compatible to 8594E
8594E	Command sets A and B are available. Command sets A and B differ in the rules regarding the command structure.

Notes:

●   If you select a language other than "SCPI", the GPIB address is set to 18 if it was 20 before.

●   The Start/stop frequency, reference level and # of sweep points are adapted to the selected instrument model.

●   When you switch between remote-control languages, the following settings or changes are made:
SCPI:
The instrument performs a PRESET.
8566A/B, 8568A/B, 8594E:
–   The instrument performs a PRESET.

–   The following instrument settings are changed:

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8566A/B	1001	2 GHz	22 GHz	0 dBm	AC
8568A/B	1001	0 Hz	1.5 GHz	0 dBm	AC
8560E	601	0 Hz	2.9 GHz	0 dBm	AC
8561E	601	0 Hz	6.5 GHz	0 dBm	AC
8562E	601	0 Hz	13.2 GHz	0 dBm	AC
8563E	601	0 Hz	26.5 GHz	0 dBm	AC
8564E	601	0 Hz	40 GHz	0 dBm	AC
8565E	601	0 Hz	50 GHz	0 dBm	AC
8594E	401	0 Hz	3 GHz	0 dBm	AC

Note: The stop frequency indicated in the table may be limited to the corresponding frequency of the analyzer, if required.

IF Gain settings

You can configure the internal IF gain settings in HP emulation mode according to the application needs (only for resolution bandwidth < 300 kHz).

NORMal	Optimized for high dynamic range, overload limit is close to reference level.
PULS	Optimized for pulsed signals, overload limit up to 10 dB above reference level.

"IF Gain (Norm/Puls)" on page 67This setting can be defined using the "IF Gain" softkey or the remote command `SYSTem:IFGain:MODE` on page 745.

Sweep settings

"Sweep Repeat (On/Off)" on page 68You can define whether the sweep is to be repeated when you set a marker using the E1 and MKPK HI commands. In single sweep mode, you should avoid repeating the sweep. This setting can be defined using the "Sweep Repeat" softkey or the remote command `SYSTem:RSW` on page 749.

Coupling settings

You can define the default coupling ratios in the HP emulation mode for:

● span and resolution bandwidth (Span/RBW)

● resolution bandwidth and video bandwidth (RBW/VBW)

For FSP(=FSV), the standard parameter coupling of the instrument is used. As a result, in most cases a shorter sweeptime is used than in case of HP.

"Coupling (FSx/HP)" on page 68This setting can be defined using the "Coupling (FSx/HP)" softkey or the remote command `SYSTem:HPCoupling` on page 744.

4.2.5.2 Command Set of Models 8560E, 8561E, 8562E, 8563E, 8564E, 8565E, 8566A/B, 8568A/B, 8591E, 8594E, 71100C, 71200C, and 71209A

As with the original units, the analyzer includes the command set of the A models in the command set of the B models.

The HP model 8591E is compatible to HP model 8594E, the HP models 71100C, 71200C, and 71209A are compatible to HP models 8566A/B.

Command	Supported subset	Function	Corresp. HP-Models	Status
A1	A1	Clear/Write A	HP 8566A/ HP 8568A	available
A2	A2	Max Hold A	HP 8566A/ HP 8568A	available
A3	A3	View A	HP 8566A/ HP 8568A	available
A4	A4	Blank A	HP 8566A/ HP 8568A	available
ABORT [1]	ABORT	Stop previous function	HP 856xE/ HP 8566B/HP 8568B/HP 8594E	available
ADD		Add	HP 8566B/ HP 8568B/ HP 8594E	available
ADJALL	ADJALL	Adjust all	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ADJCRT [2]	ADJCRT	Adjust CRT	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ADJIF [2]	ADJIF	Auto adjust IF	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AMB	AMB ON|OFF AMB 1|0 AMB?	Trace A – B -> Trace A	HP 856xE/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
AMBPL	AMBPL ON|OFF AMBPL 1|0 AMBPL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ANNOT	ANNOT ON|OFF ANNOT 1|0 ANNOT?	Annotation	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
APB	APB	Trace A + B -> Trace A	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AT	AT <numeric_value> DB | DM AT DN AT UP AT AUTO AT?	Attenuation	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AUNITS	AUNITS DBM | DBMV | DBUV | AUNITS?	Amplitude Units	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AUTOCPL	AUTOCPL	Coupling default	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
AXB	AXB	Exchange trace A and B	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
B1	B1	Clear/Write B	HP 8566A/ HP 8568A	available
B2	B2	Max Hold B	HP 8566A/ HP 8568A	available
B3	B3	View B	HP 8566A/ HP 8568A	available
B4	B4	Blank B	HP 8566A/ HP 8568A	available
BL	BL	Trace B – Display Line -> Trace B	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
BML	BML	Trace B – Display Line -> Trace B	HP 856xE/ HP8594E	available
BTC	BTC	Transfer Trace B -> C	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
BXC	BXC	Exchange Trace B and C	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
BLANK	BLANK TRA|TRB|TRC	Blank Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
C1	C1	A-B off	HP 8566A/ HP 8568A	available
C2	C2	A-B -> A	HP 8566A/ HP 8568A	available
CA	CA	Couple Attenuation	HP 8566A/ HP 8568A	available
CAL [1]	CAL ALL CAL ON CAL OFF	Start analyzer self alignment	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CF	CF <numeric_value> HZ| KHZ|MHZ|GHZ CF UP CF DN CF?	Center Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CHANPWR	CHANPWR TRA|TRB, <numeric_value>,?	Channel Power Measurement	HP 856xE/ HP 8594E	available
CHPWRBW	CHPWRBW <numeric_value> HZ| KHZ|MHZ|GHZ	Channel Power Bandwidth	HP 856xE/ HP 8594E	available
CLRW	CLRW TRA|TRB|TRC	Clear/Write Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
CLS [1]	CLS	Clear all status bits	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CONTS	CONTS		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
COUPLE	COUPLE AC|DC	Input coupling	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
CR	CR	Couple RBW	HP 8566A/ HP 8568A	available
CS	CS	Couple Step Size	HP 8566A/ HP 8568A	available
CT	CT	Couple SWT	HP 8566A/ HP 8568A	available
CTA		Convert to absolute units	HP 8566B/ HP 8568B/ HP 8594E	available
CV	CV	Couple VBW	HP 8566A/ HP 8568A	available
D1 [2]	D1	Display Size normal	HP 8566A/ HP 8568A	available
DA [2]	DA	Display address		available
DEMOD [1]	DEMOD ON|OFF|AM|FM	AF Demodulator	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DEMODAGC [2]	DEMODAGC ON|OFF|1|0 DEMODAGC?	Demodulation AGC	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DEMODT	DEMODT <numeric_value> S|MS|US|SC DEMODT UP|DN DEMODT?	Demodulation time	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
DET	DET POS|SMP|NEG DET?	Detector	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DISPOSE [2]	ONEOS | TRMATH | ONSWP | ALL | <numeric_value>			available
DIV		Divide	HP 8566B/ HP 8568B/ HP 8594E	available
DL	DL <numeric_value> DB| DM DL DN DL UP DL ON DL OFF DL?	Display Line	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DLE	DLE ON|OFF	Display Line enable	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DONE	DONE DONE?	Done query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
DW [2]	DW	Write to display and increment address		available
E1	E1	Peak Search	HP 8566A/ HP 8568A	available
E2	E2	Marker to Center Freq.	HP 8566A/ HP 8568A	available
E3	E3	Deltamarker Step Size	HP 8566A/ HP 8568A	available
E4	E4	Marker to Ref. Level	available	available
EDITDONE		limit line edit done	HP 856xE	available
EDITLIML		edit limit line	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
ERR	ERR 250 cal level error ERR 300 LO unlock ERR 472 cal error digital filter ERR 473 cal error analog filter ERR 552 cal error log amp ERR 902 unscale tracking generator ERR 906 oven cold ERR 117 numeric unit error ERR 112 Unrecognized Command	Now some FSx errors are mapped to HP errors.	HP8568A HP856xE	not yet available
ERR?	ERR?	Error queue query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not yet available
EX	EX	Exchange trace A and B	HP 8566A/ HP 8568A	available
FA	FA <numeric_value> HZ|KHZ|MHZ|GHZ FA UP FA DN FA?	Start Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FB	FB <numeric_value> HZ|KHZ|MHZ|GHZ FB UP FB DN FB?	Stop Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FOFFSET [1]	FOFFSET <numeric_value> HZ|KHZ|MHZ|GHZ FOFFSET?	Frequency Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FREF	FREF INT|EXT	Reference Frequency	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
FS	FS	Full Span	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
FUNCDEF		Define Function Function must be in one line between delimiters @	HP 8594E/ HP 856xE/ HP 8566B	available
GATE [1]	GATE ON|OFF GATE 1|0		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GATECTL [1]	GATECTL EDGE|LEVEL GATECTL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GD [1]	GD <numeric_value> US|MS|SC GD DN GD UP GD?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GL [1]	GL <numeric_value> US|MS|SC GL DN GL UP GL?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GP [1]	GP POS|NEG GP?		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
GRAT [2]	GRAT ON|OFF	Graticule	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
I1	I1		HP 8566A/ HP 8568A	available
I2	I2		HP 8566A/ HP 8568A	available
ID	ID ID?	Identify	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
INZ [1]	INZ 75 INZ 50 INZ?	Input Impedance	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
IP	IP	Instrument preset	HP 8566A/ HP 8568A	available
KEYDEF	KEYDEF	Key definition	HP 8566B/ HP 856xE/ HP 859xE	available
KEYEXEC	KEYEXEC	Key execute	HP 8566B	available
KS=	KS= <numeric_value> HZ|KHZ|MHZ|GHZ KS= DN KS= UP KS=?	Marker Frequency Counter Resolution	HP 8566A/ HP 8568A	available
KS/	KS/	Manual Peaking	HP 8566A/ HP 8568A	available
KS(	KS(	Lock register	HP 8566A/ HP 8568A	available
KS)	KS)	Unlock register	HP 8566A/ HP 8568A	available
KS91	KS91	Read Amplitude Error	HP 8566A/ HP 8568A	available
KSA	KSA	Amplitude Units in dBm	HP 8566A/ HP 8568A	available
KSB	KSB	Amplitude Units in dBmV	HP 8566A/ HP 8568A	available
KSC	KSC	Amplitude Units in dBuV	HP 8566A/ HP 8568A	available
KSD	KSD	Amplitude Units in V	HP 8566A/ HP 8568A	available
KSE	KSE <numeric_value>| <char data>@	Title mode	HP 8566A/ HP 8568A	available
KSG	KSG KSG ON KSG <numeric_value>	Video Averaging on	HP 8566A/ HP 8568A	available
KSH	KSH	Video Averaging Off	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
KSK		Marker to Next Peak	HP 8566A/ HP 8568A	available
KSL		Marker Noise off	HP 8566A/ HP 8568A	available
KSM		Marker Noise on	HP 8566A/ HP 8568A	available
KSO	KSO	Deltamarker to span	HP 8566A/ HP 8568A	available
KSP	KSP <numeric_value>	HPIB address	HP 8566A/ HP 8568A	available
KSQ [2]	KSQ	Band lock off	HP 8566A/ HP 8568A	available
KST	KST	Fast Preset	HP 8566A/ HP 8568A	available
KSV	KSV <numeric_value> HZ|KHZ|MHZ|GHZ KSV?	Frequency Offset	HP 8566A/ HP 8568A	available
KSW	KSW	Error Correction Routine	HP 8566A/ HP 8568A	available
KSX	KSX	Correction Values On	HP 8566A/ HP 8568A	available
KSY	KSY	Correction Values Off	HP 8566A/ HP 8568A	available
KSZ	KSZ <numeric_value> DB KSZ?	Reference Value Offset	HP 8566A/ HP 8568A	available
KSa	KSa	Normal Detection	HP 8566A/ HP 8568A	available
KSb	KSb	Pos Peak Detection	HP 8566A/ HP 8568A	available
KSd	KSd	Neg Peak Detection	HP 8566A/ HP 8568A	available
KSe	KSe	Sample Detection	HP 8566A/ HP 8568A	available
KSg		CRT beam off		available
KSh		CRT beam on		available
KSj	KSj	View Trace C	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
KSk	KSk	Blank Trace C	HP 8566A/ HP 8568A	available
KSl	KSl	Transfer B to C	HP 8566A/ HP 8568A	available
KSm	KSm	Graticule off	HP 8566A/ HP 8568A	available
KSn[2]	KSn	Grid on	HP 8566A/ HP 8568A	available
KSo	KSn	Character display off	HP 8566A/ HP 8568A	available
KSp	KSp	Character display on	HP 8566A/ HP 8568A	available
KSr	KSr	Create service request	HP 8566A/ HP 8568A	available
KSt [2]	KSt	Band lock on	HP 8566A/ HP 8568A	available
KSv [2]	KSv	Signal ident on	HP 8566A/ HP 8568A	available
L0	L0	Display line off	HP 8566A/ HP 8568A	available
LB	LB <numeric_value>| <char data>@	Label	HP 8566A/ HP 8568A	available
LF	LF	Low frequency band preset	HP 8566A/ HP 8568A	available
LIMD		limit line delta	HP 856xE	available
LIMF		limit line frequency	HP 856xE	available
LIMIFAIL		limit fail query	HP 856xE	available
LIMIPURGE		purge limit line	HP 856xE	available
LIMIRCL		recall limit line	HP 856xE	available
LIMIREL		relative limit line	HP 856xE	available
LIMISAV		save limit line	HP 856xE	available
LIMITEST		limit line test	HP 856xE	available
LIML		lower limit line value	HP 856xE	available
LIMM		middle limit line value	HP 856xE	available
LIMTFL		flat limit line segment	HP 856xE	available
LIMTSL		slope limit line segment	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
LIMU		upper limit line value	HP 856xE	available
LG	LG <numeric_value> DB | DM LG?	Amplitude Scale Log	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
LL [2]	LL	Plot command	HP 8566A/ HP 8568A	available
LN	LN	Amplitude Scale Lin	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
M1	M1	Marker Off	HP 8566A/ HP 8568A	available
M2	M2 M2 <numeric_value> HZ|KHZ|MHZ|GHZ M2 DN M2 UP M2?	Marker Normal	HP 8566A/ HP 8568A	available
M3	M3 M3 <numeric_value> HZ|KHZ|MHZ|GHZ M3 DN M3 UP M3?	Delta Marker	HP 8566A/ HP 8568A	available
M4	M4 <numeric_value> HZ|KHZ|MHZ|GHZ	Marker Zoom	HP 8566A/ HP 8568A	available
MA	MA	Marker Amplitude	HP 8566A/ HP 8568A	available
MC0	MC0	Marker Count off	HP 8566A/ HP 8568A	available
MC1	MC1	Marker Count on	HP 8566A/ HP 8568A	available
MDS	MDS	Measurement data size	HP 8566B	available
MEAS		Measurement status	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MF	MF MF?	Marker Frequency	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MINH[1]	MINH TRC	Minimum Hold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKA	MKA \<numeric_value> MKA?	Marker Amplitude	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKACT	MKACT 1 MKACT?	Select the active marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
MKBW [1]	MKBW \<numeric_value> MKBW ON MKBW OFF	N dB Down	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKD	MKD MKD \<numeric_value> HZ|KHZ| MHZ|GHZ MKD DN MKD UP MKD ON MKD OFF MKD?	Delta Marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKDR	MKDR \<numeric_value> HZ|KHZ| MHZ|GHZ| S|SC|MS|MSEC| USMKDR?	Delta Marker reverse	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKDR?		Delta Marker reverse query		available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKF	MKF <numeric_value> HZ|KHZ|MHZ|GHZ MKF?	Set Marker Frequency	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKFC	MKFC ON|OFF	Frequency Counter on/ off	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKFCR [1)]	MKFCR <numeric_value> HZ|KHZ| MHZ|GHZ MKFCR DN MKFCR UP MKFCR?	Frequency Counter Resolution	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKMIN	MKMIN	Marker -> Min	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKN	MKN MKN <numeric_value> HZ|KHZ|MHZ|GHZ MKN DN MKN UP MKN ON MKN OFF MKN?	Normal Marker	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKNOISE	MKNOISE ON|OFF MKNOISE 1|0 MKNOISE?	Noise Measurement	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKOFF	MKOFF MKOFF ALL	Marker off	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKP	MKP <numeric_value> MKP?	Marker position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKPK	MKPK MKPK HI MKPK NH MKPK NR MKPK NL	Marker Search	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKPT	MKPT MKPT HI MKPT NH MKPT NR MKPT NL	Marker Peak Threshold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKPX	MKPX <numeric_value> DB MKPX DN MKPX UP MKPX?	Peak Excursion	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKRL	MKRL	Ref Level = Marker Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKSP	MKSP	Deltamarker to span	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKSS	MKSS	CF Stepsize = Marker Freq	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKT	MKT <numeric_value> S|MS|US|SC MKT?	MKF = fstart + MKT/ SWT*Span	HP 856xE/ HP 8594E	available
MKTRACE	MKTRACE TRA|TRB| TRC	Marker to Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MKTRACK	MKTRACK ON|OFF MKTRACK 1|0 MKTRACK?	Signal Track	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
MKTYPE	MKTYPE AMP MK TYPE?	Marker type	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ML		Mixer level	HP 856xE	available
MOV	MOV TRA|TRB|TRC, TRA|TRB|T RC	Move Trace Contents	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
MPY		Multiply	HP 8566B/ HP 8568B/ HP 8594E	available
MT0	MT0	Marker Track Off	HP 8566A/ HP 8568A	available
MT1	MT1	Marker Track On	HP 8566A/ HP 8568A	available
MXMH	MXMH TRA|TRB	Maximum Hold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
NORMALIZE	NORMALIZE	Normalize trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available available
NRL [1)	NRL <numeric_value> DB | DM NRL?	Normalized Reference Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
NRPOS	NRPOS <numeric_value> NRL?	Normalize position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
O1	O1	Format ASCII, Values 0 to 4095	HP 8566A/ HP 8568A	available
O2	O2	Format Binary, Values 0 to 4095	HP 8566A/ HP 8568A	available
O3	O3	Format ASCII	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
OA	OA	Output All	HP 8566A/ HP 8568A	available
OL	OL <80 characters> OL?	Output Learn String	HP 8566A/ HP 8568A	available
OT	OT	Output Trace Annotations	HP 8566A/ HP 8568A	available
PA [2]	PA <numeric_value>, <numeric_value	Plot command	HP 8566A/ HP 8568A	available
PD [2]	PD <numeric_value>, <numeric_value	Plot command	HP 8566A/ HP 8568A	available
PH_MKF		Spot frequency in Hz	HP 856xE	available
PH_FMIN		Min offset frequency to be measured	HP 856xE	available
PH_FMAX		Max offset frequency to be measured	HP 856xE	available
PH_MKA		Queries amplitude at the spot frequency	HP 856xE	available
PH_DRIFT		0: for stable signals, 1: for drifty	HP 856xE	available
PH_RLVL		Reference level for the log plot	HP 856xE	available
PH_SMTHV		Trace smoothing	HP 856xE	available
PH_VBR		Filtering	HP 856xE	available
PH_RMSPT		Amount of data points to skip when doing the integration	HP 856xE	available
PH_RMSFL		Lower integration frequency in Hz	HP 856xE	available
PH_RMSFU		Upper integration frequency in Hz	HP 856xE	available
PH_EXIT		Quits phase noise	HP 856xE	available
PH_F_UDT		Updates internal frequency variables	HP 856xE	available
PH_LMT_L		Apply limits to PH_FMIN and PH_FMAX	HP 856xE	available
PH_MEAS		Generates log frequency plot	HP 856xE	available
PH_MKF_D		Updates the spot frequency	HP 856xE	available

Command	Supported subset	Function	Corresp. HP-Models	Status
PH_RMS		Requests the rms phase noise	HP 856xE	available
PH_RMSFT		Updates internal frequency variables	HP 856xE	available
PH_RMSX		Calculates the rms phase noise	HP 856xE	available
PH_SPOTF		Executes the spot frequency measurement	HP 856xE	available
PLOTORG [2]	PLOTORG DSP|GRT	Plot command	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PLOTSRC [2]	PLOTSRC ANNT|GRT| TRB| TRA|ALLDSP|GRT	Plot command	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PP	PP	Preselector Peaking	HP 8566A/ HP 8568A	available
PRINT [1]	PRINT PRINT 1|0	Hardcopy	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PSDAC [2]	PSDAC <numeric_value> PSDAC UP|DN	Preselector DAC value	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PSTATE [2]	PSTATE ON|OFF|1|0	Protect State	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
PU [2]	PU	Pen Up	HP 8566A/ HP 8568A	available
PWRBW	PWRBW	Power Bandwidth	HP 8566B/ HP 859x/ HP 856xE	available
R1	R1	Set Status Bit Enable	HP 8566A/ HP 8568A	available
R2	R2	Set Status Bit Enable	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
R3	R3	Set Status Bit Enable	HP 8566A/ HP 8568A	available
R4	R4	Set Status Bit Enable	HP 8566A/ HP 8568A	available
RB	RB <numeric_value> HZ| KHZ|MHZ|GHZ RB DN RB UP RB AUTO RB?	Resolution Bandwidth	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RBR	RBR <numeric_value> RBR DN RBR UP RBR?	Resolution Bandwidth Ratio	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RC1…6	RC1…6	Recall Last State	HP 8566A/ HP 8568A	available
RCLS	RCLS <numeric_value>	Recall State Register	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RCLT	RCLT TRA|TRB, <number>	Recall Trace	HP856xE/ HP8594E	available
RESET	RESET	Instrument preset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
REV	REV REV?	Firmware revision	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RL	RL <numeric_value> DB|DM RL DN RL UP RL?	Reference Level	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RLCAL	RLCAL <numeric_value> RL?	Reference Level Calibration	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
RCLOSCAL	RCLOSCAL	Recall Open/Short Average	HP 856xE/ HP 8594E	not available
RCLTHRU	RCLTHRU	Recall Thru	HP 856xE/ HP 8594E	not available
RLPOS [1]	RLPOS <numeric_value> RLPOS DN RLPOS UP RLPOS?	Reference Level Position	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ROFFSET	ROFFSET <numeric_value> DB | DM ROFFSET?	Reference Level Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
RQS	RQS	Service Request Bit mask	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
S1	S1	Continuous Sweep	HP 8566A/ HP 8568A	available
S2	S2	Single Sweep	HP 8566A/ HP 8568A	available
SADD		add a limit line segment	HP 856xE	available
SAVES	SAVES <numeric_value>	Save State Register	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SAVET	SAVET TRA|TRB,<number>	Save Trace	HP856xE/ HP8594E	available
SDEL		delete limit line segment	HP 856xE	available
SDON		limit line segment done	HP 856xE	available
SEDI		edit limit line segment	HP 856xE	available
SMOOTH	SMOOTH TRA|TRB|TRC, <number of points>	Smooth Trace	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SNGLS	SNGLS	Single Sweep	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
SQUELCH [2]	SQUELCH <numeric_value> DM | DB SQUELCH UP|DN SQUELCH ON|OFF	Squelch	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SP	SP <numeric_value> HZ|KHZ|MHZ|GHZ SP DN SP UP SP?	Span	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SRCNORM [1]	SRCNORM ON|OFF SRCNORM 1|0	Source Normalization	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
SRCPOFS [1]	SRCPOFS <numeric_value> DB | DM SRCPOFS DN SRCPOFS UP SRCPOFS?	Source Power Offset	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
SRCPWR [1]	SRCPWR <numeric_value> DB | DM SRCPWR DN SRCPWR UP SRCPWR ON SRCPWR OFF SRCPWR?	Source Power	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	not available
SS	SS <numeric_value> HZ|KHZ|MHZ|GHZ SS DN SS UP SS AUTO SS?	CF Step Size	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
ST	ST <numeric_value> US|MS|SC ST DN ST UP ST AUTO ST?	Sweep Time	HP 8566A/ HP 8568A/ HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
STB	STB	Status byte query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
STOREOPEN	STOREOPEN	Store Open	HP 856xE/ HP 8594E	not available
STORESHORT	STORESHORT	Store Short	HP 856xE/ HP 8594E	not available
STORETHRU	STORETHRU	Store Thru	HP 856xE/ HP 8594E	not available
SUB		Subtract	HP 8566B/ HP 8568B/ HP 8594E	available
SUM		sum of trace amplitudes	HP 8566B/ HP 8568B/ HP 8594E	available
SV1…6	SV1…6	Save State	HP 8566A/ HP 8568A	available
SWPCPL [2]	SWPCPL SA | SR SWPCPL?	Sweep Couple	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
SWPOUT [2]	SWPOUT FAV|FAVA| RAMP SWPOUT?	Sweep Output	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
T0	T0	Threshold off	HP 8566A/ HP 8568A	available
T1	T1	Free Run Trigger	HP 8566A/ HP 8568A	available
T2 [2]	T2	Line Trigger	HP 8566A/ HP 8568A	available
T3	T3	External Trigger	HP 8566A/ HP 8568A	available
T4	T4	Video Trigger	HP 8566A/ HP 8568A	available
TA	TA	Transfer A	HP 8566A/ HP 8568A	available

Command	Supported subset	Function	Corresp. HP-Models	Status
TACL	TACL?	Returns instantaneous measurement results. See TRACe<trace #>:IMMediate:LEVel? for full description.		not available
TBCL	TBCL?			
TCCL	TCCL?			
TACR	TACR?	Returns instantaneous measurement results. See TRACe<trace #>:IMMediate:LEVel? for full description.		not available
TBCR	TBCR?			
TCCR	TCCR?			
TB	TB	Transfer B	HP 8566A/ HP 8568A	available
TDF	TDF P TDF M TDF B TDF A TDF I	Trace Data Format	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TH	TH <numeric_value> DB| DM TH DN TH UP TH ON TH OFF TH AUTO TH?	Threshold	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
THE	THE ON| OFF	Threshold Line enable	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TIMEDSP [1]	TIMEDSP ON|OFF TIMEDSP 1|0 TIMEDSP?	Time Display	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TM	TM FREE|VID|EXT| LINE[2] TM?	Trigger Mode	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TM LINE [2]	TM LINE	Trigger Line	HP 8566B	available

Command	Supported subset	Function	Corresp. HP-Models	Status
TRA	TRA B TRA A TRA I	Transfer A	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TRB	TRB B TRB A TRB I	Transfer B	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TRSTAT	TRSTAT?	Trace State Query	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
TS	TS	Take Sweep	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
UR [2)	UR	Plot Command	HP 8566A/ HP 8568A	available
VARDEF	VARDEF	Variable definition, arrays are not supported	HP 8566B/ HP 8568B/ HP 8594E	available
VAVG	VAVG VAVG TRA|TRB|TRC	Video Averaging	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VB	VB <numeric_value> HZ|KHZ|MHZ|GHZ VB DN VB UP VB AUTO VB?	Video Bandwidth	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VBR [1)	VBR <numeric_value> VBR DN VBR UP VBR?	Video Bandwidth Ratio	HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available
VIEW	VIEW TRA|TRB|TRC		HP 856xE/ HP 8566B/ HP 8568B/ HP 8594E	available

Command	Supported subset	Function	Corresp. HP-Models	Status
VTL	VTL <numeric_value> DB|DM VTL DN VTL UP VTL?	Video Trigger Level	HP 856xE/ HP 8594E	not available
1) HP 8594E only				
2) Command is accepted without error message, but is ignored				

4.2.5.3 Special Features of the Syntax Parsing Algorithms for 8566A and 8568A Models

The command syntax is very different for models A and B. Different names are assigned to identical instrument functions, and the command structure likewise differs considerably between models A and models B.

The command structure for models A is as follows:

```
<command>::= <command
code>[<SPC>][<data>|<step>][<SPC>][<delimiter>][<command
code>]…<delimiter>

<data>::= <Value>[<SPC>][<units
code>][<SPC>][<delimiter>][<SPC>][<data>]…

<step>::= UP|DN
```

where

`<command code>` = see Table "Supported Commands"

`<Value>` = integer or floating-point numerical value

`<units code>` = DM | -DM | DB | HZ | KZ | MZ | GZ | MV | UV | SC | MS | US

`<delimiter>` = <CR> | <LF> | <,> | <;> | <ETX>

`<SPC>` = 32_{10}

`<ETX>` = 3_{10}

Command sections given in [ ] are optional.

The analyzer GPIB hardware differs from that used in the HP analyzers. Therefore, the following constraint exists:

`<LF>| <EOI>` are still used as delimiters since the GPIB hardware is able to identify them. The other delimiters are identified and evaluated during syntax analysis.

4.2.5.4 Special Behavior of Commands

Command	Known Differences
ABORT	Does not automatically set the command complete bit (bit 4) in the status byte. An additional DONE is required for that purpose.
ANNOT	Only frequency axis annotation is affected.
AT	AT DN/UP: Step size
CAL	The CAL commands do not automatically set the command complete bit (bit 4) in the status byte. An additional DONE command is required for that purpose.
CF	Default value, range, step size
CR	Default ratio Span/RBW
CT	Formula for coupled sweeptime
CV	Default ratio RBW/VBW
DEMOD	requires option R&S FSV-B3
DET	DET? returns SAMP instead of SMP on the analyzer. DET not automatically set the command complete bit (bit 4) in the status byte. An additional DONE is required for that purpose.
ERR?	Deletes the error bit in the status register but always returns a '0' in response.
FA	Default value, range, step size
FB	Default value, range, step size
ID	"ID String User" on page 66Query of instrument type. The instrument type entered with "SETUP > General Setup > GPIB > ID String User" is returned.
M2	Default value, range, step size
M3	Default value, range, step size
MKACT	Only marker 1 is supported as the active marker.
MKBW	Default value
MKPT	Step size
MKPX	Step size
OL?	Storage of instrument settings: 80 characters are returned as information on the instrument settings. The contents of the 80 characters returned does not correspond to the original data contents of the 8566A/8568A family.
OL	Readout of instrument settings: The 80 characters read by means of OL? are accepted as information on the corresponding instrument settings. The contents of the 80 characters read does not correspond to the original data contents of the 8566A/8568A family.
RB	Default value, range, step size
RL	Default value, step size

Command	Known Differences
RLPOS	Adapts the position of the reference level even if the tracking generator normalization is not active.
RQS	Supported bits:

1. (Units key pressed)

2. (End of Sweep)

3. (Device error)

4. (Command complete)

5. (Illegal command)

SRCNORM	Requires option R&S FSV-B9 or R&S FSV-B10
SRCPWR	Requires option R&S FSV-B9 or R&S FSV-B10
SP	Default value, range, step size
SS	Default value, range, step size
ST	Default value, range, step size
STB	The status bits are mapped as described with command RQS. **Note**: Bit 2 and 4 are always set in parallel if "Command Complete" or "End of Sweep" are recognized. The analyzer cannot distinguish between these conditions. Additionally these bits are not suitable for synchronization on the end of sweep in continuous sweep operation.
TA	Output of 1001 trace points of trace A in O1 or O3 format.
TB	Output of 1001 trace points of trace B in O1 or O3 format.
TH	Default value
VB	Range
VBR	Default value

4.2.5.5 Model-Dependent Default Settings

If the GPIB language is switched over to an 85xx model, the GPIB address is automatically switched over to 18 provided that the default address of the analyzer (20) is still set. If a different value is set, this value is maintained. Upon return to SCPI, this address remains unchanged.

The following table shows the default settings obtained after a change of the GPIB language and for the commands IP, KST and RESET:

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8566A/B	1001	2 GHz	22 GHz	0 dBm	AC
8568A/B	1001	0 Hz	1.5 GHz	0 dBm	AC

Model	# of Trace Points	Start Freq.	Stop Freq.	Ref Level	Input Coupling
8560E	601	0 Hz	2.9 GHz	0 dBm	AC
8561E	601	0 Hz	6.5 GHz	0 dBm	AC
8562E	601	0 Hz	13.2 GHz	0 dBm	AC
8563E	601	0 Hz	26.5 GHz	0 dBm	AC
8564E	601	0 Hz	40 GHz	0 dBm	AC
8565E	601	0 Hz	50 GHz	0 dBm	AC
8594E	401	0 Hz	3 GHz	0 dBm	AC

Stop frequency

The stop frequency given in the table may be limited to the corresponding frequency range of the analyzer.

Command LF sets the stop frequency for 8566A/B to a maximum value of 2 GHz.

Test points (trace points)

The number of trace points is switched over only upon transition to the REMOTE state.

4.2.5.6 Data Output Formats

In the case of the SCPI and IEEE488.2 standards, the output formats for numerical data are flexible to a large extent. The output format for the HP units, by contrast, is accurately defined with respect to the number of digits. The memory areas for reading instrument data have therefore been adapted accordingly in the remote-control programs for instruments of this series.

Therefore, in response to a query, the analyzer returns data of the same structure as that used by the original instruments; this applies in particular to the number of characters returned.

Two formats are currently supported when trace data is output: Display Units (command O1) and physical values (command O2, O3 or TDF P). As to the "Display Units" format, the level data of the analyzer is converted to match the value range and the resolution of the 8566/8568 series. Upon transition to the **REMOTE** state, the analyzer is reconfigured such that the number of test points (trace points) corresponds to that of the 85xx families (1001 for 8566A/B and 8568A/B, 601 for 8560E to 8565E, 401 for 8594E).

4.2.5.7 Trace Data Output Formats

All formats are supported for trace data output: display units (command O1), display units in two byte binary data (command O2 or TDF B and MDS W), display units in one byte binary data (command O4 or TDF B and MDS B) and physical values (commands O3 or TDF P). With format "display units" the level data is converted into value range and resolution of the 8566/8568 models. On transition to REMOTE state the number of trace

points are reconfigured in order to be conform to the selected instrument model (1001 for 8566A/B and 8568 A/B, 601 for 8560E to 8565E, 401 for 8594E).

4.2.5.8   Trace Data Input Formats

Trace data input is only supported for binary date (TDF B, TDF A, TDF I, MDS W, MDS B).

4.2.5.9   GPIB Status Reporting

The assignment of status bits by commands R1, R2, R3, R4, RQS is supported.

The STB command and the serial poll respond with an 8-bit value with the following assignment:

Bit enabled by RQS	
0	not used (value 0)
1	Units key pressed
2	End of Sweep
3	Device Error
4	Command Complete
5	Illegal Command
6	Service Request
7	not used (value 0)

Bits 0 and 7 are not used and always have the value 0.

Please note that the analyzer reports any key pressed on the front panel rather than only the unit keys if bit 1 was enabled.

Another difference is the behavior of bit 6 when using the STB? query. On the HP analyzers this bit monitors the state of the SRQ line on the bus. On the analyzer this is not possible. Therefore this bit is set, as soon as one of the bits 1 to 5 is set. It won't be reset by performing a serial poll.

4.3   Remote Control – Programming Examples

In this chapter, more complex programming examples are given. In the Quick Start Guide, basic steps in remote control programming are provided.

The following programming examples have a hierarchical structure, i.e. subsequent examples are based on previous ones. It is thus possible to compile an operational program from the modules of the given examples very easily. VISUAL BASIC has been used as programming language. However, the programs can be translated into other languages.

In programming languages as C, C++ or programs as MATLAB, NI Interactive Control, a backslash starts an escape sequence (e.g. "\n" is used to start a new line). In these programming languages and programs, two backslashes instead of one must be used in remote commands (for an example refer to the Quick Start Guide.)

4.3.1 Service Request

The service request routine requires an extended initialization of the instrument in which the relevant bits of the transition and enable registers are set. In addition the service request event must be enabled in the VISA session.

4.3.1.1 Initiate Service Request

```
REM ---- Example of initialization of the SRQ in the case of errors -------
PUBLIC SUB SetupSRQ()
CALL InstrWrite (analyzer, "*CLS") 'Reset status reporting system
CALL InstrWrite (analyzer, "*SRE 168") 'Enable service request for
'STAT:OPER, STAT:QUES and ESR
'register
CALL InstrWrite (analyzer, "*ESE 60") 'Set event enable bit for
'command, execution, device-
'dependent and query error
CALL InstrWrite (analyzer, "STAT:OPER:ENAB 32767")
'Set OPERation enable bit for
'all events
CALL InstrWrite (analyzer, "STAT:OPER:PTR 32767")
'Set appropriate OPERation
'Ptransition bits
CALL InstrWrite (analyzer, "STAT:QUES:ENAB 32767")
'Set questionable enable bits
'for all events
CALL InstrWrite (analyzer, "STAT:QUES:PTR 32767")
'Set appropriate questionable
'Ptransition bits
CALL viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, 0)
'Enable the event for service
'request
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, SRQWaitTimeout, VI_NULL, VI_NULL)
IF (status = VI_SUCCESS) THEN CALL Srq
'If SRQ is recognized =>
'subroutine for evaluation
END SUB
REM ************************************************************************
```

4.3.1.2   Waiting for the Arrival of a Service Request

There are basically two methods of waiting for the arrival of a service request:

Blocking (user inputs not possible):

This method is appropriate if the waiting time until the event to be signaled by an SRQ is short (shorter than the selected timeout), if no response to user inputs is required during the waiting time, and if – as the main criterion – the event is absolutely certain to occur.

Reason:

From the time the viWaitOnEvent() function is called until the occurrence of the expected event, it does not allow the program to respond to mouse clicks or key entries during the waiting time. Moreover, it returns an error if the SRQ event does not occur within the predefined timeout period.

The method is, therefore, in many cases not suitable for waiting for measurement results, especially when using triggered measurements.

The following function calls are required:

```
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, SRQWaitTimeout, VI_NULL, VI_NULL)
'Wait for service request user
'inputs are not possible during
'the waiting time!
IF (status = VI_SUCCESS) THEN CALL Srq
'If SRQ is recognized =>
'subroutine for evaluation
```

Non-blocking (user inputs possible):

This method is recommended if the waiting time until the event to be signaled by an SRQ is long (longer than the selected timeout), and user inputs should be possible during the waiting time, or if the event is not certain to occur. This method is, therefore, the preferable choice for waiting for the end of measurements, i.e. the output of results, especially in the case of triggered measurements.

The method necessitates a waiting loop that checks the status of the SRQ line at regular intervals and returns control to the operating system during the time the expected event has not yet occurred. In this way, the system can respond to user inputs (mouse clicks, key entries) during the waiting time.

It is advisable to employ the Hold() auxiliary function, which returns control to the operating system for a selectable waiting time (see section Waiting Without Blocking the Keyboard and Mouse), so enabling user inputs during the waiting time.

```
result% = 0
For i = 1 To 10 'Abort after max. 10 loop
'iterations
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_TMO_IMMEDIATE, VI_NULL, VI_NULL)
'Check event queue
If (status = VI_SUCCESS) Then
result% = 1
CALL Srq 'If SRQ is recognized =>
```

```
'subroutine for evaluation
Else
CALL Hold(20) 'Call hold function with
'20 ms 'waiting time. User inputs
'are possible.
Endif
Next i
If result% = 0 Then
Debug.Print "Timeout Error; Program aborted"'Output error message
STOP 'Stop software
Endif
```

4.3.1.3 Waiting Without Blocking the Keyboard and Mouse

A frequent problem with remote control programs using Visual Basic is to insert waiting times without blocking the keyboard and the mouse.

If the program is to respond to user inputs also during a waiting time, control over the program events during this time must be returned to the operating system. In Visual Basic, this is done by calling the DoEvents function. This function causes keyboard-or mouse-triggered events to be executed by the associated elements. For example, it allows the operation of buttons and input fields while the user waits for an instrument setting to be completed.

The following programming example describes the Hold() function, which returns control to the operating system for the period of the waiting time selectable in milliseconds.

```
Rem ************************************************************************
Rem The waiting function below expects the transfer of the desired
Rem waiting time in milliseconds. The keyboard and the mouse remain
Rem operative during the waiting period, thus allowing desired elements
Rem to be controlled
Rem ************************************************************************
Public Sub Hold(delayTime As Single)
Start = Timer 'Save timer count on calling the
'function
Do While Timer < Start + delayTime/1000 'Check timer count
DoEvents 'Return control to operating
'system to enable control of
'desired elements as long as
'timer has not elapsed
Loop
End Sub
Rem ************************************************************************
```

The waiting procedure is activated simply by calling Hold(<Waiting time in milliseconds>).

4.3.1.4 Service Request Routine

A service request is processed in the service request routine.

The variables userN% and userM% must be pre-assigned usefully!

```
REM ------------ Service request routine ---------------------------------
Public SUB Srq()
ON ERROR GOTO noDevice 'No user existing
CALL viReadSTB(analyzer, STB%) 'Serial poll, read status byte
IF STB% > 0 THEN 'This instrument has bits set in
'the STB
SRQFOUND% = 1
IF (STB% AND 16) > 0 THEN CALL Outputqueue
IF (STB% AND 4) > 0 THEN CALL ErrorQueueHandler
IF (STB% AND 8) > 0 THEN CALL Questionablestatus
IF (STB% AND 128) > 0 THEN CALL Operationstatus
IF (STB% AND 32) > 0 THEN CALL Esrread
END IF
noDevice:
END SUB 'End of SRQ routine
REM **********************************************************************
```

Reading out the status event registers, the output buffer and the error/event queue is effected in subroutines.

4.3.1.5 Reading Out the Output Buffer

```
REM -------- Subroutine for the individual STB bits ----------------------
Public SUB Outputqueue() 'Reading the output buffer
result$ = SPACE$(100) 'Make space for response
CALL InstrRead(analyzer, result$)
Debug.Print "Contents of Output Queue:"; result$
END SUB
REM **********************************************************************
```

4.3.1.6 Reading Error Messages

```
REM -------- Subroutine for reading the error queue ----------------------
Public SUB ErrorQueueHandler()
ERROR$ = SPACE$(100) 'Make space for error variable
CALL InstrWrite (analyzer, "SYSTEM:ERROR?")
CALL InstrRead(analyzer, ERROR$)
Debug.Print "Error Description:"; ERROR$
END SUB
REM **********************************************************************
```

4.3.1.7 Evaluation of SCPI Status Registers

```
REM ------ Subroutine for evaluating Questionable Status Register ---------
Public SUB Questionablestatus()
```

```
Ques$ = SPACE$(20)
'Preallocate blanks to text
'variable
CALL InstrWrite (analyzer, "STATus:QUEStionable:EVENt?")
CALL InstrRead(analyzer, Ques$)
Debug.Print "Questionable Status:"; Ques$
END SUB
REM ***********************************************************************
REM ------ Subroutine for evaluating Operation Status Register ------------
Public SUB Operationstatus()
Oper$ = SPACE$(20) 'Preallocate blanks to text
'variable
CALL InstrWrite (analyzer, "STATus:OPERation:EVENt?")
CALL InstrRead(analyzer, Oper$)
Debug.Print "Operation Status:"; Oper$
END SUB
REM ***********************************************************************
```

4.3.1.8   Evaluation of Event Status Register

```
REM ------ Subroutine for evaluating the Event Status Register ------------
Public SUB Esrread()
Esr$ = SPACE$(20) 'Preallocate blanks to text
'variable
CALL InstrWrite (analyzer, "*ESR?") 'Read ESR
CALL InstrRead(analyzer, Esr$)
IF (VAL(Esr$) AND 1) > 0 THEN Debug.Print "Operation complete"
IF (VAL(Esr$) AND 2) > 0 THEN Debug.Print "Request Control"
IF (VAL(Esr$) AND 4) > 0
THEN Debug.Print "Query Error"
IF (VAL(Esr$) AND 8) > 0
THEN Debug.Print "Device dependent error"
IF (VAL(Esr$) AND 16) > 0
THEN Debug.Print "Execution Error; Program aborted"'Output error message
STOP 'Stop software
END IF
IF (VAL(Esr$) AND 32) > 0
THEN Debug.Print "Command Error; Program aborted"'Output error message
STOP 'Stop software
END IF
IF (VAL(Esr$) AND 64) > 0 THEN Debug.Print "User request"
IF (VAL(Esr$) AND 128) > 0 THEN Debug.Print "Power on"END SUB
REM ***********************************************************************
```

4.3.2 Using Marker and Delta Marker

4.3.2.1 Shape Factor Measurement (using n dB down)

The n-dB-down function of the analyzer is used twice to determine the shape factor of a filter (ratio of bandwidths at 60 dB and 3 dB below the filter maximum).

The following example is again based on a signal with a level of -30 dBm at 100 MHz. The shape factor is determined for the 30 kHz resolution bandwidth. The default setting of the analyzer is used for measurements (SetupInstrument).

```
REM ************************************************************************
Public Sub ShapeFactor()
result$ = Space$(100)
'--------- R&S FSV default setting --------------------------------------
CALL SetupInstrument 'Default setting
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
'--------- Set frequency -----------------------------------------------
CALL InstrWrite (analyzer, "FREQ:SPAN 1 MHz")
'Span
CALL InstrWrite (analyzer, "BAND:RES 30 kHz")
'Resolution bandwidth
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
'--------- Measure 60 dB value -----------------------------------------
CALL InstrWrite (analyzer, "CALC:MARK:PEXC 6 DB")
'Peak excursion
CALL InstrWrite (analyzer, "CALC:MARK:STAT ON")
'Marker1 on
CALL InstrWrite (analyzer, "CALC:MARK:TRAC 1")
'Assign marker1 to trace1
CALL InstrWrite (analyzer, "CALC:MARK:MAX") 'Set marker1 to 100 MHz
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:NDBD 45 dB")
'Read out bandwidth measured at
'45 dB
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:NDBD:RES?")
CALL InstrRead(analyzer, result$)
result60 = Val(result$)
'--------- Measure 3 dB down value--------------------------------------
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:NDBD 3 dB")
'Read out bandwidth measured at
'3 dB
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:NDBD:RES?")
CALL InstrRead(analyzer, result$)
result3 = Val(result$)
'--------- Read out shape factor----------------------------------------
Print "Shapefaktor 60 dB/3 dB:";result60/result3
END SUB
REM ************************************************************************
```

4.3.2.2 Measuring the Third Order Intercept Point

The third order intercept point (TOI) is the (virtual) level of two adjacent useful signals at which the intermodulation products of third order have the same level as the useful signals.

The intermodulation product at f_{S2} is obtained by mixing the first harmonic of the useful signal P_{N2} with signal P_{N1}, the intermodulation product at f_{S1} by mixing the first harmonic of the useful signal P_{N1} with signal P_{N2}.

$f_{s1} = 2 \times f_{n1} - f_{n2}$ (1)

$f_{s2} = 2 \times f_{n2} - f_{n1}$ (2)

The following example is based on two adjacent signals with a level of -30 dBm at 100 MHz and 110 MHz. The intermodulation products lie at 90 MHz and 120 MHz according to the above formula. The frequency is set so that the examined mixture products are displayed in the diagram. Otherwise, the default setting of the analyzer is used for measurements (SetupInstrument).

```
REM ***********************************************************************
Public Sub TOI()
result$ = Space$(100)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Set status registers
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
CALL InstrWrite (analyzer, "SYST:DISP:UPD ON")
'ON: display on'OFF: off
'--------- Set frequency ------------------------------------------------
CALL InstrWrite (analyzer, "FREQ:STARt 85 MHz;STOP 125 MHz")
'Span
'--------- Set level ----------------------------------------------------
CALL InstrWrite (analyzer, "DISP:WIND:TRAC:Y:RLEV -20 dBm")
'Reference level
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
'--------- TOI measurement ----------------------------------------------
CALL InstrWrite (analyzer, "CALC:MARK:PEXC 6 DB")
'Peak excursion
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:TOI ON")
'Switch on TOI measurement
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:TOI:RES?")
'and read out results
CALL InstrRead(analyzer, result$)
'--------- Read out result ----------------------------------------------
Print "TOI [dBm]:";result$
END SUB
REM ***********************************************************************
```

4.3.2.3   Measuring the AM Modulation Depth

The example below is based on an AM-modulated signal at 100 MHz with the following characteristics:

Carrier signal level	-30 dBm
AF frequency	100 kHz
Modulation depth	50 %

The default setting of the analyzer for measurements can be used for the measurements described below (SetupInstrument).

```
REM ************************************************************************
Public Sub AMMod()
result$ = Space$(100)
CALL SetupInstrument 'Default setting
CALL InstrWrite (analyzer, "BAND:RES 30 kHz") 'Set appropriate RBW
'--------- Peak search ----------------------------------------------------
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:MARK:PEXC 6 DB")
'Peak excursion
CALL InstrWrite (analyzer, "CALC:MARK:STAT ON")
'Marker 1 on
CALL InstrWrite (analyzer, "CALC:MARK:TRAC 1")
'Assign marker1 to trace1
'--------- Measure modulation depth ---------------------------------------
CALL InstrWrite (analyzer, "CALC:MARK:MAX;FUNC:MDEP ON")
'Marker to Peak;
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:MDEP:RES?")
'Measure mod. depth
CALL InstrRead(analyzer, result$) 'Read out result
'--------- Read out result ------------------------------------------------
Print "AM Mod Depth [%]:";result$
END SUB
REM ************************************************************************
```

4.3.3   Limit Lines and Limit Test

The example below shows the definition and use of a new limit line 5 for trace 1 with the following characteristics:

- Upper limit line
- Absolute x-axis in the frequency range
- 7 reference values:
  - 120 MHz/-70 dB,
  - 126 MHz/-40 dB,
  - 127 MHz/-40 dB,

- – 128 MHz/-10 dB,
    - – 129 MHz/-40 dB,
    - – 130 MHz/-40 dB,
    - – 136 MHz/-70 dB
- Relative y-axis with unit dB
- Absolute threshold at –75 dBm
- No margin

The signal of the integrated calibration source (128 MHz, -30 dBm) is used to check the limit test.

```
REM ************************************************************************
Public Sub LimitLine()
result$ = Space$(100)
'--------- R&S FSV default setting -------------------------------------
CALL SetupInstrument 'Default setting
CALL InstrWrite (analyzer, "FREQUENCY:CENTER 128 MHz;Span 10 MHz")
'Span
CALL InstrWrite (analyzer, "Diag:Serv:Inp Cal;CSO -30 dBm")
'Cal signal on
'--------- Definition of limit lines -----------------------------------
CALL InstrWrite (analyzer, "CALC:LIM5:NAME 'TEST1'")
'Define name
CALL InstrWrite (analyzer, "CALC:LIM5:COMM 'Upper limit'")
'Define comment
CALL InstrWrite (analyzer, "CALC:LIM5:TRAC 1")
'Assign trace
CALL InstrWrite (analyzer, "CALC:LIM5:CONT:DOM FREQ")
'Define x-axis range
CALL InstrWrite (analyzer, "CALC:LIM5:CONT:MODE ABS")
'Define x-axis scaling
CALL InstrWrite (analyzer, "CALC:LIM5:UNIT DB")
'Define y-axis unit
CALL InstrWrite (analyzer, "CALC:LIM5:UPP:MODE REL")
'Define y-axis scaling
'--------- Definition of data points and threshold ---------------------
xlimit$ = "CALC:LIM5:CONT 120 MHZ,126 MHZ,127 MHZ,128 MHZ,129 MHZ,130 MHZ,136 MHZ"
CALL InstrWrite (analyzer, xlimit$) 'Set values for x-axis
CALL InstrWrite (analyzer, "CALC:LIM5:UPP -70,-40,-40,-20,-40,-40,-70")
'Set values for y-axis
CALL InstrWrite (analyzer, "CALC:LIM5:UPP:THR -75 DBM")
'Set y threshold (only
'possible for relative
'y-axis)
'--------- Definition of margin or x/y offset---------------------------
'A margin or an x/y offset can be defined here.
'----------- Activate and evaluate the limit line -------------
CALL InstrWrite (analyzer, "CALC:LIM5:UPP:STAT ON")
'Activate line 5
```

```
CALL InstrWrite (analyzer, "CALC:LIM5:STAT ON")
'Activate limit check
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:LIM5:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$) 'Result: 1 (= FAIL)
'--------- Read out result -------------------------------------------
Print "Limit Result Line 5: ";result$
'------ Evaluate limit line by means of status register -------
CALL InstrWrite (analyzer, "*CLS") 'Reset status register
'--------- Measure ---------------------------------------------------
CALL InstrWrite (analyzer, "INIT;*OPC") 'Perform sweep with sync
CALL viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, 0)
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, SRQWaitTimeout, VI_NULL, VI_NULL)
IF (status = VI_SUCCESS) THEN CALL Srq 'If SRQ is recognized =>
'subroutine for evaluation
'--------- Read out result -------------------------------------------
IF (status% = 1) THEN
CALL InstrWrite (analyzer, "STAT:QUES:LIM1:COND?")
'Read out STAT:QUES:LIMit
'register
CALL InstrRead(analyzer, result$)
IF ((Val(result$) And 16) <> 0) THEN
Print "Limit5 failed"ELSE
Print "Limit5 passed"END IF
END IF
END SUB
REM ************************************************************************
```

4.3.4 Measuring the Channel and Adjacent Channel Power

In the following example, the channel and adjacent channel power is first measured on a signal with a level of 0 dBm at 800 MHz to IS95. Then the channel and adjacent channel power is measured on a GSM signal at 935.2 MHz with fast ACP measurement (FAST ACP).

In addition, the limit test is activated.

```
REM ************************************************************************
Public Sub ACP()
result$ = Space$(100)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Set status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
CALL InstrWrite (analyzer, "SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'--------- Set frequency -------------------------------------------------
CALL InstrWrite (analyzer, "FREQ:CENT 800 MHz")
```

```
'Set frequency
'--------- Set level ---------------------------------------------------
CALL InstrWrite (analyzer, "DISP:WIND:TRAC:Y:RLEV 10 dBm")
'Reference level
'--------- Example 1: Configure CP/ACP for CDMA-----------------------------
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:SEL ACP")
'ACP measurement on
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:PRES F8CDMA")
'Select CDMA800 FWD
CALL InstrWrite (analyzer, "SENS:POW:ACH:ACP 2")
'Select 2 adjacent channels
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES ACP")
'Optimize settings
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES:RLEV")
'Optimize reference level
CALL InstrWrite (analyzer, "SENS:POW:ACH:MODE ABS")
'Absolute measurement
CALL InstrWrite (analyzer, "SENS:POW:HSP ON")
'Fast ACP measurement
'--------- Perform measurement and query results ------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:RES? ACP")
 'Query result CALL InstrRead(analyzer, result$)
'--------- Read out result ------------------------------------------------
Print "Result (CP, ACP low, ACP up, Alt low, Alt up):"Print result$
'--------- Example 2: Configure CP/ACP manually for GSM--------------------
result$ = Space$(100)
CALL InstrWrite (analyzer, "FREQ:CENT 935.2 MHz")
'Set frequency
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:SEL ACP")
'ACP measurement on
CALL InstrWrite (analyzer, "SENS:POW:ACH:ACP 1")
'1 adjacent channel
CALL InstrWrite (analyzer, "SENS:POW:ACH:BAND 200 KHZ")
'Channel bandw. 200 kHz
CALL InstrWrite (analyzer, "SENS:POW:ACH:BAND:ACH 200 KHZ")
'Adjacent channel band-
'width 200 kHz
CALL InstrWrite (analyzer, "SENS:POW:ACH:SPAC 200 KHZ")
'Channel spacing 200 kHz
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES ACP")
'Optimize settings
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES:RLEV")
'Optimize reference level
CALL InstrWrite (analyzer, "SENS:POW:ACH:MODE ABS")
'Absolute measurement
'--------- Start measurement and query result -----------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:RES? ACP")
'Query result
```

```
CALL InstrRead(analyzer, result$)
'--------- Read out result ------------------------------------------------
Print "Result (CP, ACP low, ACP up):"Print result$
'--------- Active limit check ----------------------------------------------
result$ = Space$(100)
CALL InstrWrite (analyzer, "CALC:LIM:ACP:ACH 30 DB, 30 DB")
'Set relative limit
CALL InstrWrite (analyzer, "CALC:LIM:ACP:ACH:ABS -35 DBM,-35 DBM")
'Set absolute limit
CALL InstrWrite (analyzer, "CALC:LIM:ACP:ACH:STAT ON")
'Rel. limit check on
CALL InstrWrite (analyzer, "CALC:LIM:ACP:ACH:ABS:STAT ON")
'Abs. limit check on
CALL InstrWrite (analyzer, "CALC:LIM:ACP ON")
'Limit check on
'--------- Start measurement and query result -----------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:LIM:ACP:ACH:RES?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
'--------- Read out result ------------------------------------------------
Print "Result Limit Check:";result$
END SUB
REM ************************************************************************
```

Example of channel/adjacent-channel power measurement

`POW:ACH:ACP 3`

Sets the number of adjacent/alternate channels to 3.

`POW:ACH:BAND 30 KHZ`

Sets the bandwidth of the transmission channel to 30 kHz.

`POW:ACH:BAND:ACH 40 KHZ`

Sets the bandwidth of each adjacent channel to 40 kHz.

`POW:ACH:BAND:ALT1 50 KHZ`

Sets the bandwidth of each alternate channel to 50 kHz.

`POW:ACH:BAND:ALT2 60 KHZ`

Sets the bandwidth of alternate channel 2 to 60 kHz.

`POW:ACH:SPAC 30 KHZ`

Sets the spacing between the transmission channel and the adjacent channel to 30 kHz, the spacing between the transmission channel and alternate channel 1 to 60 kHz, and the spacing between the transmission channel and alternate channel 2 to 90 kHz.

`POW:ACH:SPAC:ALT1 100 KHZ`

Sets the spacing between the alternate adjacent channels and the TX channel. For details refer to [SENSe:]POWer:ACHannel:SPACing:ALTernate<channel> on page 640.

```
POW:ACH:SPAC:ALT2 140 KHZ
```

Sets the spacing between the transmission channel and alternate channel 2 to 140 kHz.

```
POW:ACH:MODE ABS
```

Switches on absolute power measurement.

```
CALC:MARK:FUNC:POW:SEL ACP
```

Switches on the adjacent-channel power measurement.

```
INIT:CONT OFF
```

Switches over to single sweep mode.

```
INIT;*WAI
```

Starts a sweep and waits for the end of the sweep.

```
CALC:MARK:FUNC:POW:RES? ACP
```

Queries the result of adjacent-channel power measurement.

```
POW:ACH:REF:AUTO ONCE
```

Defines the measured channel power as the reference value for relative power measurements.

If the channel power only is to be measured, all commands relating to adjacent/alternate channel bandwidth and channel spacings are omitted. The number of adjacent/alternate channels is set to 0 with [SENSe:]POWer:ACHannel:ACPairs on page 633.

4.3.5 Occupied Bandwidth Measurement

In the following example, the bandwidth is to be found in which 95 % of the power of a GSM signal is contained. Signal frequency is 935.2 MHz; channel bandwidth is 200 kHz.

```
REM ***********************************************************************
Public Sub OBW()
result$ = Space$(100)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Set status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
CALL InstrWrite (analyzer, "SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'--------- Configure R&S FSV for OBW for GSM----------------------------
CALL InstrWrite (analyzer, "FREQ:CENT 935.2 MHz")
'Set frequency
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:SEL OBW")
'OBW measurement on
```

```
CALL InstrWrite (analyzer, "SENS:POW:ACH:BAND 200 KHZ")
'Channel bandw. 200 kHz
CALL InstrWrite (analyzer, "SENS:POW:BWID 95PCT")
'Percentage of power
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES OBW")
'Set frequency and optimize reference level
CALL InstrWrite (analyzer, "SENS:POW:ACH:PRES:RLEV")
CALL InstrWrite (analyzer, "SENS:POW:NCOR OFF")
'Noise correction
'OFF: switch off
'ON: switch on
'--------- Perform measurement and query results --------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:POW:RES? OBW")
'Query result
CALL InstrRead(analyzer, result$)
Print result$
END SUB
REM ************************************************************************
```

4.3.6 Time Domain Power Measurement

In the following example, the mean carrier power of a signal with 300 kHz bandwidth at 100 MHz is to be determined. In addition, the peak power, the rms value and the standard deviation are measured. To do this, the time-domain-power measurement functions are used.

```
REM ************************************************************************
Public Sub TimeDomainPower()
result$ = Space$(100)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Set status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep
CALL InstrWrite (analyzer, "SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'--------- Configure R&S FSV for time domain power measurement ------------
CALL InstrWrite (analyzer, "FREQ:CENT 100 MHz;SPAN 0Hz")
'Set frequency
CALL InstrWrite (analyzer, "BAND:RES 300 kHz")
'Resolution bandwidth
CALL InstrWrite (analyzer, "SWE:TIME 200US") 'Sweep time
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:SUMM:PPE ON")
'Peak measurement on
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:SUMM:MEAN ON")
'Mean measurement on
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:SUMM:RMS ON")
'RMS measurement on
```

```
CALL InstrWrite (analyzer, "CALC:MARK:FUNC:SUMM:SDEV ON")
'Standard deviation on
'------------------ Perform measurement and query results ----------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
'Query results:
query$ = "CALC:MARK:FUNC:SUMM:PPE:RES?;" 'Peak measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:MEAN:RES?;"'Mean measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:RMS:RES?;"'RMS measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:SDEV:RES?"'Standard deviation
CALL InstrWrite (analyzer, query$)
CALL InstrRead(analyzer, result$)
Print result$
END SUB
REM ***********************************************************************
```

4.3.7 Fast Power Measurement on Power Ramps

A frequent task in mobile radio tests is measurement of a DUT at various power control levels at the highest possible speed. The analyzer offers two test functions for this task, which can be used depending on the signal characteristics.

In the following, the two methods are presented by means of two examples.

4.3.7.1 Power Measurement with Multi-Summary Marker

The multi-summary marker function is suitable for measuring the power of a sequence of pulses with the following characteristics:

● The pulses occur at identical time intervals, which is typical of GSM transmission in slots, for example.

● The level of the first signal is reliably above threshold.

● The subsequent pulses may have any levels.

● The function uses the first pulse as a trigger signal. The power of the subsequent pulses is determined exclusively via the timing pattern selected for the pulse sequence. The function is, therefore, suitable for adjustments where the DUT output power varies considerably and is not reliably above the trigger threshold.

● The measurement accuracy is determined by the ratio of pulse duration to total measurement time; this should not be below 1:50.

● The function always uses TRACE 1.
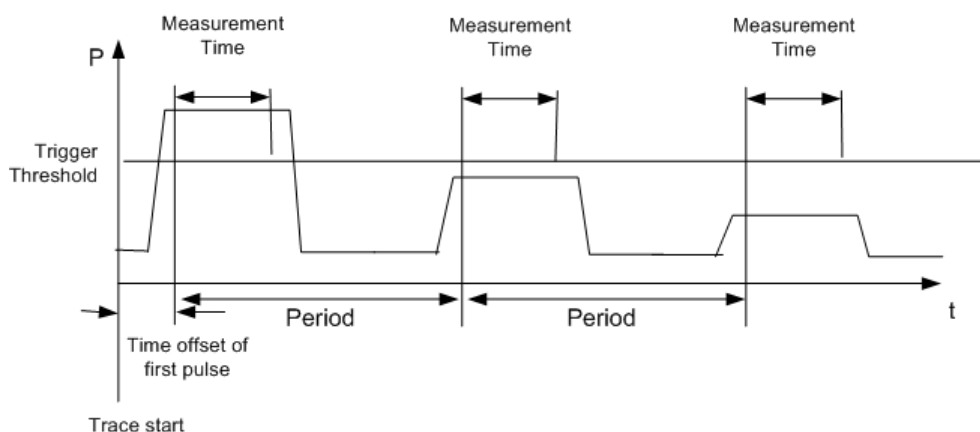
Fig. 4-5: Block diagram illustrating signal processing in analyzer

In the example below, a GSM pulse sequence of 8 pulses is measured with an offset of 50 μs of the first pulse, 450 μs measurement time/pulse and 576.9 μs pulse period.

```
REM ***********************************************************************
Public Sub MultiSumMarker()
result$ = Space$(200)
'--------- R&S FSV default setting-------------------------------------
CALL SetupStatusReg 'Configure status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite (analyzer, "SYST:DISP:UPD ON")
'ON: switch display on
'OFF: switch display off
'--------- Configure R&S FSV for power measurement in time domain ---------
CALL InstrWrite (analyzer, "FREQ:CENT 935.2 MHz;SPAN 0Hz")
'Frequency setting
CALL InstrWrite (analyzer, "DISP:WIND:TRAC:Y:RLEV 10 dBm")
'Set reference level to 10 dB
CALL InstrWrite (analyzer, "INP:ATT 30 dB") 'Set input attenuation to 30 dB
CALL InstrWrite (analyzer, "BAND:RES 1 MHz;VID 3 MHz")
'Bandwidth setting
CALL InstrWrite (analyzer, "DET RMS") 'Select RMS detector
CALL InstrWrite (analyzer, "TRIG:SOUR VID") 'Trigger source: video
CALL InstrWrite (analyzer, "TRIG:LEV:VID 50 PCT")
'Trigger threshold: 50 %
CALL InstrWrite (analyzer, "SWE:TIME 50ms") 'Sweep time ≥ 1 frame
'--------- Perform measurement and query results ------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep with sync
'Query results:
cmd$ = "CALC:MARK:FUNC:MSUM?"cmd$ = cmd$ + "50US," 'Offset of first pulse
cmd$ = cmd$ + "450US," 'Measurement time
cmd$ = cmd$ + "576.9US," 'Pulse period
cmd$ = cmd$ + "8" 'Number of bursts
CALL InstrWrite (analyzer, cmd$)
CALL InstrRead(analyzer, result$) 'Read results
Print result$
```

```
END SUB
REM ************************************************************************
```

4.3.7.2 Multi-Burst Power Measurement

The multi-burst power measurement function is suitable for measuring the power of a sequence of pulses with the following characteristics:

● The pulses occur at variable time intervals.

● The levels of all pulses of the sequence are reliably above the trigger threshold, or an external trigger signal is used.

● The function requires one trigger event per pulse. This means that if the video trigger or the IF power trigger is used, the levels of all pulses must be above the trigger threshold.

● The function is, therefore, particularly suitable for re-measuring DUTs already adjusted and whose output power is within the specified range. The measurement is optimized for minimum overhead relative to the actual measurement time.
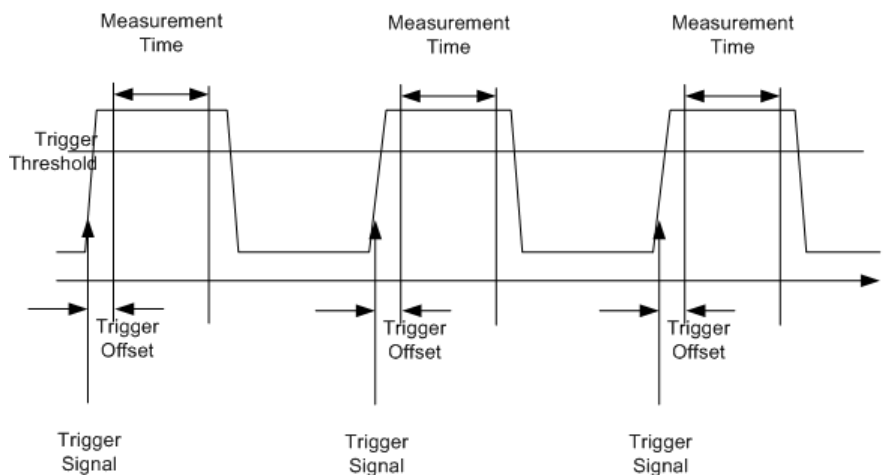
Fig. 4-6: Block diagram illustrating signal processing in analyzer

Either the root-mean-square power or the peak power is measured, depending on whether the RMS detector or the PEAK detector is selected. The function always uses TRACE 1.

The following parameters are to be set for this measurement:

● Analyzer frequency

● Resolution bandwidth

● Measurement time per single pulse

● Trigger source

● Trigger threshold

● Trigger offset

● Type of power measurement (PEAK, MEAN)

● Number of pulses to be measured

During the measurement, each pulse is mapped into a pixel of the screen, i.e. any change of the trace can be detected only at the left-hand edge of the screen. Maximum measurement speed is as usual achieved with the display switched off.

In the example below, a GSM pulse sequence of 8 pulses is measured with 5 μs trigger offset, 434 μs measurement time/pulse, video trigger with 50 % trigger threshold, and peak detection:

```
REM ************************************************************************
Public Sub MultiBurstPower()
result$ = Space$(200)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Configure status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite (analyzer, "SYST:DISP:UPD OFF")
'OFF: display off
'--------- Perform measurement and query results --------------------
cmd$ = "MPOW? "cmd$ = cmd$ + "935.2 MHZ," 'Center frequency
cmd$ = cmd$ + "1 MHZ," 'Resolution bandwidth
cmd$ = cmd$ + "434US," 'Measurement time
cmd$ = cmd$ + "VID," 'Trigger source
cmd$ = cmd$ + "50PCT," 'Trigger threshold
cmd$ = cmd$ + "1US," 'Trigger offset
cmd$ = cmd$ + "PEAK," 'Peak detector
cmd$ = cmd$ + "8" 'Number of bursts
CALL InstrWrite (analyzer, cmd$)
CALL InstrRead(analyzer, result$) 'Read results
Print result$
END SUB
REM ************************************************************************
```

4.3.8 Fast Level Measurement Using Frequency Lists

A typical task for the analyzer is power measurement at a number of frequency points, e.g. at multiples of the fundamental (harmonics measurement), or at frequencies defined by a mobile radio standard (e.g. spectrum due to transients at ± 200 kHz, ± 400 kHz, etc about the carrier frequency of a GSM signal). In many cases, different level and/or bandwidth settings are required for the different frequency points to match the channel spacing and meet the requirements of dynamic range.

Especially for this application, the analyzer offers a number of remote-control functions (commands available in SENSe:LIST subsystem) that allow level measurement based on a frequency list with different instrument settings assigned to different frequencies. Not only the frequency list can be programmed, but also the measurement types (PEAK, RMS, AVG) to be performed simultaneously can be selected.

The example below describes a harmonics measurement on a dual-band amplifier. The harmonics level in general decreases as the frequency increases. To boost measurement sensitivity, therefore, the reference level is lowered by 10 dB from the third harmonic.

The following settings are used:

Reference level:	10.00 dBm up to first harmonic, 0 dBm from 2nd harmonic
RF attenuation:	20 dB
Electronic attenuation:	0 dB (OFF)
Filter type:	NORMal
RBW:	1 MHz
VBW:	3 MHz
Measurement time:	300 μs
Trigger delay:	100 μs
Trigger:	video, 45 %

Frequency	Type
935.2 MHz	GSM 900 fundamental
1805.2 MHz	GSM 1800 fundamental
1870.4 MHz	GSM 900 2nd harmonic
2805.6 MHz	GSM 900 3rd harmonic
3610.4 MHz	GSM 1800 2nd harmonic
3740.8 MHz	GSM 900 4th harmonic
5815.6 MHz	GSM 1800 3rd Harmonic

The frequencies are selected in ascending order to minimize system-inherent waiting times resulting from frequency changes.

At each frequency point the peak power and the rms power are measured. The peak power and the rms power values are stored alternately in the results memory.

```
REM ***********************************************************************
Public Sub FrequencyList()
result$ = Space$(500)
'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg 'Configure status register
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite (analyzer, "SYST:DISP:UPD OFF") 'Display off
'---------Configure R&S FSV for power measurement based on frequency list -
CALL InstrWrite (analyzer, "TRIG:LEV:IFP -20 dBm")
'Set IF power trigger level
CALL InstrWrite (analyzer, "LIST:POWer:SET ON,ON,OFF,IFP,POS,100us,0")
'--------- Perform measurement and query results -------------------------
cmd$ = "LIST:POWer?"cmd$ = cmd$ + "935.2 MHZ, 10 dBm, 20 dB,OFF,NORM,1 MHz,3 MHz,300 us, 0, "
cmd$ = cmd$ + "1805.2 MHZ, 10 dBm, 20 dB,OFF,NORM,1 MHz,3 MHz,300 us, 0, "
cmd$ = cmd$ + "1870.4 MHZ, 10 dBm, 20 dB,OFF,NORM,1 MHz,3 MHz,300 us, 0, "
```

```
cmd$ = cmd$ + "2805.6 MHZ, 0 dBm, 20 dB,OFF,NORM,1 MHz,3 MHz,300 us, 0, "
cmd$ = cmd$ + "3610.4 MHz, 10 dBm,20 dB,OFF,NORM,1 MHz,3 MHz,300 us, 0, "
cmd$ = cmd$ + "3740.8 MHz, 0 dBm, 20 dB, OFF, NORM, 1 MHz,3 MHz,300 us, 0, "
cmd$ = cmd$ + "5815.6 MHz, 0 dBm, 20 dB, OFF, NORM, 1 MHz, 3 MHz, 300 us, 0"
CALL InstrWrite (analyzer, cmd$)
CALL InstrRead(analyzer, result$)
Print result$
END SUB
REM ************************************************************************
```

4.3.9 Level Correction of Transducers

In more complex test systems, the frequency response of the test setup must be taken into account in all power measurements to avoid any measurement errors being introduced from sources other than the DUT.

The analyzer offers the possibility of defining a frequency-dependent attenuation correction factor (transducer factor).

In the example below, a factor with the following characteristics is defined:

Name:	Transtest
Unit:	dB
Scaling:	lin
Comment:	simulated cable correction
Frequency	Level
10 MHz	0 dB
100 MHz	3 dB
1 GHz	7 dB
3 GHz	10 dB

The factor is defined and can be activated as required.

```
REM ************************************************************************
Public Sub TransducerFactor()
'--------- Define transducer factor -------------------------------------
CALL InstrWrite (analyzer, "CORR:TRAN:SEL 'TRANSTEST'")
'Define "Transtest"'transducer factor
CALL InstrWrite (analyzer, "CORR:TRAN:UNIT 'DB'")
'Unit 'dB'
CALL InstrWrite (analyzer, "CORR:TRAN:SCAL LIN")
'Linear frequency-axis
CALL InstrWrite (analyzer, "CORR:TRAN:COMM 'Simulated cable correction'")
cmd$ = "CORR:TRAN:DATA" 'Enter frequency and level
cmd$ = cmd$ + "10 MHz, 0," 'values. Level values without
cmd$ = cmd$ + "100 MHz, 3," 'unit!
cmd$ = cmd$ + "1GHz, 7,"cmd$ = cmd$ + "3GHz, 10"
```

```
CALL InstrWrite (analyzer,cmd$) 'Enter frequency and level values
'--------- Activate transducer -------------------------------------
CALL InstrWrite (analyzer, "CORR:TRAN:STAT ON")
'Activate transducer factor
END SUB
REM ***********************************************************************
```

4.3.10 Measuring the Magnitude and Phase of a Signal

Due to the analyzer's internal architecture, it is capable of measuring and outputting the magnitude and phase of a signal in addition to its power values. This opens up a variety of possibilities for more in-depth analysis (FFT, demodulation, etc).

I/Q data is stored in memory areas each containing 512 k words. Hardware triggering controls the memory.

The following example shows the steps necessary to collect data at a predefined sampling rate and read it from the I/Q memory.

1. Data is output in the form of voltage values referred to the analyzer input. Data can be read in binary or ASCII format.

   - In binary format, the length information carried in the message header is evaluated and used for calculating the x-axis values.
   - In ASCII format, only a list of voltage values is output.

2. Binary data is read in three steps:

3. The number of digits carrying the length information is read.

4. The length information itself is read.

5. The trace data is read.

This procedure is necessary with programming languages like Visual Basic which support only structures of identical data types (arrays), whereas the binary data format uses different data types in the header and the data section.

> The arrays for measured data are dimensioned in such a way that they can accommodate the I/Q data of the analyzer (2 × 512 k).

```
REM ***********************************************************************
Public Sub ReadIQData()
'--------- Create variables -------------------------------------------
Dim IData(131072) As Single 'Buffer for floating-point
'I data (= 512*1024 bytes)
Dim QData(131072) As Single 'Buffer for floating-point
'Q data (= 512*1024 bytes)
'Note:
'Visual Basic cannot read in
'data volumes larger than
```

```
'512 k words!
Dim digits As Byte 'No. of digits as length
Dim IQBytes As Long 'Length of trace data in bytes
Dim IQValues As Long 'No. of meas. values in buffer
Dim retCount As Integer 'Return count from read
asciiResult$ = Space$(6553600) 'Buffer for ASCII I/Q data
'(= 25*2*1024 bytes)
result$ = Space$(100) 'Buffer for simple results
'--------- Default setting -------------------------------------
CALL SetupInstrument 'Default setting
CALL InstrWrite (analyzer, "TRAC:IQ:STAT ON")
'Activate I/Q data
'acquisition mode; must be
'done before TRAC:IQ:SET !
'Select number of test points
'(= 512 * 1024 – 512) at
'RBW 10 MHz, 'sample rate 32 MHz,
'trigger free run, pos. trigger
'edge and 0 s trigger delay.
CALL InstrWrite (analyzer, "TRAC:IQ:SET NORM,10 MHz,32 MHz,IMM,POS,0,130560")
'--------- Read-out in binary format-------------------------------------
CALL InstrWrite (analyzer, "FORMAT REAL,32")
'Set binary format
CALL InstrWrite (analyzer, "TRAC:IQ:DATA?")
'Measure + read out I/Q data
CALL viRead(analyzer, result$, 2, retCount)
'Read and store length for
digits = Val(Mid$(result$, 2, 1)) 'number of digits
result$ = Space$(100) 'Re-initialize buffer
CALL viRead(analyzer, result$, digits, retCount)
'Read and store length
IQBytes = Val(Left$(result$, digits))
IQBytes = IQBytes/2 'Divide no. per buffer in half
CALL viRead(analyzer, IData(0), IQBytes, retCount)
'Read I data in buffer
CALL viRead(analyzer, QData(0), IQBytes, retCount)
'Read Q data in buffer
CALL viRead(analyzer, result$, 1, retCount)
'Read in end character <NL>
'--------- Output of binary data as frequency/level pair -----------------
IQValues = IQBytes/4 'Single Precision = 4 Bytes
For i = 0 To IQValues – 1
Print "I-Value["; i; "] = "; IData(i)
Print "Q-Value["; i; "] = "; QData(i)
Next i
'--------- Read-out in ASCII format -------------------------------------
CALL InstrWrite (analyzer, "FORMAT ASCII") 'Set ASCII format
CALL InstrWrite (analyzer, "TRAC:IQ:DATA?")
'Re-measure and read out
'I/Q data
```

```
CALL InstrRead(analyzer, asciiResult$)
CALL InstrWrite (analyzer, "TRAC:IQ:STAT OFF")
'Stop I/Q data aquisition
'mode if no further
'measurements are to be
'done
END SUB
REM ************************************************************************
```

4.3.11   Reading and Writing Files

4.3.11.1   Reading a File from the Instrument

In the following example, the `TEST1.analyzer.DFL` file stored under `C:
\R_S\Instr\user` is read from the instrument and stored in the controller.

```
REM ************************************************************************
Public Sub ReadFile()
'--------- Generate variables ------------------------------------------
Dim digits As Byte 'Number of digits of
'length information
Dim fileBytes As Long 'Length of file with trace data
'in bytes
result$ = Space$(100) 'Buffer for simple results
'--------- Default setting of status register --------------------------
CALL SetupStatusReg 'Configure status register
'--------- Read out file -----------------------------------------------
CALL InstrWrite (analyzer, "MMEM:DATA? 'C:\R_S\Instr\user\TEST1.R&S FSV.DFL'")
'Select file
CALL ilrd(analyzer, result$, 2) 'Read and store number of
digits = Val(Mid$(result$, 2, 1)) 'digits of length information
CALL ilrd(analyzer, result$, digits) 'Read and store length
fileBytes = Val(Left$(result$, digits)) 'information
FileBuffer$ = Space$(fileBytes) 'Buffer for file
CALL ilrd(analyzer, FileBuffer, fileBytes)
'Read file into buffer
CALL ilrd(analyzer, result$, 1) 'Read terminator <NL>
'--------- Store file to controller ------------------------------------
Open "TEST1.R&S FSV.DFL" For Output As #1
Print #1, FileBuffer; '; to avoid linefeed at
'end of file
Close #1
END SUB
REM ************************************************************************
```

4.3.11.2 Creating a File on the Instrument

In the following example, the `TEST1.analyzer.DFL` file available on the controller is stored in the instrument under `C:\R_S\Instr\user\DUPLICAT.analyzer.DFL`.

```
REM ************************************************************************
Public Sub WriteFile()
'--------- Generate variables ----------------------------------------------
FileBuffer$ = Space$(100000) 'Buffer for file
Dim digits As Long 'Number of digits of
'length information
Dim fileBytes As Long 'Length of file in bytes
fileSize$ = Space$(100) 'Length of file as a string
result$ = Space$(100) 'Buffer for simple results
'--------- Default setting of status register ------------------------------
CALL SetupStatusReg 'Configure status register
'--------- Prepare the definite length block data --------------------------
fileBytes = FileLen("H:\work\vb\TEST1.R&S FSV.DFL")
'Determine length of file
fileSize$ = Str$(fileBytes)
digits = Len(fileSize$) – 1 'Determine number of digits of
fileSize$ = Right$(fileSize$, digits) 'length information
FileBuffer$ = "#" + Right$(Str$(digits), 1) + fileSize$
'Store length information in
'file buffer
'--------- Read file from controller ---------------------------------------
Open "H:\work\vb\TEST1.R&S FSV.DFL" For Binary As #1
FileBuffer$ = FileBuffer$ + Left$(Input(fileBytes, #1), fileBytes)
Close #1
'--------- Write file ------------------------------------------------------
CALL InstrWrite (analyzer, "SYST:COMM:GPIB:RTER EOI") 'Set receive
'terminator on the
'instrument
CALL InstrWrite (analyzer, "MMEM:DATA
'DUPLICAT.R&S FSV.DFL', " + FileBuffer$)
'Select file
END SUB
REM ************************************************************************
```

4.3.12 Spectrum Emission Mask Measurement

You can configure Spectrum Emission Mask measurements via XML files provided for different standards or by defining ranges and parameters. For both ways an example is given.

4.3.12.1 Using Predefined Standard Wibro

In the following example, the Spectrum Emission Mask measurement is configured using a predefined standard XML file.

```
REM ************************************************************************
'--------- General settings of the instrument ----------------------------
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Switch to single sweep
CALL InstrWrite (analyzer, ":SENSe1:SWEep:MODE ESPectrum")
'Set measurement mode
Rem After preset 3 ranges are available where the middle one is
Rem the reference range for calculating the TX power
CALL InstrWrite (analyzer, ":SENSe1:FREQuency:CENTer 2.2 GHz")
'Center frequency 2.2 GHz
CALL InstrWrite (analyzer, ":SENSe1:DETector1 RMS")
'Set RMS detector
'--------- Setting up the gated trigger ----------------------------------
CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe ON")
'Switch on the external gate mode
CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:SOURce EXTernal")
'Set enternal gate source
CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:HOLDoff 0s")
'Set delay time to 0 s
CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:LENGth 200 US")
'Set time interval
'--------- Setting the standard -------------------------------------------
CALL InstrWrite (analyzer, "SENSe1:ESPectrum:PRESet:STANdard
'WIBRO\DL\PowerClass_29_40.xml'")
'Set WiBro standard
'--------- Measuring ------------------------------------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep, wait for sweep
'end
'--------- Reading out results --------------------------------------------
CALL InstrWrite (analyzer, ":TRACe1:DATA? LIST")
'Query list results
CALL InstrWrite (analyzer, ":CALCulate:LIMit:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM ************************************************************************
```

4.3.12.2 Defining 5 Ranges with all Parameters

In the following example, the Spectrum Emission Mask measurement is configured by defining ranges and parameters.

```
REM ************************************************************************
'--------- General settings of the instrument ----------------------------
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Switch to single sweep
CALL InstrWrite (analyzer, ":SENSe1:SWEep:MODE ESPectrum")
'Set measurement mode
Rem After preset 3 ranges are available where the middle one is
Rem the reference range for calculating the TX power
CALL InstrWrite (analyzer, ":SENSe1:FREQuency:CENTer 2.2GHz")
```

```
'Center frequency 2.2 GHz
CALL InstrWrite (analyzer, ":SENSe1:DETector1 RMS")
'Set RMS detector
CALL InstrWrite (analyzer, ":TRIGger1:SEQuence:SOURce IMMediate")
'Trigger setup
'--------- Setting up the gated trigger -----------------------------------
Rem If a free run trigger is not appropriate a gated trigger can
Rem the be set up (just comment in the following lines).
Rem CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe ON")
Rem Switch on the external gate mode
Rem CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:SOURce EXTernal")
Rem Set enternal gate source
Rem CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:HOLDoff 0s")
Rem Set delay time to 0 s
Rem CALL InstrWrite (analyzer, ":SENSe1:SWEep:EGATe:LENGth 200 US")
Rem Set time interval
'--------- Setting the span ------------------------------------------------
CALL InstrWrite (analyzer, ":SENSe1:FREQuency:SPAN 8 MHZ")
'Set the span to 8 MHz
'--------- Inserting new ranges -------------------------------------------
Rem Enlarge number of ranges to 5 by adding one at the end
Rem and one at the beginnig. This ensures that the reference range
Rem remains in the middle
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:INSert AFTer")
'Insert a range after range 2
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:INSert BEFore")
'Insert a range before range 1
'--------- Defining the limit check for all ranges ------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe:LIMit:STATe AND")
'Set check for absolute and 'relative limit
'--------- Defining the reference range settings --------------------------
Rem The bandwith of the reference range limits the minimum span
Rem of the reference range definition later in the script.
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RTYPe CPOWer")
'Set power reference type
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:BWID 2 MHZ")
'Set bandwidth
'--------- Defining the settings of range 1 -------------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:FREQuency:STARt -4 MHz")
'Set the start frequency
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:FREQuency:STOP -2 MHz")
'Set the stop frequency
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:BANDwidth:RESolution 1 MHZ")
'Set the resolution bandwidth
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:FILTer:TYPE CFILter")
'Set the channel filters
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:BANDwidth:VIDeo 3 MHZ")
'Set the video bandwidth to 3 MHz
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:SWEep:TIME 20 ms")
'Set the sweep time to 20 ms
```

```
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:RLEVel 5 DBM")
'Set the reference level to 5 dBm
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:INPut:ATTenuation 20 DB")
'Set the attenuation to 20 dB
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:LIMit:ABSolute:STARt -50")
'Set an absolute limit of -50 dBm
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:LIMit:ABSolute:STOP -50")
'Set an absolute limit of -50 dBm
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:LIMit:RELative:STARt -70")
'Set a relative limit of -70 dBc
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe1:LIMit:RELative:STOP -60")
'Set a relative limit of -60 dBc
'--------- Defining the settings of range 2 ------------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:FREQuency:STARt -2 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:FREQuency:STOP -1 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:BANDwidth:RESolution
100 kHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:FILTer:TYPE NORM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:BANDwidth:VIDeo 300 kHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:SWEep:TIME 50 ms")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:RLEVel 10 DBM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:INPut:ATTenuation 30 DB")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:LIMit:ABSolute:STARt
-40")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:LIMit:RELative:STARt
-60")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:LIMit:ABSolute:STOP -40")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe2:LIMit:RELative:STOP -40")
'--------- Defining the settings of range 3 ------------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:FREQuency:STARt -1 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:FREQuency:STOP 1 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:BANDwidth:RESolution
30 kHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:FILTer:TYPE NORM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:BANDwidth:VIDeo 100 kHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:SWEep:TIME 5 ms")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:RLEVel 20 DBM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:INPut:ATTenuation 30 DB")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:LIMit:ABSolute:STARt 200")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:LIMit:ABSolute:STOP 200")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:LIMit:RELative:STARt 200")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe3:LIMit:RELative:STOP 200")
'--------- Defining the settings of range 4 ------------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:FREQuency:STARt 1 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:FREQuency:STOP 2 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:BANDwidth:RESolution
100 kHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:FILTer:TYPE NORM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:BANDwidth:VIDeo 300 kHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:SWEep:TIME 50 ms")
```

```
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:RLEVel 10 DBM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:INPut:ATTenuation 30 DB")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:LIMit:ABSolute:STARt
-40")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:LIMit:ABSolute:STOP -40")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:LIMit:RELative:STARt
-40")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe4:LIMit:RELative:STOP -60")
'--------- Defining the settings of range 5 -------------------------------
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:FREQuency:STARt 2 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:FREQuency:STOP 4 MHz")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:BANDwidth:RESolution 1 MHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:FILTer:TYPE CFILter")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:BANDwidth:VIDeo 3 MHZ")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:SWEep:TIME 20 ms")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:RLEVel 5 DBM")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:INPut:ATTenuation 20 DB")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:LIMit:ABSolute:STARt
-50")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:LIMit:ABSolute:STOP -50")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:LIMit:RELative:STARt -60")
CALL InstrWrite (analyzer, ":SENSe1:ESPectrum:RANGe5:LIMit:RELative:STOP -70")
'--------- Measuring ------------------------------------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep, wait for sweep
'end
'--------- Reading out results --------------------------------------------
CALL InstrWrite (analyzer, ":TRACe1:DATA? LIST")
'Query list results
CALL InstrWrite (analyzer, ":CALCulate:LIMit:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM ***********************************************************************
```

4.3.13 Spurious Emissions Measurement

In the following example, the Spurious Emissions measurement is configured by defining ranges and parameters.

```
REM ***********************************************************************
'--------- General settings of the instrument -----------------------------
CALL InstrWrite (analyzer, "*RST") 'Reset instrument
Rem After preset 4 ranges are available. Range settings can be questioned
Rem independent from the set measurement mode.
'--------- Deleting all ranges --------------------------------------------
Rem Delete all ranges to prepare for setting up a new measurement
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:DELete")
'Delete range 4
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:DELete")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:DELete")
```

```
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:DELete")
'--------- Defining the start frequency for all ranges --------------------
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STARt 1000000")
Rem Setting the start frequency of range 1 will create the ranges and
Rem every other range value will be set to the default value.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:FREQuency:STARt 2000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:FREQuency:STARt 3000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:FREQuency:STARt 4000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe5:FREQuency:STARt 5000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe:COUNT?")
'Queries the number of defined
'ranges
'--------- Querying the parameters of range 1 -----------------------------
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STARt?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STOP?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FILTer:TYPE?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BANDwidth:RESolution?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BANDwidth:VIDeo?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:SWEep:TIME:AUTO?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:DETector?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:RLEVel?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:INPut:ATTenuation:AUTO?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:INPut:GAIN:STATe?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BREak?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:TRANsducer?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:SWEep:TIME?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:INPut:ATTenuation?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:POINts?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STARt?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STOP?")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STATe?")
'--------- Changing into the Spurious Emissions measurement mode -----------
CALL InstrWrite (analyzer, ":SENSe1:SWEEP:MODE LIST")
Rem In continuous sweep mode, editing the ranges is not allowed.
Rem You have to stop the measurement first.
Rem In single sweep mode, you can edit the ranges at the end of the sweep.
'--------- Single sweep version -------------------------------------------
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Switch to single sweep
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STARt 500000")
'Change the start frequency
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep, wait for sweep
'end
'--------- Continuous sweep version ---------------------------------------
CALL InstrWrite (analyzer, "INIT:CONT ON") 'Switch to continuous sweep
CALL InstrWrite (analyzer, "ABORt") 'Stop the measurement
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STARt 500000")
'Change the start frequency
CALL InstrWrite (analyzer, ":INITiate1:SPURious") 'Restart the measurement
'--------- Defining the range settings in single sweep mode ---------------
CALL InstrWrite (analyzer, "INIT:CONT OFF") 'Switch to single sweep
```

```
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep, wait for sweep
'end
Rem Edit one range at a time. Make sure to edit the ranges in a correct
Rem order to prevent limit violations. Ranges cannot overlap.
Rem The best way is to start with range 1.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STARt 500000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FREQuency:STOP 550000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:FILTer:TYPE NORM")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BANDwidth:RESolution 3000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BANDwidth:VIDeo 10000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:SWEep:TIME:AUTO ON")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:DETector RMS")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:RLEVel -10")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:INPut:ATTenuation:AUTO ON")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:POINts 8001")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:INPut:GAIN:STATe OFF")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:BREak OFF")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STARt -20")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STOP -20")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STATe ON")
Rem Proceed with range 2.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:FREQuency:STARt 1000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:FREQuency:STOP 200000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:FILTer:TYPE CFILter")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:BANDwidth:RESolution 5000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:DETector POS")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:RLEVel -20")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:INPut:ATTenuation 0")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:POINts 32001")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe2:INPut:GAIN:STATe ON")
Rem Proceed with range 3.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:FREQuency:STARt 250000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:FREQuency:STOP 1000000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:FILTer:TYPE RRC")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe3:POINts 32001")
Rem Proceed with range 4.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:FREQuency:STARt 1200000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:FREQuency:STOP 4000000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:FILTer:TYPE PULSe")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe4:POINts 251")
Rem Proceed with range 5.
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe5:FREQuency:STARt 5000000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe5:FREQuency:STOP 6000000000")
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe5:POINts 7001")
'--------- Defining the limit check for all ranges -----------------------
CALL InstrWrite (analyzer, "SENSe1:LIST:RANGe1:LIMit:STATe ON")
'Activate the limit check
'--------- Setting the span to include all ranges ------------------------
CALL InstrWrite (analyzer, ":SENSe1:FREQuency:STARt 500000")
CALL InstrWrite (analyzer, ":SENSe1:FREQuency:STOP 6000000000")
```

```
'--------- Measuring ---------------------------------------------------------
CALL InstrWrite (analyzer, "INIT;*WAI") 'Perform sweep, wait for sweep
'end
'--------- Reading out results -----------------------------------------------
CALL InstrWrite (analyzer, ":TRACe1:DATA? LIST")
'Query list results
CALL InstrWrite (analyzer, ":CALCulate1:PSEarch[:IMMediate]")
'Deactivate limit line and
'just look for peaks
Rem Or set margin to 200 in order to find all peaks
CALL InstrWrite (analyzer, ":TRACe1:DATA? SPUR")
'Query just the peaks
CALL InstrWrite (analyzer, ":CALCulate:LIMit:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM ***********************************************************************
```

4.3.14 Averaging I/Q Data

The analyzer has averaging capability also for I/Q measurements, i.e. I/Q data can be averaged over several test runs. This is subject to the following conditions:

● An external trigger signal must be available for data measurement, and the trigger signal must be phase-locked to the signal measured.

● The same reference-frequency signal must be used for the DUT and the analyzer.

● Internal I/Q data averaging is supported up to 512 k I/Q samples.

If all of the above conditions are fulfilled, no phase shift will occur between consecutive test runs. Phase shift may falsify the measured average so that in extreme cases a value of 0 is obtained.

The default setting of the instrument for data measurement without averaging has to be changed as follows:

```
REM ***********************************************************************
'--------- R&S FSV default setting -------------------------------------
CALL SetupInstrument 'Default setting
CALL InstrWrite (analyzer, "TRAC:IQ:STAT ON")
'Activate I/Q data acquisition
'mode; this must be
'done before TRAC:IQ:SET!
'Select max. number of test points (= 512 * 1024) at 10 MHz RBW,
'32 MHz sampling rate, external
'trigger, pos. trigger edge and
'0 s trigger delay.
CALL InstrWrite (analyzer, "TRAC:IQ:SET NORM,10 MHz,32 MHz,EXT,POS,0,524288")
CALL InstrWrite (analyzer, "TRAC:IQ:AVER ON") 'Switch on I/Q averaging
CALL InstrWrite (analyzer, "TRAC:IQ:AVER:COUN 10") 'Set 10 test runs
'--------- Read data in binary format ----------------------------------
```

```
…
REM  ****************************************************************************
```

4.3.15 Using IQ Gating

IQ gating refers to recording IQ samples in certain time intervals – the gate areas. There are different modes to define the gate areas:

- Edge triggered recording
- Level triggered recording

For more information, see "IQ Gating" in the "Remote Commands" chapter under "Trace:IQ" subsystem.

Measurement example: Level mode

With IQ gating in level mode, the area in which the gate signal is active is recorded. In this example, the gate signal is generated by the IFP trigger. The figure 4-7 shows the signal (triggered externally) in IQ mode. The following sample program records the signal in level mode with an external trigger.
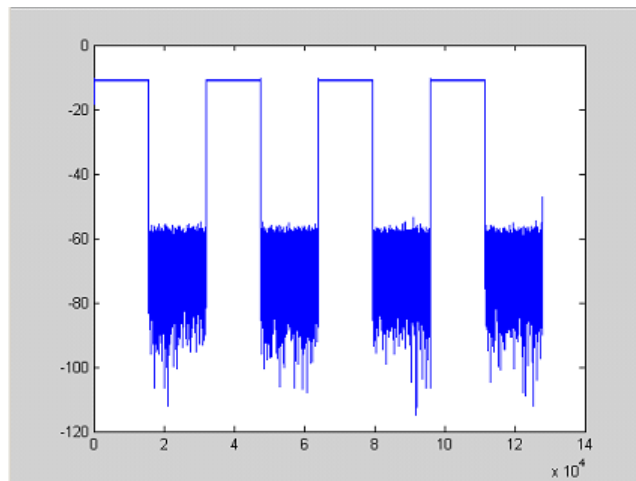
Fig. 4-7: Signal to be recorded in IQ mode

Used values

sample rate: 32 MHz

number of IQ samples: 128000

trigger mode: IFP

Program

```
:TRACe1:IQ ON

Trace:iq:set NORM,0,32000000,IFP,POS,0,128000

:TRIGger1:SEQuence:LEVel:IFPower -20
```

```
:TRACe1:IQ:EGATe ON

:TRACe1:IQ:EGATe:TYPE LEVel
```

Result

In figure 4-8, the recorded signal using IQ gating in level mode is displayed. Edges are only visible around the IFP trigger point, otherwise only the signal level is recorded.
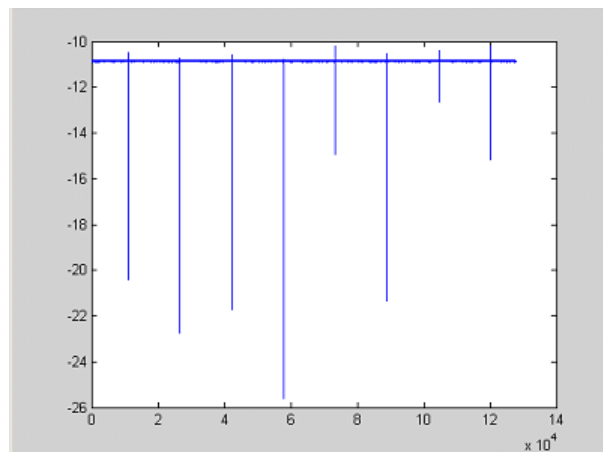
Fig. 4-8: Recorded signal using IQ gating in level mode

Measurement example: Edge mode

In edge mode, the gate area is defined by:

● delay (pretrigger samples)
● length
● number of periods
● gap between the periods

The gate starting point can be defined using an IFP or external trigger.

The figure 4-9 shows the signal to be recorded in IQ mode.
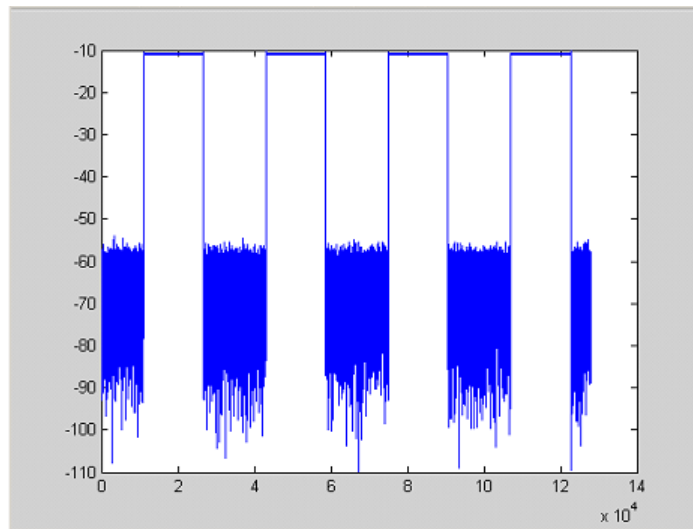
Fig. 4-9: Signal to be recorded in IQ mode

Example 1: Signal only

The following sample program records the signal in edge mode and displays only the signal, without gaps and noise.

Used values

sample rate: 32 MHz

number of IQ samples: 128000

delay = 11020 samples

length =15500 samples

trigger mode: EXT

Program

```
:TRACe1:IQ ON

Trace:iq:set NORM,0,32000000,EXT,POS, 11020,128000

:TRACe1:IQ:EGATe ON

:TRACe1:IQ:EGATe:TYPE EDGE

:TRACe1:IQ:EGATe:LENGth 15500
```

Result
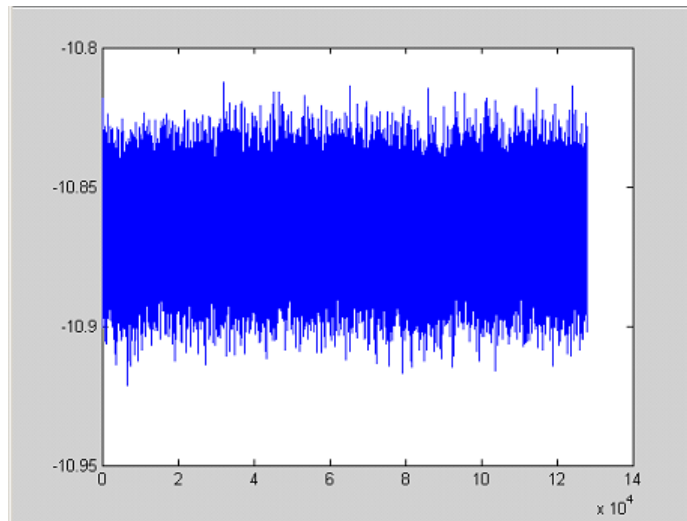
Fig. 4-10: Result: signal only (no gaps, no noise)

Example 2: Noise only

The following sample program records the signal in edge mode and displays only the noise.

Used values

sample rate: 32 MHz

number of IQ samples: 128000

delay = 0 samples

length =9000 samples

trigger mode: EXT

Program

```
:TRACe1:IQ ON

Trace:iq:set NORM,0,32000000,EXT,POS, 0,128000

:TRACe1:IQ:EGATe ON

:TRACe1:IQ:EGATe:TYPE EDGE

:TRACe1:IQ:EGATe:LENGth 9000
```

Result
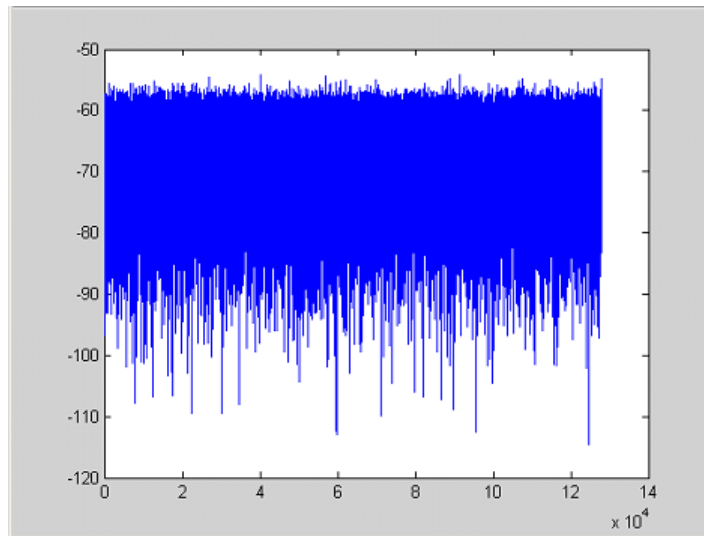
Fig. 4-11: Result: noise only

Measurement example: Periodic signal intervals in edge mode

The gate area can also be defined by a number of gate periods and the distance between two periods (gap). In this example, a power ramp is recorded, triggered by the IFP on the highest edge (see figure 4-12). As a result, only the levels of the individual ramp areas of the first 3 periods are displayed (see figure 4-13).
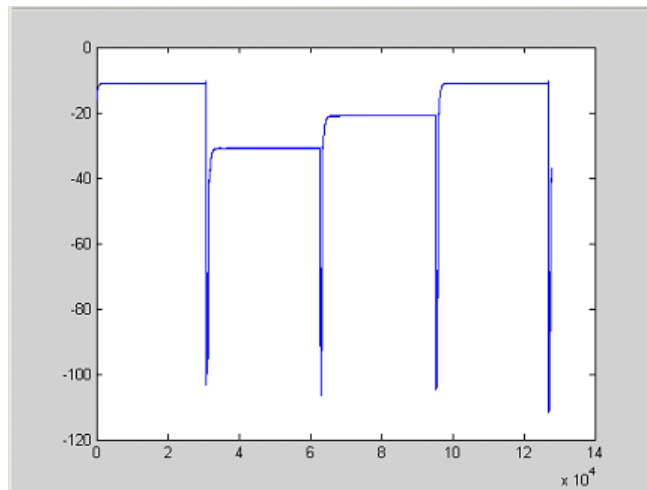
Fig. 4-12: Periodic signal recording in edge mode

Used values:

sample rate: 3,2 MHz

number of IQ samples: 228000

trigger mode: IFP

length: 28800

number of periods: 3

gap: 3800 samples

Program

```
:TRACe1:IQ ON

trace:iq:set NORM,0,3200000,IFP,POS,0,228000

:TRIGger1:SEQuence:LEVel:IFPower -20

:TRACe1:IQ:EGATe ON

:TRACe1:IQ:EGATe:TYPE EDGE

:TRACe1:IQ:EGATe:LENGth 28800

:TRACe1:IQ:EGATe:NOF 3

:TRACe1:IQ:EGATe:GAP 3800
```

Result
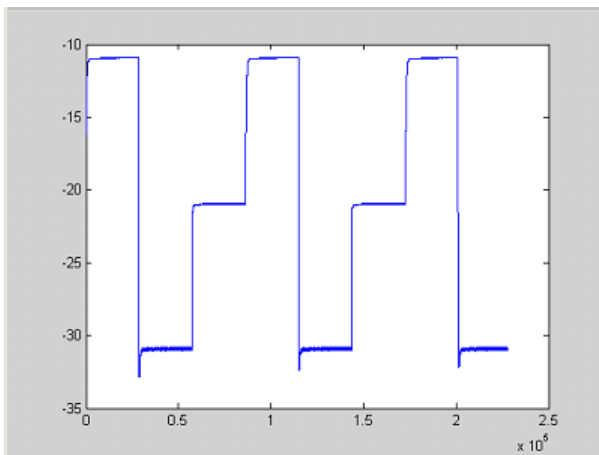
Fig. 4-13: Result: periodic power ramp levels

4.3.16   Usage of Four Spectrum Instances

As of analyzer firmware version 1.50, you can open up to four tabs for spectrum mode with the softkey "New Spectrum" in the "MODE" menu. The following remote example shows how to set up four tabs with four different measurements on a WCDMA signal.

```
REM ********************************************************************
Public Sub 4SpectrumTabs()
result$ = Space$(100)

'--------- R&S FSV default setting --------------------------------------
CALL SetupStatusReg                 'Set status registers
CALL InstrWrite(analyzer,"*RST")         'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF")    'Single sweep
```

```
'--------- Setup the first Spectrum tab (Spectrum Overview Measurement) ----
CALL InstrWrite(analyzer,"INIT:CONT OFF")    'Single sweep
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:SCAL:RLEV 10 dBm")'Reference level
CALL InstrWrite(analyzer,"FREQ:STARt 100MHz;STOP 6 GHz")    'Span

'--------- Setup the Spectrum 2 Tab (ACLR measurement) --------------------
CALL InstrWrite(analyzer,"INST:CRE SAN,'Spectrum 2'")    'Create Tab 2

'--- After creation the tab is in standard preset setup ---
CALL InstrWrite(analyzer,"INIT:CONT OFF")    'Single sweep
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:SCAL:RLEV 10 dBm")'Reference level
CALL InstrWrite(analyzer,"FREQ:CENT 2.1175GHz")        'different CF
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:SEL ACP")    'select ACLR meas
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:PRES FW3Gppcdma")
     'select WCDMA BTS standard

'--------- Setup the Spectrum 3 Tab (OBW measurement) ---------------------
CALL InstrWrite(analyzer,"INST:CRE SAN,'Spectrum 3'")    'Create Tab 3
CALL InstrWrite(analyzer,"INIT:CONT OFF")    'Single sweep
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:SCAL:RLEV 10 dBm")'Reference level
CALL InstrWrite(analyzer,"FREQ:CENT 2.1175GHz")        'different CF
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:SEL OBW")    'select OBW meas
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:PRES FW3Gppcdma")
     ' select WCDMA BTS standard
'--------- Setup the Spectrum 4 Tab (CCDF measurement) --------------------
CALL InstrWrite(analyzer,"INST:CRE SAN,'Spectrum 4'")    'Create Tab 4
CALL InstrWrite(analyzer,"INIT:CONT OFF")    'Single sweep
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:SCAL:RLEV 10 dBm")'Reference level
CALL InstrWrite(analyzer,"FREQ:CENT 2.1175GHz")        'different CF
CALL InstrWrite(analyzer," CALC:STAT:CCDF ON")        'select CCDF meas

'--------- Sweep in first Spectrum Tab and query marker -------------------
CALL InstrWrite(analyzer,"INST:SEL SAN")        'Select Tab 1
CALL InstrWrite(analyzer,"INIT;*WAI")        'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK1:MAX")        'Marker to peak
CALL InstrWrite(analyzer,"CALC:MARK1:X?")        'Query Marker x value
CALL InstrRead(analyzer,result$)
Print "Spectrum 1 Marker x  [Hz]: ";result$
CALL InstrWrite(analyzer,"CALC:MARK1:Y?")        'Query Marker y value
CALL InstrRead(analyzer,result$)
Print "Spectrum 1 Marker y [dBm]: ";result$
'--------- Sweep in Spectrum 2 Tab and query ACLR results -----------------
CALL InstrWrite(analyzer," INST:SEL 'Spectrum 2'")    'Select Tab 2
CALL InstrWrite(analyzer,"INIT;*WAI")        'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:RES? ACP")'Query ACLR results
CALL InstrRead(analyzer,result$)
Print "Spectrum 2 ACRL results  : ";result$

'--------- Sweep in Spectrum 3 Tab and query OBW results  -----------------
CALL InstrWrite(analyzer," INST:SEL 'Spectrum 3'")    'Select Tab 3
CALL InstrWrite(analyzer,"INIT;*WAI")        'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:RES? OBW")'Query OBW results
```

```
CALL InstrRead(analyzer,result$)
Print "Spectrum 3 OBW  results  : ";result$

'--------- Sweep in Spectrum 4 Tab and query CCDF results  ----------------
CALL InstrWrite(analyzer," INST:SEL 'Spectrum 4'")    'Select Tab 4
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:STAT:RES1? ALL")'Query CCDF results
CALL InstrRead(analyzer,result$)
Print "Spectrum 4 CCDF results  : ";result$
'--------- Now the sweep part can be redone without the need of ------------
'--------- doing the setup of all 4 measurements again.        .------------
END SUB
REM **********************************************************************
```

5 Maintenance

The following chapter contains information on the maintenance of the analyzer. The instrument does not need a periodic maintenance. What is necessary is essentially the cleaning of the instrument. However, it is recommended to check the rated data from time to time.

Follow the instructions in the service manual and the safety instructions when exchanging modules or ordering spares. The order no. for spare parts is included in the service manual. The service manual includes further information particularly on troubleshooting, repair, exchange of modules (including battery exchange, adjustment of the OCXO oscillator) and alignment.

The address of our support center and a list of all Rohde & Schwarz service centers can be found at the beginning of this manual.

5.1 Storing and Packing

The storage temperature range of the instrument is given in the data sheet. If the instrument is to be stored for a longer period of time, it must be protected against dust.

Repack the instrument as it was originally packed when transporting or shipping. The two protective foam plastic parts prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

5.2 List of Available Power Cables

Table 5-1: List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 006.7013.00	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 006.7036.00	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia

Stock No.	Earthed-contact connector	Preferably used in
DS 0025.2365.00	DIN 49 441, 10 A, 250 V, angular	Europe (except Switzerland)
DS 0099.1456.00	DIN 49 441, 10 A, 250 V, straight	

6 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTem:ERRor?`. The answer format of analyzer to the command is as follows:

`<error code>, "<error text with queue query>;`

`<remote control command concerned>"`

The indication of the remote control command with prefixed semicolon is optional.

`Example:`

The command "`TEST:COMMAND`" generates the following answer to the query SYS-Tem:ERRor?

`-113,"Undefined header;TEST:COMMAND"`

There are two types of error messages:

● Error messages defined by SCPI are marked by negative error codes. These messages are defined and described in the SCPI standard and not listet here.

● Device-specific error messages use positive error codes. These messages are listed below.

The right-hand column in the following tables contains the error text in bold which is entered in the error/event queue and can be read out by means of query `SYSTem:ERRor?`. A short explanation of the error cause is given. The left-hand column contains the associated error code.

Additionally, option-specific warnings and error messages displayed in the status bar are explained.

Table 6-1: Device-specific error messages

Error code	Error text in the case of queue poll Error explanation
1052	**Frontend LO is Unlocked** This message is displayed when the phase regulation of the local oscillator fails in the RF front-end.
1060	Trigger-Block Gate Delay Error- gate length < Gate Delay This message is displayed when the gate signal length is not sufficient for the pull-in delay with a predefined gate delay.
1064	**Tracking LO is Unlocked** This message is displayed when the phase regulation of the local oscillator fails on the tracking generator module.
2028	**Hardcopy not possible during measurement sequence** This message is displayed when a printout is started during scan sequences that cannot be interrupted. Such sequences are for example: ● Recording the system error correction data (alignment) ● Instrument self test In such cases synchronization to the end of the scan sequence should be performed prior to starting the printout.

Error code	Error text in the case of queue poll Error explanation
2033	**Printer Not Available** This message is displayed when the selected printer is not included in the list of available output devices. A possible cause is that the required printer driver is missing or incorrectly installed.
2034	**CPU Temperature is too high** This message is displayed when the temperature of the processor exceeds 70 °C.

List of Commands

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