

# R&S® FSV-K40

## Firmware Option Phase Noise Measurements

### Operating Manual



1173.0708.02 – 04

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

- analyzer-K40 (1310.8403.02)

This manual is applicable for the following analyzer models with firmware version 1.55:

- 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)
- R&S®FSVR 7 (1311.0006K7)
- R&S®FSVR 13 (1311.0006K13)
- R&S®FSVR 30 (1311.0006K30)

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

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

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# 1 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.





## 2 Conventions Used in the Documentation

### 2.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

### 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.



## 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.

## 4 Phase Noise Measurements Option R&S FSV-K40

Phase Noise Measurement Software R&S FSV-K40 extends the measurement capabilities of Rohde&Schwarz signal and spectrum analyzers by phase noise tests. The analyzer is ideal for this purpose because of its low inherent phase noise and noise figure. The high phase noise measurement speed is achieved through the high sweep rates of all analyzers. It is possible to trade off speed against accuracy at small resolution bandwidths ( $\leq 1$  kHz) by using either FFT or digital filters. The software allows different settings within a phase noise diagram, e.g. FFT close to the carrier and analog/digital filters far off the carrier.

This part of the documentation consists of the following chapters:

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## 4.1 Instrument Functions of Phase Noise Measurements (R&S FSV-K40)

### To open the main Phase Noise measurements menu

- If the Phase Noise mode is not the active measurement mode, press the MODE key and activate the "Phase Noise" option.
- If the Phase Noise mode is already active, press the HOME key. The main phase noise figure measurements menu is displayed.

### Menu and softkey description

In the following sections the specific softkeys available for phase noise measurements are described.

- [chapter 4.1.2, "Softkeys of the Phase Noise Menu \(R&S FSV-K40\)", on page 29](#)
- [chapter 4.1.7, "Softkeys of the Sweep Menu – SWEEP key \(R&S FSV-K40\)", on page 33](#)
- [chapter 4.1.8, "Softkeys of the Trace Menu – TRACE key \(R&S FSV-K40\)", on page 33](#)
- [chapter 4.1.11, "Softkeys of the Lines Menu – LINES key \(R&S FSV-K40\)", on page 38](#)
- [chapter 4.1.9, "Softkeys of the Marker Menu – MKR key \(R&S FSV-K40\)", on page 37](#)

- [chapter 4.1.10, "Softkeys of the Marker To Menu – MKR-> key \(R&S FSV-K40\)", on page 38](#)

The "Auto Set", "Trigger", "Meas Config", "Input/Output", and "Marker Functions" menus are not available for Phase noise measurements.

#### Further information

- [chapter 4.1.1.4, "Measurement Settings and Results Display", on page 27](#)
- [chapter 4.1.14, "Detector Overview", on page 41](#)
- [chapter 4.1.17, "Trace Mode Overview", on page 45](#)
- [chapter 4.1.15, "Selecting the Appropriate Filter Type", on page 43](#)
- [chapter 4.1.16, "List of Available RRC and Channel Filters", on page 43](#)
- [chapter 4.1.18, "ASCII File Export Format", on page 47](#)

#### Tasks

- [chapter 4.1.1.1, "Overview of General Settings", on page 16](#)
- [chapter 4.1.1.2, "Overview of Measurement Settings", on page 23](#)
- [chapter 4.1.1.3, "Running Measurements", on page 26](#)
- [chapter 4.1.12, "Working with Limit Lines", on page 39](#)
- [chapter 4.1.13, "Editing Limit Lines", on page 40](#)

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## 4.1.1 Measurements and Results

This section contains a detailed description of performing measurements and their results. It covers the following subjects:

- [chapter 4.1.1.3, "Running Measurements"](#), on page 26
- [chapter 4.1.1.4, "Measurement Settings and Results Display"](#), on page 27

### 4.1.1.1 Overview of General Settings

This section describes the "General Settings" view where all settings related to the general measurement can be modified, i.e. the signal characteristics, display settings, trace settings, residual calculation settings and spot noise settings.



When a particular parameter is selected within the "General Settings" view, the status bar changes to display information on the valid settings for the selected parameter.

---



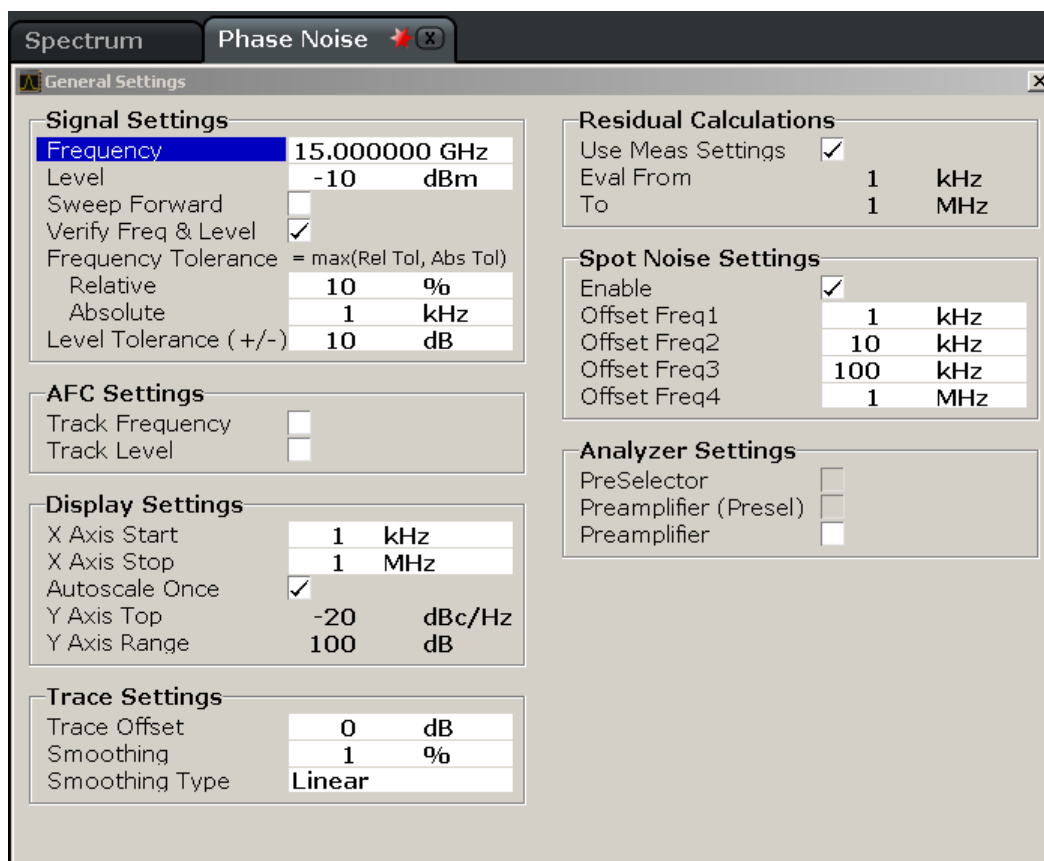


Fig. 4-1: "General Settings" view

The parameters within the "General Settings" view are logically grouped together into:

- Signal Settings.....18
  - └ Frequency.....18
  - └ Level.....18
  - └ Sweep Forward.....18
  - └ Verify Freq and Level.....18
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### Signal Settings

The "Signal Settings" are the general settings concerning the level and frequency of the signal to be measured. These settings contain the following parameters:

- "Frequency" on page 18
- "Level" on page 18
- "Sweep Forward" on page 18
- "Verify Freq and Level" on page 18
- "Frequency Tolerance" on page 19
- "Level Tolerance" on page 19

#### Frequency ← Signal Settings

Specifies the center frequency of the signal to be measured.

**Tip:** you can switch directly to this field by pressing the FREQ key.

SCPI command:

[SENSe:] FREQuency: CENTer on page 78

#### Level ← Signal Settings

Specifies the expected level of the RF input signal.

**Tip:** you can switch directly to this field by pressing the AMPT key.

[SENSe:] POWer: RLEVel on page 81

#### Sweep Forward ← Signal Settings

Determines the sweep direction for the current measurement.

"ON"           The measurement is performed from the start offset frequency to the stop offset frequency.

"OFF"           The measurement is performed from the stop offset frequency to the start offset frequency.

SCPI command:

[SENSe:] SWEEp: FORWard on page 83

#### Verify Freq and Level ← Signal Settings

Enables a search across a frequency tolerance range, for the carrier of greatest magnitude. Carrier frequency and level are measured. If the level is within a level tolerance range, the measured level overrides the specified [Level](#). Otherwise the measurement is aborted.

This should be used when the carrier frequency is not known precisely.

When "Verify Freq" is on, [Frequency Tolerance](#) and [Level Tolerance](#) parameters become enabled.

SCPI command:

[\[SENSe:\]FREQuency:VERify\[:STATe\]](#) on page 79

#### **Frequency Tolerance ← Signal Settings**

Used to verify the input signal frequency; the value used is the higher value of the specified "Relative" or "Absolute" tolerance values.

"Relative"      The "Relative Frequency Tolerance" parameter is the ratio of the sub-span's start frequency. A frequency and level check is carried out before each subsweep.

"Absolute"      The "Absolute Frequency Tolerance" is the range either side of the "Signal Frequency" within which the carrier is known to be. A frequency and level check is carried out before each subsweep.

SCPI command:

[\[SENSe:\]FREQuency:VERify:TOLerance:RELative](#) on page 80

[\[SENSe:\]FREQuency:VERify:TOLerance](#) on page 79

#### **Level Tolerance ← Signal Settings**

Offset relative to the "Level". It is used to verify the "Level" of the input signal.

"Level Tolerance" specifies the maximum and minimum deviation from the specified "Level" setting that the input signal may vary by and still pass the verification, i.e. the measured level between ("Level"+"Level\_Tolerance") and ("Level"- "Level\_Tolerance") is accepted.

SCPI command:

[\[SENSe:\]POWer:RLEVel:VERify:TOLerance](#) on page 82

#### **AFC Settings Track Frequency**

Enables or disables the signal frequency tracking mechanism during the measurement.

This parameter is only available when the ["Verify Freq and Level"](#) on page 18 parameter is enabled.

SCPI command:

[\[SENSe:\]FREQuency:TRACk](#) on page 79

#### **Track Level ← AFC Settings Track Frequency**

Enables or disables the signal level tracking mechanism during the measurement.

This parameter is only available when the ["Verify Freq and Level"](#) on page 18 parameter is enabled.

SCPI command:

[\[SENSe:\]POWer:TRACk](#) on page 82

#### **Display Settings**

The display settings configure the display of the measurement results. The settings contain the following parameters:

- ["X Axis Start"](#) on page 20
- ["X Axis Stop"](#) on page 20
- ["Autoscale Once"](#) on page 20

- ["Y Axis Top"](#) on page 20
- ["Y Axis Range"](#) on page 20

**X Axis Start ← Display Settings**

Specifies the minimum frequency for the X axis.

When "X Axis Start" changes, the "Start" parameter in the "Measurement Settings" view is updated accordingly.

SCPI command:

[\[SENSe:\] FREQuency: START](#) on page 78

**X Axis Stop ← Display Settings**

Specifies the maximum frequency for the X axis.

When "X Axis Stop" changes, the "Stop" parameter in the "Measurement Settings" view is updated accordingly.

SCPI command:

[\[SENSe:\] FREQuency: STOP](#) on page 79

**Autoscale Once ← Display Settings**

If activated, the y-axis scaling is calculated from the results.

The autoscaling is only carried out once in the first sweep. The subsequent sweeps do not autoscale the y-axis.

When "Autoscale Once" is on, "Y Axis Top" and "Range" parameters are unavailable. When it is off, the "Y Axis Top" and "Range" parameters are editable.

SCPI command:

[DISPlay\[:WINDow<n>\]: TRACe<t>: Y\[:SCALe\]: AUTO](#) on page 69

**Y Axis Top ← Display Settings**

Specifies the maximum phase noise level in the y-axis for the trace results.

SCPI command:

[DISPlay\[:WINDow<n>\]: TRACe<t>: Y\[:SCALe\]: AUTO](#) on page 69

**Y Axis Range ← Display Settings**

Specifies the distance from the top to the origin in the y-axis.

SCPI command:

[\[SENSe:\] POWer: RLEVel: VERify: TOLerance](#) on page 82

**Trace Settings**

The trace settings configure the trace and contain the following parameters:

- ["Trace Offset"](#) on page 21
- ["Smoothing"](#) on page 21
- ["Smoothing Type"](#) on page 21

If smoothing is activated using the ["Smoothing"](#) on page 35 softkey in the "Trace" menu, the trace on the screen is smoothed by the defined smoothing percentage (see ["Smoothing"](#) on page 21). Each trace (trace1, trace2 and trace3) can be smoothed and unsmoothed individually.

The smoothing algorithm used is as follows:

$$y'(s) = 10 * \text{Log}_{10} \left( \left( \sum_{x=s-\frac{n-1}{2}}^{x=s+\frac{n-1}{2}} 10^{\left(\frac{y(x)}{10}\right)} \right) \div n \right)$$

Where:

"s" = the trace sample number

"y(s)" = the phase noise at sample "s"

"x" = the sample offset from "s"

"n" = the width of the sliding window

When "x" exceeds the boundary samples, the boundary sample is used, i.e. if the trace has samples numbered 0 to 500, then with "n" = 5 and "s" = 0, the average is calculated as:

$$y'(0) = 10 * \text{Log}_{10} \left( \left( 3 * 10^{\left(\frac{y(0)}{10}\right)} + 10^{\left(\frac{y(1)}{10}\right)} + 10^{\left(\frac{y(2)}{10}\right)} \right) \div 5 \right)$$

If both trace averaging (see ["Sweep Mode Settings"](#) on page 24) and smoothing are activated, then trace smoothing is applied first, and averaging is performed on the smoothed trace.

When smoothing is applied to a trace, the original (unsmoothed) trace is still held in memory. This makes it possible to toggle between a smoothed and unsmoothed trace without the need to run a new measurement sweep.

SCPI command:

[Display\[:WINDow<n>\]:TRACe<t>:SMOothing:APERture](#) on page 68

#### Trace Offset ← Trace Settings

Defines an arithmetic reference level offset which is added to the y axis labelling.

SCPI command:

[Display\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:RLEVel:OFFSet](#) on page 72

#### Smoothing ← Trace Settings

Specifies the % of the display width to be used as a window when a trace is smoothed.

The larger the setting of the "Smoothing" parameter, the greater the smoothing effect.

SCPI command:

[Display\[:WINDow<n>\]:TRACe<t>:SMOothing:APERture](#) on page 68

#### Smoothing Type ← Trace Settings

Defines whether linear or logarithmic smoothing is to be used.

SCPI command:

[Display\[:WINDow<n>\]:TRACe<t>:SMOothing:TYPE](#) on page 69

#### Residual Calculations Use Meas Settings

Specifies whether to use the whole measurement range or the user defined evaluation range for the residual calculations.

If the "Use Meas Settings" is activated, the "Eval From" on page 22 and "To" on page 22 fields become disabled and residual calculations are performed across the complete range of the measurement results.

If the "Use Meas Settings" is deactivated, the "Eval From" on page 22 and "To" on page 22 fields become enabled. Use them to specify the range over which residual calculations are performed.

SCPI command:

`CALCulate<n>:EVALuation[:STATe]` on page 53

### Eval From

Specifies the start of the measurement range for which residual calculations are to be performed.

The minimum value that can be specified for the "Eval From" setting is the value of the "X Axis Start" on page 20 setting.

The maximum value that can be specified for the "Eval From" setting is the value of the "X Axis Stop" on page 20 setting.

When the "X Axis Start" on page 20 or "X Axis Stop" on page 20 settings are modified, the "Eval From" is automatically adjusted to ensure that it is not outside the measurement range.

The "Eval From" setting cannot be set higher than the "To" setting.

SCPI command:

`CALCulate<n>:EVALuation:START` on page 54

### To

Specifies the end of the measurement range for which residual calculations are to be performed.

The minimum value that can be specified for the "To" setting is the value of the "X Axis Start" on page 20 setting.

The maximum value that can be specified for the "To" setting is the value of the "X Axis Stop" on page 20 setting.

When the "X Axis Start" on page 20 or "X Axis Stop" on page 20 settings are modified, the "Eval From" on page 22 setting is automatically adjusted to ensure that it is not outside the measurement range.

The "To" setting cannot be set lower than the "Eval From" on page 22 setting.

SCPI command:

`CALCulate<n>:EVALuation:STOP` on page 54

### Spot Noise Settings

In spot noise settings you can specify up to 4 discrete frequency points from which the phase noise result from a measurement sweep can be obtained and displayed.

Spot noise results are updated while a sweep is running.

**Enable ← Spot Noise Settings**

Activates and deactivates spot noise calculations.

SCPI command:

[CALCulate<n>:SNOise<m>:STATe](#) on page 65

[CALCulate<n>:SNOise<m>:AOFF](#) on page 65

**Offset Freq 1,2,3,4 ← Spot Noise Settings**

In the "Offset Freq" settings you can specify up to four frequency points at which spot noise calculations are performed.

If an offset frequency is specified which is outside the measurement frequency range, no results are displayed for that offset frequency.

SCPI command:

[CALCulate<n>:SNOise<m>:X](#) on page 65

**PreSelector**

Activates or deactivates the preselector (if installed).

SCPI command:

[INPut:PRESelection\[:STATe\]](#) on page 74

**Preamplifier (Preselect)**

Activates or deactivates the preamplifier on the preselector (if installed).

SCPI command:

[INPut:GAIN:STATe](#) on page 76

**Preamplifier**

Activates or deactivates the preamplifier.

SCPI command:

[INPut:GAIN:STATe](#) on page 76

#### 4.1.1.2 Overview of Measurement Settings

This section describes the "Measurement Settings" view, in which the settings associated with measurement sweep are specified.

The "Measurement Settings" are logically grouped together into:

- "Sweep Mode Settings" on page 24
- "Span Settings" on page 25
- "Carrier Frequency Offset Table" on page 25
- "Preset Settings" on page 26

When a particular parameter is selected within the "Measurement Settings" view, the status bar changes to display information about the valid settings for the selected parameter.

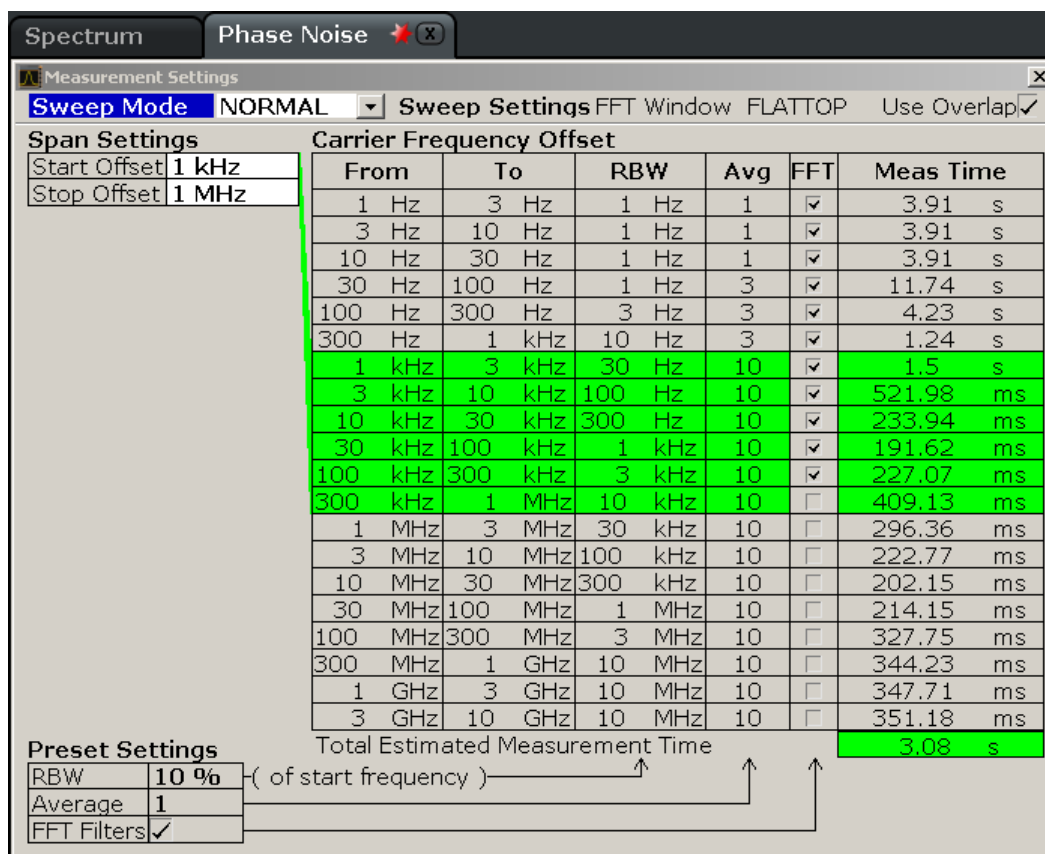


Fig. 4-2: Measurement Settings view

### Sweep Mode Settings

When the "Sweep Mode" parameter is changed, the "Carrier Frequency Offset" table is updated from the instrument's default settings.

**Tip:** You can switch directly to this field by pressing the "Sweep Mode" softkey.

In fast, normal and averaged modes, the table is not editable, it is for information only.

- "Fast" Not averaged. The measurement is very fast, as the average column is set to 1 for all sub-bands.
- "Normal" Normal averaged. The measurement is slower than the "Fast" mode, but the sub-bands are averaged more.
- "Averaged" Highly averaged. The measurement is very slow, with high average in each sub-band for more accurate results.
- "Manual" The "RBW", "Average" and "FFT" columns in the "Carrier Frequency Offset Table", as well as the "Preset Settings", can be set by the user (see ["Carrier Frequency Offset Table"](#) on page 25 and ["Preset Settings"](#) on page 26).

### Sweep Settings ← Sweep Mode Settings

The following sweep settings are displayed for information only:



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<b>Sweep type</b>	FFT, Sweep or Auto
<b>Window function</b>	Window function for FFT, e.g. "Window FLATTOP"
<b>Use overlap</b>	Overlapping FFTs

**Span Settings**

Defines the span settings of the measurement.

**Start Offset ← Span Settings**

Defines the start frequency of the measurement.

When this parameter changes, the "[X Axis Start](#)" on page 20 parameter in the "General Settings" view is updated accordingly.

The selected span for the noise measurement is highlighted in the "[Carrier Frequency Offset Table](#)" on page 25 table.

**Tip:** you can switch directly to this setting by pressing the SPAN key.

**Stop Offset ← Span Settings**

Defines the stop frequency of the measurement.

When this parameter changes, the "[X Axis Stop](#)" on page 20 parameter in the "General Settings" view is updated accordingly.

The selected span for the noise measurement is highlighted in the "[Carrier Frequency Offset Table](#)" on page 25 table.

**Carrier Frequency Offset Table**

Carrier Frequency Offset						
From	To	RBW	Avg	FFT	Meas Time	
1 Hz	3 Hz	1 Hz	1	<input checked="" type="checkbox"/>	3.91 s	
3 Hz	10 Hz	1 Hz	1	<input checked="" type="checkbox"/>	3.91 s	
10 Hz	30 Hz	1 Hz	1	<input checked="" type="checkbox"/>	3.91 s	
30 Hz	100 Hz	1 Hz	3	<input checked="" type="checkbox"/>	11.74 s	
100 Hz	300 Hz	3 Hz	3	<input checked="" type="checkbox"/>	4.23 s	
300 Hz	1 kHz	10 Hz	3	<input checked="" type="checkbox"/>	1.24 s	
1 kHz	3 kHz	30 Hz	10	<input checked="" type="checkbox"/>	1.5 s	
3 kHz	10 kHz	100 Hz	10	<input checked="" type="checkbox"/>	521.98 ms	
10 kHz	30 kHz	300 Hz	10	<input checked="" type="checkbox"/>	233.94 ms	
30 kHz	100 kHz	1 kHz	10	<input checked="" type="checkbox"/>	191.62 ms	
100 kHz	300 kHz	3 kHz	10	<input checked="" type="checkbox"/>	227.07 ms	
300 kHz	1 MHz	10 kHz	10	<input type="checkbox"/>	409.13 ms	
1 MHz	3 MHz	30 kHz	10	<input type="checkbox"/>	296.36 ms	
3 MHz	10 MHz	100 kHz	10	<input type="checkbox"/>	222.77 ms	
10 MHz	30 MHz	300 kHz	10	<input type="checkbox"/>	202.15 ms	
30 MHz	100 MHz	1 MHz	10	<input type="checkbox"/>	214.15 ms	
100 MHz	300 MHz	3 MHz	10	<input type="checkbox"/>	327.75 ms	
300 MHz	1 GHz	10 MHz	10	<input type="checkbox"/>	344.23 ms	
1 GHz	3 GHz	10 MHz	10	<input type="checkbox"/>	347.71 ms	
3 GHz	10 GHz	10 MHz	10	<input type="checkbox"/>	351.18 ms	
Total Estimated Measurement Time					3.08 s	

**Note:** Selected span highlighted in table. The selected spans for the noise measurement are highlighted in the "Carrier Frequency Offset" table.

The "RBW", "Avg" and "FFT" fields are editable in "Manual" sweep mode only. For all other sweep modes, this table is for information only.

The total measurement time for the selected sub-bands is displayed at the bottom of the table.

**From ← Carrier Frequency Offset Table**

The start frequency of each sub-band.

SCPI command:

[SENSe:] FREQuency: START on page 78

**To ← Carrier Frequency Offset Table**

The stop frequency of each sub-band.

SCPI command:

[SENSe:] FREQuency: STOP on page 79

**RBW ← Carrier Frequency Offset Table**

The resolution filter bandwidth used for each sub-band. Enter values in steps of 1/3/10.

**Tip:** you can switch directly to the first "RBW" field in the span by pressing the BW key.

**Range ← Carrier Frequency Offset Table**

0.1 % .. 30 % of the start frequency in that row.

**Average ← Carrier Frequency Offset Table**

The number of sweeps to average over for each sub-band.

**Range ← Carrier Frequency Offset Table**

1 .. 10000

**FFT ← Carrier Frequency Offset Table**

Selection to use the FFT Resolution Filter or the conventional filter for each decade.

FFT is only available for RBW values between 1 Hz and 30 kHz.

**Meas Time ← Carrier Frequency Offset Table**

The estimated measurement time for each sub-band. Note this time is for the measurement only and does not include processing time.

**Preset Settings**

The "Preset Settings" display the default values used for "RBW", "Average", "FFT" when the "Preset Settings" softkey is pressed (see "Preset Settings" on page 31). For sweep mode "MANUAL", you can edit these settings. In this case, the values in the "Carrier Frequency Offset" table are changed accordingly (see "Carrier Frequency Offset Table" on page 25).

#### 4.1.1.3 Running Measurements

To start a measurement, press the RUN SINGLE or RUN CONT key.

- "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" on page 33 softkey in the "Sweep" menu does.



If you press one of the RUN keys while a measurement is running, the measurement is aborted.

During a measurement, the text "Running..." is displayed in the status bar at the bottom of the screen. A progress bar is also displayed to show progress through the current measurement sweep. After successful completion of a single measurement, the status bar displays "Measurement Complete".

If the "Verify Freq and Level" on page 18 parameter is selected in the "General Settings" view, then R&S FSV-K40 checks if there is a signal within the specified frequency and level tolerance ranges relative to the specified signal frequency and level. If no signal is found, or a signal is found which is outside the tolerance range, then a message is displayed in the status bar ("No signals found within tolerance range") and the measurement is aborted.

While a measurement sweep is running, changing any of the settings in the "General Settings" or "Meas Settings" views causes the measurement to be aborted, apart from the following settings:

- "Verify On/Off" on page 30
- "Track Level On/Off" on page 30
- "Track Freq On/Off" on page 31
- "Preset Settings" on page 31
- "Autoscale Y Axis" on page 31
- "Ref Meas" on page 31

Once a measurement sweep has been performed, all active limit lines as well as the limit result are displayed.

#### 4.1.1.4 Measurement Settings and Results Display

The diagram header shows the general measurement settings used to obtain the current measurement results.

Settings		Residual Noise		Spot Noise [T1]	
Signal Freq	15.000000 GHz	Eval from	...	1 kHz	...
Signal Level	-10 dBm	Residual PM	...	10 kHz	...
Signal Freq Δ	...	Residual FM	...	100 kHz	...
Signal Level Δ	...	RMS Jitter	...	1 MHz	...
Top	-20 dBc/Hz	RF Atten	...		

Fig. 4-3: Diagram header with measurement settings and results

The header includes the following information:

<b>Signal Frequency</b>	The frequency of the measured input signal.
<b>Signal Level</b>	The level of the input signal

## Instrument Functions of Phase Noise Measurements (R&amp;S FSV-K40)

<b>Signal Freq <math>\Delta</math></b>	The measured frequency difference (during verification and tracking)
<b>Signal Level <math>\Delta</math></b>	The measured level difference (during verification and tracking)
<b>Top</b>	The Y-Axis top (the maximum phase noise level in the y-axis for the trace results)
<b>RF Atten</b>	The RF attenuation
<b>Eval from</b>	The frequency range for which residual noise and spot noise results are calculated. The range of the residual noise calculations is displayed in the results trace by two lines, marker EL1 and EL2.
<b>Residual PM</b>	The residual PM result over the selected evaluation range.
<b>Residual FM</b>	The residual FM result over the selected evaluation range.
<b>RMS Jitter</b>	The RMS jitter result over the selected evaluation range

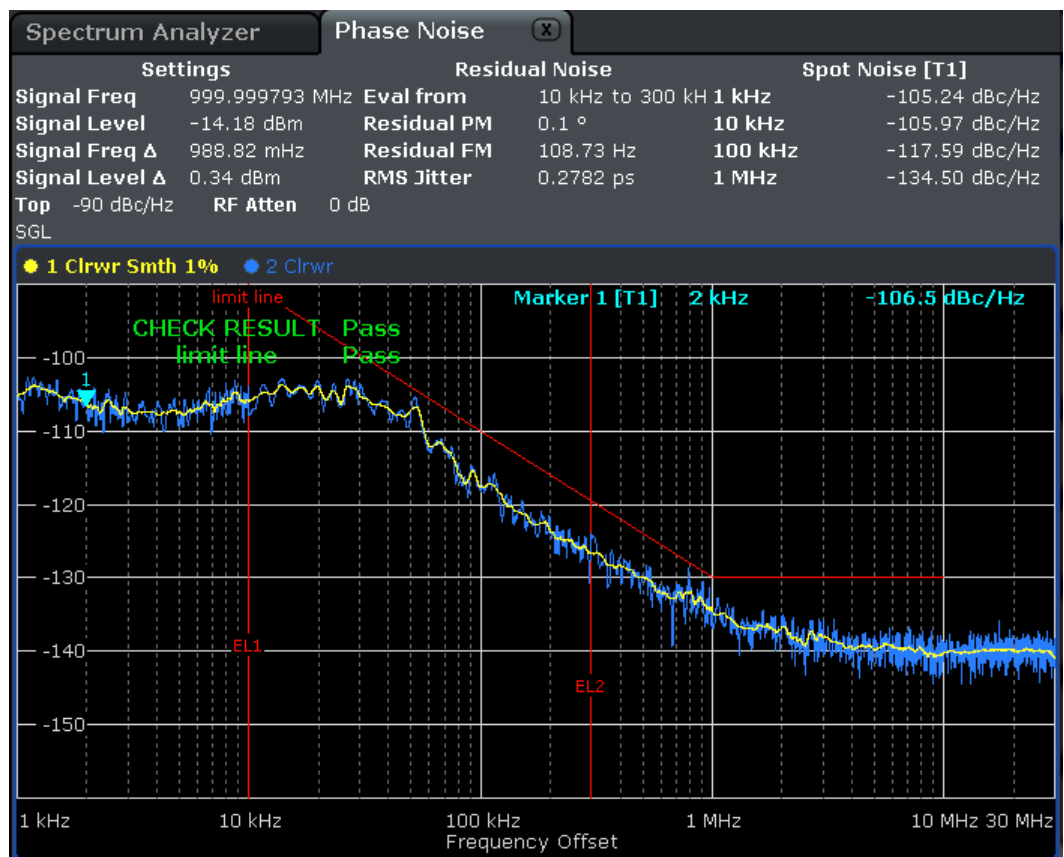


Fig. 4-4: Phase Noise Measurement Results

Note that the residual noise results are displayed at the end of a measurement sweep. If you change the range for the residual noise results in the "General Setting" view after a measurement sweep has been run, the residual noise results are automatically updated. The range of the residual noise calculations is displayed in the results trace by two lines, marker EL1 and EL2.

### 4.1.2 Softkeys of the Phase Noise Menu (R&S FSV-K40)

The following table shows all softkeys available in the "Phase Noise" menu.

General Settings.....	29
L Signal Settings.....	29
L Display Settings.....	29
L Trace Settings.....	29
L Residual Calc.....	29
L Spot Noise.....	29
L Smoothing %.....	30
Meas Settings.....	30
L Sweep Mode.....	30
L Span Start.....	30
L Span Stop.....	30
L Subspan RBW.....	30
L RBW %.....	30
L Average.....	30
L Use FFT On/Off.....	30
Verify On/Off.....	30
Track Level On/Off.....	30
Track Freq On/Off.....	31
Preset Settings.....	31
Autoscale Y Axis.....	31
Ref Meas.....	31

#### General Settings

Displays the "General Settings" view and the "General Settings" submenu. See [Overview of General Settings](#) for details.

#### Signal Settings ← General Settings

Switches to the first setting in the "Signal Settings" area of the "General Settings" view.

#### Display Settings ← General Settings

Switches to the first setting in the "Display Settings" area of the "General Settings" view. See [Overview of General Settings](#) for details.

#### Trace Settings ← General Settings

Switches to the first setting in the "Trace Settings" area of the "General Settings" view. See [Overview of General Settings](#) for details.

#### Residual Calc ← General Settings

Switches to the first setting in the "Residual Calculations" area of the "General Settings" view. See [Overview of General Settings](#) for details.

#### Spot Noise ← General Settings

Switches to the first setting in the "Spot Noise Settings" area of the "General Settings" view. See [Overview of General Settings](#) for details.

**Smoothing % ← General Settings**

Switches to the "Smoothing" setting in the "Trace Settings" area of the "General Settings" view. See [Overview of General Settings](#) for details.

**Meas Settings**

Displays the "Meas Settings" view and the "Meas Settings" submenu. See [Overview of Measurement Settings](#) for details.

**Sweep Mode ← Meas Settings**

Switches to the "Sweep Mode" setting in the "Measurement Settings" view. See [Overview of Measurement Settings](#) for details.

**Span Start ← Meas Settings**

Switches to the "Start Offset" setting in the "Span Settings" area of the "Measurement Settings" view. See [Overview of Measurement Settings](#) for details.

**Span Stop ← Meas Settings**

Switches to the "Stop Offset" setting in the "Span Settings" area of the "Measurement Settings" view. See [Overview of Measurement Settings](#) for details.

**Subspan RBW ← Meas Settings**

Switches to the first field in the "RBW" column for the subspan in the "Measurement Settings" view. This softkey is only available in sweep mode "MANUAL". See [Overview of Measurement Settings](#) for details.

**RBW % ← Meas Settings**

Switches to the "RBW" setting in the "Preset Settings" area of the "Measurement Settings" view. This softkey is only available in sweep mode "MANUAL". See [Overview of Measurement Settings](#) for details.

**Average ← Meas Settings**

Switches to the "Average" setting in the "Preset Settings" area of the "Measurement Settings" view. This softkey is only available in sweep mode "MANUAL". See [Overview of Measurement Settings](#) for details.

**Use FFT On/Off ← Meas Settings**

Switches to the "FFT Filters" setting in the "Preset Settings" area of the "Measurement Settings" view. This softkey is only available in sweep mode "MANUAL". See [Overview of Measurement Settings](#) for details.

**Verify On/Off**

toggles frequency and level verification on and off

SCPI command:

```
[SENSe:] FREQuency: VERify[:STATe]
```

**Track Level On/Off**

toggles level tracking on and off

SCPI command:

```
[SENSe:] POWer: TRACk
```

**Track Freq On/Off**

toggles frequency tracking on and off

SCPI command:

```
[SENSe:] FREQuency: TRACk
```

**Preset Settings**

Presets the option back to the default settings

**Autoscale Y Axis**

Scales the Y axis according to the trace results

SCPI command:

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

**Ref Meas**

Performs a measurement and stores the trace as a reference trace in trace 3

SCPI command:

```
CONFigure: POWer: EXPeCted: RF
```

### 4.1.3 FREQ key

This key opens the "General Settings" dialog box and jumps directly to the "Frequency" field (see "Frequency" on page 18). Furthermore, a submenu with the following softkeys is displayed:

**Frequency**

Opens the "General Settings" dialog box and jumps directly to the "Frequency" field (see "Frequency" on page 18).

SCPI command:

```
[SENSe:] FREQuency: CeNTER on page 78
```

**X Axis Start**

Opens the "General Settings" dialog box and jumps directly to the "X Axis Start" field (see "X Axis Start" on page 20).

SCPI command:

```
[SENSe:] FREQuency: STARt on page 78
```

**X Axis Stop**

Opens the "General Settings" dialog box and jumps directly to the "X Axis Stop" field (see "X Axis Stop" on page 20).

SCPI command:

```
[SENSe:] FREQuency: STOP on page 79
```

#### 4.1.4 SPAN key

This key opens the "Measurement Settings" dialog box and jumps directly to the "Start Offset" field (see ["Start Offset"](#) on page 25 ["Span Settings"](#) on page 25).

Furthermore, the "Frequency" submenu is displayed, see [chapter 4.1.3, "FREQ key"](#), on page 31.

#### 4.1.5 AMPT key

This key opens the "General Settings" dialog box and jumps directly to the "Level" field (see ["Level"](#) on page 18).

Furthermore, a submenu with the following softkeys is displayed:

##### Level

Opens the "General Settings" dialog box and jumps directly to the "Level" field (see ["Level"](#) on page 18).

SCPI command:

[\[SENSe:\]POWER:RLEVEL](#) on page 81

##### Autoscale Once

Activates or deactivates the "Autoscale Once" function (see ["Autoscale Once"](#) on page 20).

SCPI command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:AUTO](#) on page 69

##### Y Axis Top

Opens the "General Settings" dialog box and jumps directly to the "Y Axis Top" field (see ["Y Axis Top"](#) on page 20).

SCPI command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:AUTO](#) on page 69

##### Y Axis Range

Opens the "General Settings" dialog box and jumps directly to the "Y Axis Range" field (see ["Y Axis Range"](#) on page 20).

SCPI command:

[\[SENSe:\]POWER:RLEVEL:VERify:TOLerance](#) on page 82

#### 4.1.6 BW key

This key opens the "Measurement Settings" dialog box and jumps directly to the "Sweep Mode" field (see ["Sweep Mode Settings"](#) on page 24).



#### 4.1.7 Softkeys of the Sweep Menu – SWEEP key (R&S FSV-K40)

##### 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 33).

SCPI command:

INIT:CONT ON, see INITiate<n>:CONTinuous on page 75

##### 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 75

##### 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.

SCPI command:

[SENSe:] SWEEp:COUNT on page 83

#### 4.1.8 Softkeys of the Trace Menu – TRACE key (R&S FSV-K40)

The TRACE key is used to configure the data acquisition for measurement and the analysis of the measurement data. In this section, only the commands specific to the phase noise option are described. The following softkeys of the "Trace" menu are available for phase noise measurements:

Trace 1 / Trace 2 / Trace 3.....	34
L Clear Write.....	34
L Max Hold.....	34
L Min Hold.....	34
L Average.....	34
L View.....	35
L Blank.....	35
L Smoothing.....	35
Sweep Count.....	35
ASCII Trace Export.....	36
Decim Sep.....	36

Trace Math.....	36
L T1-T3->T1.....	36
L T2-T3->T2.....	36
L Trace Math Off.....	37

### Trace 1 / Trace 2 / Trace 3

Selects the active trace (1, 2, 3) and opens the "Trace" submenu for the selected trace.

### Clear Write ← Trace 1 / Trace 2 / Trace 3

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 71

### Max Hold ← Trace 1 / Trace 2 / Trace 3

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 71

### Min Hold ← Trace 1 / Trace 2 / Trace 3

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 71

### Average ← Trace 1 / Trace 2 / Trace 3

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 4.1.14, "Detector Overview"](#), on page 41).

This mode is not available for statistics measurements.

For more information see


- ["Sweep Count"](#) on page 33

SCPI command:

DISP:TRAC:MODE AVER, see [DISPlay\[:WINDow<n>\]:TRACe<t>:MODE](#) on page 71

#### **View ← Trace 1 / Trace 2 / Trace 3**

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 71

#### **Blank ← Trace 1 / Trace 2 / Trace 3**

Hides the selected trace.

SCPI command:

DISP:TRAC OFF, see [DISPlay\[:WINDow<n>\]:TRACe<t>\[:STATe\]](#) on page 71

#### **Smoothing ← Trace 1 / Trace 2 / Trace 3**

Activates or deactivates smoothing for the selected trace according to the ["Trace Settings"](#) on page 20. If activated, the trace on the screen is smoothed by the smoothing percentage (see ["Smoothing"](#) on page 21). Toggling this softkey has an immediate effect on the active trace on display. Each trace (trace1, trace2 and trace3) can be smoothed/unsmoothed individually.

For details on smoothing, see ["Trace Settings"](#) on page 20.

#### **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.

SCPI command:

[\[SENSe:\]SWEep:COUNT](#) on page 83

**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 4.1.18, "ASCII File Export Format"](#), on page 47.

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 36).

SCPI command:

[FORMat:DEXPort:DSEParator](#) on page 74

[MMEMory:STORe<n>:TRACe](#) on page 77

**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 74

**Trace Math**

Opens the "Trace Math" submenu to select a trace math function. The following functions are available:

- ["T1-T3->T1"](#) on page 36
- ["T2-T3->T2"](#) on page 36

**T1-T3->T1 ← Trace Math**

Activates/Deactivates the trace math function that subtracts Trace3 from Trace1 and copies the results into Trace1.

To switch off the trace math, use the [Trace Math Off](#) softkey.

SCPI command:

[CALCulate<n>:MATH\[:EXpression\]\[:DEFine\]](#) on page 66

[CALCulate<n>:MATH:STATe](#) on page 67

**T2-T3->T2 ← Trace Math**

Activates/Deactivates the trace math function that subtracts Trace3 from Trace2 and copies the results into Trace2.

To switch off the trace math, use the [Trace Math Off](#) softkey.

SCPI command:

[CALCulate<n>:MATH\[:EXpression\]\[:DEFine\]](#) on page 66

[CALCulate<n>:MATH:STATe](#) on page 67

**Trace Math Off ← Trace Math**

Deactivates any previously selected trace math functions.

SCPI command:

CALC:MATH:STAT OFF, see CALCulate<n>:MATH:STATe on page 67

**4.1.9 Softkeys of the Marker Menu – MKR key (R&S FSV-K40)**

The MKR key opens a submenu for the marker settings. The following table shows all softkeys available in the "Marker" menu in "Phase Noise" mode.

Marker 1/2/3/4.....	37
Marker Norm/Delta.....	37
Marker Zoom.....	37
All Marker Off.....	38

**Marker 1/2/3/4**

Selects the corresponding marker and activates it.

Marker 1 is always a normal marker. After Marker 2 to 4 have been switched on, they are delta markers that are referenced to Marker 1. These markers can be converted into markers with absolute value displays using the "Marker Norm/Delta" softkey. When Marker 1 is the active marker, pressing the "Marker Norm/Delta" softkey switches on an additional delta marker. Pressing the "Marker 1" to "Marker 4" softkey again switches the corresponding marker off.

SCPI command:

CALCulate<n>:MARKer<m>[:STATe] on page 62

CALCulate<n>:MARKer<m>:X on page 63

CALCulate<n>:MARKer<m>:Y on page 64

CALCulate<n>:DELTamarker<m>[:STATe] on page 52

CALCulate<n>:DELTamarker<m>:X on page 52

CALCulate<n>:DELTamarker<m>:Y on page 53

**Marker Norm/Delta**

Changes the active marker to a normal (norm) or delta marker (with respect to marker 1).

SCPI command:

CALCulate<n>:MARKer<m>[:STATe] on page 62

CALCulate<n>:DELTamarker<m>[:STATe] on page 52

**Marker Zoom**

Activates or deactivates the zoom for the current active marker. With the zoom function, more details of the measurement signal can be seen. This softkey can only be selected if at least one of the markers is activated.

SCPI command:

CALCulate<n>:MARKer<m>:FUNctioN:ZOOM on page 62

**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 62

**4.1.10 Softkeys of the Marker To Menu – MKR-> key (R&S FSV-K40)**

The following table shows all softkeys available in the "Marker To" menu in "Phase Noise" mode (MKR-> key).

Select Marker.....	38
Marker to Trace.....	38

**Select Marker**

Opens a submenu to select one of the markers.

**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 63

**4.1.11 Softkeys of the Lines Menu – LINES key (R&S FSV-K40)**

The LINES key is used to configure limit and display lines. The "Lines" menu and the "Select Limit Line" dialog box are displayed. For details on the "Select Limit Line" dialog box refer to [chapter 4.1.12, "Working with Limit Lines"](#), on page 39.

The following table shows all softkeys available in the "Lines" menu in Phase Noise mode (LINES key).

New.....	38
L Name.....	39
L Value.....	39
L Insert.....	39
L Delete.....	39
L Save.....	39
Edit.....	39
Delete.....	39

**New**

Displays the "Edit Limit Line" dialog box and the "Limit Line Editor" submenu. For details on creating a new limit line, see [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.

**Name ← New**

Switches to the "Name" field of the "Limit Line Editor". For details see [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.

SCPI command:

`CALCulate<n>:LIMit<k>:NAME` on page 59

**Value ← New**

Switches to the "Frequency" field of the "Limit Line Editor". For details see [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.

**Insert ← New**

Inserts a row above the currently selected row in the Frequency/Limits table of the "Limit Line Editor". For details see [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.

**Delete ← New**

Deletes the currently selected row in the Frequency/Limits table of the "Limit Line Editor". For details see [chapter 4.1.13, "Editing Limit Lines"](#), on page 40. This action requires no confirmation.

**Save ← New**

Saves the currently displayed limit line definition. If data is missing or if some data is invalid, an error message is displayed.

**Edit**

Displays the "Edit Limit Line" dialog box in edit mode with all data of the selected limit line. For further details refer to [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.

**Delete**

Deletes the selected limit line.

SCPI command:

`CALCulate<n>:LIMit<k>:DELete` on page 57

## 4.1.12 Working with Limit Lines

1. Press the LINES key.

The "Select Limit Line" dialog box is displayed. For each limit line, the following information is given:

Name	Unique ID of the limit line as defined in the "Name" field (see <a href="#">chapter 4.1.13, "Editing Limit Lines"</a> , on page 40).
Domain	Frequency or time domain
Units	Unit of the y-axis
Limit	Type of limit (for phase noise: upper)
X Scaling	Absolute or relative scaling
Y Scaling	Absolute or relative scaling

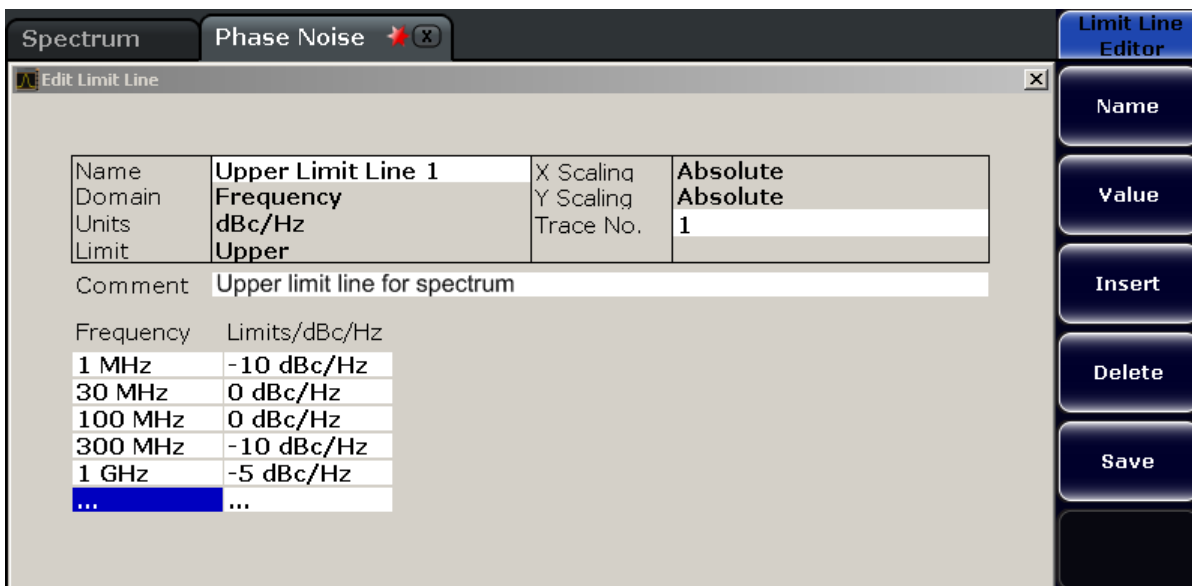
## Instrument Functions of Phase Noise Measurements (R&amp;S FSV-K40)

Trace No.	Selected trace (defined in "Trace No." field, see <a href="#">chapter 4.1.13, "Editing Limit Lines"</a> , on page 40)
Compatible	Indicates compatibility of the limit line to the current measurement settings
Check	Activates/Deactivates the limit check using the limit line for the trace. If a limit check is performed, the trace values are checked whether they exceed the limit values and the result ("Pass"/"Fail") is indicated in the display.
Comment	Optional description as defined in the "Comment" field (see <a href="#">chapter 4.1.13, "Editing Limit Lines"</a> , on page 40).

- To define a new limit line, press the "New" softkey and enter the limit line characteristics as described in [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.
- To modify a limit line, select the limit line you want to edit and press the "Edit" softkey as described in [chapter 4.1.13, "Editing Limit Lines"](#), on page 40.
- To save a limit line, press the "Save" softkey.  
If data is missing or if some data is invalid, an error message is displayed.
- To delete a limit line, select the limit line you want to edit and press the "Delete" softkey.

### 4.1.13 Editing Limit Lines

When you press the "New" softkey to define a new limit line (see "New" on page 38), or the "Edit" softkey to edit an existing limit line (see "Edit" on page 39), the "Edit Limit Line" dialog box and the "Limit Line Editor" submenu are displayed.



#### To create or edit a limit line:

- Enter the following settings as required:



<b>Name</b>	Name of the limit line to uniquely identify every limit line. Any combination of alphanumeric characters is allowed. If the entered name already exists, an error message is displayed with the request to alter the name.
<b>Trace No.</b>	Trace number for which the limit line is defined.
<b>Comment</b>	Description for the limit line. Any combination of alphanumeric characters is allowed.
<b>Frequency</b>	Receive frequencies (in Hz)
<b>Limit</b>	Limits for the receive frequencies (in dBc/Hz).

The "Frequency/Limits" table lists the limit values for specific frequency values. The list can contain up to 100 frequency/limit value pairs. Note that the frequency values must be in ascending order.

- To insert a new frequency/limit entry, press the ENTER key after entering a limit, or press the "Insert" softkey.  
To delete a frequency/limit entry, select the entry and press the "Delete" softkey.
- When you have entered all required values, press the "Save" softkey.  
If data is missing or if some data is invalid, an error message is displayed. Correct the input, if necessary.
- In the "Select Limit Line" view, define whether the limit line is to be used to perform a limit check for the trace by activating or deactivating the "Check" option for the limit line.

#### Remote commands:

[CALCulate<n>:LIMit<k>:COMMeNt](#) on page 55

Specifies a description for the limit line.

[CALCulate<n>:LIMit<k>:CONTRol\[:DATA\]](#) on page 55

Specifies the receive frequencies.

[CALCulate<n>:LIMit<k>:LOWer\[:DATA\]](#) on page 57

[CALCulate<n>:LIMit<k>:UPPer\[:DATA\]](#) on page 60

Specifies the limits for the receive frequencies.

### 4.1.14 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 4-1: 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
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 than 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.

#### 4.1.15 Selecting the Appropriate Filter Type

All resolution bandwidths are realized with digital filters.

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

The following filter types are available:

- Normal (3dB) (Gaussian) filters  
The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.
- EMI (6dB) filters  
The available bandwidths are specified in the data sheet.
- Channel filters  
For details see [chapter 4.1.16, "List of Available RRC and Channel Filters"](#), on page 43 .  
Channel filters do not support FFT mode.
- RRC filters  
For details see [chapter 4.1.16, "List of Available RRC and Channel Filters"](#), on page 43 .  
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.

#### 4.1.16 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.

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**Table 4-2: Filter types**

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

## Instrument Functions of Phase Noise Measurements (R&amp;S FSV-K40)

Filter Bandwidth	Filter Type	Application
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, $\alpha=0.22$	RRC	
4.096 MHz, $\alpha=0.22$	RRC	
5 MHz	CFILter	
20 MHz	CFILter	
28 MHz	CFILter	
40 MHz	CFILter	

#### 4.1.17 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 71

##### 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 71

### 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 71

### 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 4.1.14, "Detector Overview"](#), on page 41).

This mode is not available for statistics measurements.

For more information see


- ["Sweep Count"](#) on page 33

SCPI command:

DISP:TRAC:MODE AVER, see [DISPlay\[:WINDow<n>\]:TRACe<t>:MODE](#)  
on page 71

### 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 71

**Blank**

Hides the selected trace.

SCPI command:

DISP:TRAC OFF, see [DISPlay\[:WINDow<n>\]:TRACe<t>\[:STATe\]](#) on page 71

**4.1.18 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

**4.2 Remote Control**

This section specifies the remote control commands specific to the R&S FSV-K40 option. Only those commands provided for this option are specified.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in the base unit description.

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4.2.17	Other Commands Referenced in this Document.....	88

## 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)
ADEMODO	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 (option R&S FSV-K7S)
SPECM	Spectrogram 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 CALCulate subsystem**

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**4.2.2.1 CALCulate:DELTamarker subsystem**

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CALCulate<n>:DELTamarker<m>:TRACe.....52

CALCulate<n>:DELTamarker<m>:X.....52

CALCulate<n>:DELTamarker<m>:Y.....53

---

**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 measurement 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>[: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 DELTmarker, 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>: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.

**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>: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:

**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.

`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

#### 4.2.2.2 **CALCulate:EVALuation Subsystem**

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---

#### **CALCulate<n>:EVALuation[:STATe] <State>**

This command specifies whether residual noise values are calculated over the entire trace or within a specified frequency range.

**Suffix:**

<n> 1...4  
window

**Parameters:**

&lt;State&gt; ON (1) | OFF (0)

**ON (1)**

The residual noise values are calculated over the range specified by `CALCulate<n>:EVALuation:START` on page 54 and `CALCulate<n>:EVALuation:STOP` on page 54

**OFF (0)**

The results are calculated over the entire trace.

\*RST: 0

**Example:**

CALC:EVAL 0

Specifies that residual noise is calculated over the entire trace.

**Mode:**

PHN

**CALCulate<n>:EVALuation:START <Frequency>**

This command specifies the start frequency for residual noise calculation when `CALCulate<n>:EVALuation[:STATe]` on page 53 is switched OFF.

**Suffix:**<n> 1...4  
window**Parameters:**

&lt;Frequency&gt;

Range: 1 Hz to 3 GHz

\*RST: 1 kHz

**Example:**

CALC:EVAL:START 1MHZ

Specifies that residual noise is calculated starting from 1 MHz

**Mode:**

PHN

**CALCulate<n>:EVALuation:STOP <Frequency>**

This command specifies the stop frequency for residual noise calculation when `CALCulate<n>:EVALuation[:STATe]` on page 53 is switched ON. This command has no effect if `CALCulate<n>:EVALuation[:STATe]` on page 53 is switched OFF.

**Suffix:**<n> 1...4  
window**Parameters:**

&lt;Frequency&gt;

Range: 3 Hz to 10 GHz

\*RST: 1 MHz

**Example:**

CALC:EVAL:STOP 1 MHz

Specifies that residual noise is calculated up to 1 MHz.

**Mode:**

PHN

### 4.2.2.3 CALCulate:LIM subsystem

CALCulate<n>:LIMit<k>:CLEar[:IMMEDIATE]	55
CALCulate<n>:LIMit<k>:COMMeNt	55
CALCulate<n>:LIMit<k>:CONTRol[:DATA]	55
CALCulate<n>:LIMit<k>:CONTRol:SHIFt	56
CALCulate<n>:LIMit<k>:COpy	56
CALCulate<n>:LIMit<k>:DELeTe	57
CALCulate<n>:LIMit<k>:FAIL	57
CALCulate<n>:LIMit<k>:LOWer[:DATA]	57
CALCulate<n>:LIMit<k>:LOWer:SHIFt	58
CALCulate<n>:LIMit<k>:LOWer:STATe	58
CALCulate<n>:LIMit<k>:NAME	59
CALCulate<n>:LIMit<k>:STATe	59
CALCulate<n>:LIMit<k>:TRACe	59
CALCulate<n>:LIMit<k>:UNIT	60
CALCulate<n>:LIMit<k>:UPPer[:DATA]	60
CALCulate<n>:LIMit<k>:UPPer:SHIFt	61
CALCulate<n>:LIMit<k>:UPPer:STATe	61

---

#### 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>: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.

**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:SHIFt <XValue>**

This command moves a limit line by the indicated value in x direction. The line is shifted by modifying the individual x 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:**

<XValue> <numeric\_value>

\*RST: - (CALC:LIM is set to OFF)

**Example:** CALC:LIM2:CONT:SHIF 50 kHz

Shifts all reference values of limit line 2 by 50 kHz.

**Mode:** PHN

**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

**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

**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

**Example:** \*RST: (LIMit:STATe is set to OFF)  
`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:SHIFt <YValue>**

This command moves a limit line by the indicated value in y direction. The line is shifted by modifying the individual y 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:**

<YValue> <numeric\_value>

**Example:** \*RST: - (CALC:LIM is set to OFF)  
`CALC:LIM2:LOW:SHIF 20 dB`  
Shifts all Y-values of limit line 2 by 20 dB.

**Mode:** PHN

**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>: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 <Number>**

This command assigns a limit line to the selected trace.

**Suffix:**

<n> irrelevant

<k> 1...8  
limit line

**Parameters:**

<Number> 1...6  
Trace number

\*RST: 1

**Example:**

CALC:LIM1:TRAC 2

Assigns the limit line 1 to trace 2.

**Mode:**

PHN

**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 dB $\mu$ V.

**Mode:**

A, ADEMOD, CDMA, EVDO, PHN, TDS

**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

**Example:**

\*RST: ("CALCulate<n>:LIMit<k>" is set to OFF)

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:SHIFt <YValue>**

This command moves a limit line by the indicated value in y direction. The line is shifted by modifying the individual y 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:**

<YValue> <numeric\_value>

**Example:**

\*RST: - (CALC:LIM is set to OFF)

CALC:LIM2:UPP:SHIF 20 dB

Shifts all Y-values of limit line 2 by 20 dB.

**Mode:**

PHN

**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

**Example:**

\*RST: OFF

CALC:LIM4:UPP:STAT ON

Switches on limit line 4 (upper limit).

**Mode:**

A, ADEMOD, CDMA, EVDO, NF, PHN, TDS

#### 4.2.2.4 CALCulate:MARKer subsystem

CALCulate<n>:MARKer<m>:AOFF.....	62
CALCulate<n>:MARKer<m>:FUNcTion:ZOOM.....	62
CALCulate<n>:MARKer<m>[:STATe].....	62
CALCulate<n>:MARKer<m>:TRACe.....	63
CALCulate<n>:MARKer<m>:X.....	63
CALCulate<n>:MARKer<m>:Y.....	64

---

##### 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>:FUNcTion:ZOOM <State>

If marker zoom is activated, the number of channels displayed on the screen in code domain power and code domain error power result diagram is reduced to 64.

The currently selected marker defines the center of the displayed range.

**Suffix:**

<n> irrelevant

<m> 1...4  
marker number

**Parameters:**

<State> ON | OFF

**Example:** \*RST: OFF  
CALC:MARK:FUNC:ZOOM ON

**Mode:** CDMA, EVDO, PHN, TDS, WCDMA

---

##### 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.

<b>Suffix:</b>	
<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.
<b>Parameters:</b>	
<State>	ON   OFF
<b>Example:</b>	*RST: OFF CALC:MARK3 ON Switches on marker 3 or switches to marker mode.
<b>Mode:</b>	all

---

#### 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.

<b>Suffix:</b>	
<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.
<b>Parameters:</b>	
<Trace>	<b>1 to 6</b> Selects trace 1 through 6.
<b>Example:</b>	CALC:MARK3:TRAC 2 Assigns marker 3 to trace 2.
<b>Mode:</b>	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.

<b>Suffix:</b>	
<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
<b>Parameters:</b>	
<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>: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.

#### **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

#### **4.2.2.5 CALCulate:SNOise Subsystem**

The `CALCulate:SNOise` subsystem allows spot noise measurement points to be set, and results returned.

Note that for all spot noise commands the suffix for the `CALCulate` command must be 1.

<code>CALCulate&lt;n&gt;:SNOise&lt;m&gt;:AOFF</code> .....	65
<code>CALCulate&lt;n&gt;:SNOise&lt;m&gt;:STATe</code> .....	65
<code>CALCulate&lt;n&gt;:SNOise&lt;m&gt;:X</code> .....	65
<code>CALCulate&lt;n&gt;:SNOise&lt;m&gt;:Y</code> .....	66



**CALCulate<n>:SNOise<m>:AOFF**

Switches off all active spot noise markers in the specified measurement window.

**Suffix:**

<n> 1  
window

<m> 1...4  
spot noise marker

**Example:** CALC1:SNO:AOFF  
Switches off all spot noise markers in the screen A window.

**Mode:** PHN

**CALCulate<n>:SNOise<m>:STATe <State>**

Switches on or off the currently selected spot noise marker in the selected measurement window. If no indication is made, marker 1 is selected automatically.

**Suffix:**

<n> 1  
window

<m> 1...4  
spot noise marker

**Parameters:**

<State> ON | OFF

**Example:** \*RST: 1  
CALC1:SNO1:STATE ON  
Switches the screen A marker ON.

**Mode:** PHN

**CALCulate<n>:SNOise<m>:X <Frequency>**

Positions the selected slot noise marker to the indicated frequency

**Suffix:**

<n> 1  
window

<m> 1...4  
spot noise marker

**Parameters:**

<Frequency> <numeric value>

**Example:** CALC1:SNO:X 2MHz  
Positions spot noise marker 1 in screen A to time 2 MHz.

**Mode:** PHN

**CALCulate<n>:SNOise<m>:Y?**

Returns the measured spot noise marker result in the selected measurement window. The units for this command are dBc/Hz.

**Suffix:**

<n>	1 window
<m>	1...4 spot noise marker

**Return values:**

<Result>                    <numeric value>

**Example:**

CALC1:SNO:Y?

Outputs the measured value of spot noise marker 1 in screen A.

**Usage:**

Query only

**Mode:**

PHN

**4.2.2.6 Other CALCulate commands**

CALCulate<n>:MATH[:EXpression][:DEFine].....	66
CALCulate<n>:MATH:STATe.....	67

**CALCulate<n>:MATH[:EXpression][:DEFine] <Expression>**

This command defines the mathematical expression for relating traces to trace 1.

**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:STATe <State>**

This command switches the mathematical relation of traces on or off.

**Suffix:**

<n> irrelevant

**Parameters:**

<State> ON | OFF

**Example:**

\*RST: OFF

CALC:MATH:STAT ON

Switches on the trace mathematics.

**Mode:**

A, PHN, SPECM

### 4.2.3 CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results of the measurements are queried.

CONFigure:POWer:AUTO.....	67
CONFigure:POWer:EXPEcted:RF.....	67
CONFigure:REFMeas ONCE.....	68

**CONFigure:POWer:AUTO <State>**

Switches on or off automatic power level detection. When switched on, power level detection is performed at the start of each measurement sweep.

**Parameters:**

<State> ON | OFF

\*RST: 1

**Example:**

CONF:POW:AUTO 1

The FSV-K40 option detects the input power level automatically

**Mode:**

PHN

**CONFigure:POWer:EXPEcted:RF <InputLevel>**

Specifies the input power level of the source signal as supplied to the Analyzer RF input.

**Parameters:**

<InputLevel> <numeric value>

\*RST: 0

**Example:**

CONF:POW:EXP:RF 9

The FSV-K40 option assumes an input signal strength of 9 dBm

**Mode:**

PHN

**CONFigure:REFMeas ONCE**

Configures and initiates a reference measurement.

**Example:**                   CONF:REFM ONCE  
A reference measurement is started.

**Mode:**                    PHN

**4.2.4 DISPlay Subsystem**

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:APERture.....	68
DISPlay[:WINDow<n>]:TRACe<t>:SMOothing[:STATe].....	68
DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:TYPE.....	69
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:AUTO.....	69

**DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:APERture <Value>**

Specifies the aperture of the window to be used when trace smoothing is performed.

A single aperture applies to all traces which require smoothing.

**Suffix:**

<n>                    irrelevant

<t>                    irrelevant

**Parameters:**

<Value>               <numeric value>

\*RST:                0

**Example:**               DISP:TRAC1:SMO:APER 1  
Sets the smoothing window for trace 1 to 1 %

**Usage:**                SCPI conform

**Mode:**                PHN

**DISPlay[:WINDow<n>]:TRACe<t>:SMOothing[:STATe] <State>**

Specifies whether smoothing of a particular trace is carried out.

**Suffix:**

<n>                    irrelevant

<t>                    1...3  
trace

**Parameters:**

<State>               ON | OFF

\*RST:                OFF

**Example:**               DISP:TRAC1:SMO 1  
Specifies that smoothing of trace 1 is to be performed

**Usage:** SCPI conform  
**Mode:** PHN

---

**DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:TYPE <Type>**

Specifies whether linear or logarithmic smoothing is to be used when trace smoothing is performed.

**Suffix:**  
 <n> irrelevant  
 <t> 1...3  
 trace

**Parameters:**  
 <Type> LINear|LOGarithmic

**Example:** \*RST: LIN  
 DISP:TRAC1:SMO:TYPE LIN  
 Sets the smoothing type for trace 1

**Usage:** SCPI conform  
**Mode:** PHN

---

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO <State>**

This command switches automatic scaling for the Y axis on and off. If the "ONCE" setting is used with this command, automatic scaling is performed immediately, regardless of whether automatic scaling is switched on.

**Suffix:**  
 <n> irrelevant  
 <t> irrelevant

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

**Example:** \*RST: ON  
 DISP:WIND:TRAC:Y:SCAL:AUTO 1  
 Switches on automatic Y axis scaling

**Mode:** PHN

#### 4.2.5 FETCh Subsystem

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSE subsystems.

FETCh:PNOise:RFM.....70  
 FETCh:PNOise:RPM.....70  
 FETCh:PNOise:RMS.....70

**FETCh:PNOise:RFM?**

Returns the measured Residual FM result for the specified trace.

**Example:** FETC:PNO1:RFM?  
Returns the Residual FM result for Trace1

**Usage:** Query only

**Mode:** PHN

**FETCh:PNOise:RPM?**

Returns the measured Residual PM result for the specified trace.

**Example:** FETC:PNO2:RPM?  
Returns the Residual PM result for Trace2

**Usage:** Query only

**Mode:** PHN

**FETCh:PNOise:RMS?**

Returns the measured Residual RMS result for the specified trace.

**Example:** FETC:PNO3:RMS?  
Returns the Residual RMS result for Trace3

**Usage:** Query only

**Mode:** PHN

**4.2.6 DISPlay subsystem**

DISPlay:FORMat.....	70
DISPlay[:WINDow<n>]:TRACe<t>:MODE.....	71
DISPlay[:WINDow<n>]:TRACe<t>[:STATe].....	71
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:AUTO.....	72
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALE]:RLEVel:OFFSet.....	72
DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:APERture.....	73
DISPlay[:WINDow<n>]:TRACe<t>:SMOothing[:STATe].....	73

**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[: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.

**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 4.1.17, "Trace Mode Overview"](#), on page 45.

**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>[: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.

<b>Suffix:</b>	
<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	trace
<b>Parameters:</b>	
<State>	ON   OFF
	*RST: ON for TRACe1, OFF for TRACe2 to 6
<b>Example:</b>	DISP:TRAC3 ON
<b>Mode:</b>	all

---

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO <Mode>**

This command switches on or off automatic scaling of the Y-axis for the specified trace display. Automatic scaling sets the Y-axis to automatically scale to best fit the measurement results.

<b>Suffix:</b>	
<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	only 1 trace
<b>Parameters:</b>	
<Mode>	ON   OFF   ONCE
	<b>ON</b> Automatic scaling is on.
	<b>OFF</b> Automatic scaling is off.
	<b>ONCE</b> Automatic scaling is performed once, then switched off again.
	*RST: OFF
<b>Example:</b>	DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE Activates automatic scaling of the Y-axis for the active trace
<b>Mode:</b>	CDMA, EVDO, OFDM, OFDMA/WiBro, PHN

---

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>**

This command sets the reference level offset.

<b>Suffix:</b>	
<n>	irrelevant.
<t>	irrelevant
<b>Parameters:</b>	
<Value>	-200dB to 200dB
	*RST: 0dB
<b>Example:</b>	DISP:TRAC:Y:RLEV:OFFS -10dB
<b>Mode:</b>	ALL



**DISPlay[:WINDow<n>]:TRACe<t>:SMOothing:APERture <Value>**

This command specifies the aperture of the window to be used when trace smoothing is performed. A single aperture applies to all traces which require smoothing.

**Suffix:**

<n> irrelevant

<t> irrelevant

**Parameters:**

<Value> numeric value in percent

**Example:**

DISP:TRAC3:SMO 1

Sets the smoothing window of trace 3 to 1%.

**Mode:**

PHN

**DISPlay[:WINDow<n>]:TRACe<t>:SMOothing[:STATe] <State>**

This command specifies whether smoothing of a particular trace is carried out.

**Suffix:**

<n> irrelevant

<t> trace

**Parameters:**

<State> ON | OFF

**Example:**

\*RST: OFF

DISP:TRAC3:SMO ON

Smoothing is performed for trace 3.

**Mode:**

PHN

## 4.2.7 FORMat subsystem

[FORMat\[:DATA\]](#).....73

[FORMat:DEXPort:DSEParator](#).....74

**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.

**Parameters:**

&lt;Format&gt;            ASCII | REAL

**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

**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:**

&lt;Separator&gt;            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

## 4.2.8 INPut Subsystem

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

[INPut:PRESelection\[:STATe\]](#).....74

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

Switches the preselection on or off.

**Parameters:**

&lt;State&gt;            ON | OFF

\*RST:            OFF

**Example:**

INP:PRE:STAT ON

- preselection is switched on.

**Mode:**

PHN

The command is only available with the preselector option B2.

## 4.2.9 INITiate subsystem

INITiate<n>:CONTInuous.....	75
INITiate<n>[:IMMediate].....	75
INITiate<n>:DISPlay.....	76

---

### 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

**Example:**

```
*RST:        ON
INIT:CONT OFF
```

Switches the sequence to single sweep.

```
INIT:CONT ON
```

Switches the sequence to continuous sweep.

**Mode:**                      all

---

### 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>:DISPlay <State>**

This command configures the behaviour of the display during a single sweep.

**Suffix:**

<n> irrelevant

**Parameters:**

<State> ON | OFF

**ON**

The display is switched on during the measurement

**OFF**

The display is switched off during the measurement

**Mode:** PHN

**4.2.10 INPut subsystem**

[INPut:GAIN:STATe](#) .....76

**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

**4.2.11 INSTrument subsystem**

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

[INSTrument\[:SElect\]](#).....76

[INSTrument:NSElect](#).....77

**INSTrument[:SElect] <Mode>**

This command switches between the measurement modes by means of text parameters.

**Parameters:**

<Mode>                    **PNOise**  
Phase Noise Mode (R&S FSV-K40 option)

**INSTRument:NSElect** <Mode>

This command switches between the measurement modes by means of numbers.

**Parameters:**

<Mode>                    **20**  
Phase Noise Mode (R&S FSV-K40 option)

**4.2.12 MMEMory subsystem**

[MMEMory:STORe<n>:TRACe](#).....77

**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 4.1.18, "ASCII File Export Format"](#), on page 47

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 74).

**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

**4.2.13 SENSE subsystem**

The SENSE command is used to set and get the values of parameters in the remote instrument. The get variant of the SENSE command differs from set in that it takes no parameter values (unless otherwise stated) but is followed by the character '?' and returns the parameter's value in the same format as it is set.

e.g `SENS:FREQ 10GHZ` – sets the frequency to 10 GHz

SENS:FREQ? – response 10GHZ – returns the current frequency

[SENSe:]FREQuency:CENTer.....	78
[SENSe:]FREQuency:STARt.....	78
[SENSe:]FREQuency:STOP.....	79
[SENSe:]FREQuency:TRACk.....	79
[SENSe:]FREQuency:VERify[:STATe].....	79
[SENSe:]FREQuency:VERify:TOLerance.....	79
[SENSe:]FREQuency:VERify:TOLerance:RELative.....	80
[SENSe:]LIST:RANGe<range>:BANDwidth[:RESolution].....	80
[SENSe:]LIST:RANGe<range>:FILTer:TYPE.....	81
[SENSe:]LIST:RANGe<1..20>:SWEep:COUNT.....	81
[SENSe:]POWer:RLEVel.....	81
[SENSe:]POWer:RLEVel:VERify[:STATe].....	82
[SENSe:]POWer:RLEVel:VERify:TOLerance.....	82
[SENSe:]POWer:TRACk.....	82
[SENSe:]SWEep:COUNT.....	83
[SENSe:]SWEep:FORWard.....	83
[SENSe:]SWEep:MODE.....	83
[SENSe:]SWEep:POINts.....	84

---

#### [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 f<sub>max</sub>

\*RST:            f<sub>max</sub>/2

Default unit: Hz

f<sub>max</sub> is specified in the data sheet. min span is 10 Hz

##### Example:

FREQ:CENT 100 MHz

##### Mode:

all

---

#### [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 (f<sub>max</sub> - min span)

\*RST:            0

f<sub>max</sub> is specified in the data sheet. min span is 10 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

\*RST: fmax

$f_{\max}$  is specified in the data sheet. min span is 10 Hz

**Example:**

FREQ:STOP 2000 MHz

**Mode:**

A-F, CDMA, EVDO, RT, TDS, NF, PHN, WCDMA

**[SENSe:]FREQuency:TRACk** <State>

Switches the automatic frequency control on and off.

**Parameters:**

<State> ON | OFF

\*RST: ON

**Example:**

SENS:FREQ:TRACk ON

Sets the automatic frequency control to ON.

**Usage:**

SCPI conform

**Mode:**

PHN

**[SENSe:]FREQuency:VERify[:STATe]** <State>

Specifies whether frequency and level verification are to be performed before a phase noise measurement.

This command is synonymous with [\[SENSe:\]POWer:RLEVel:VERify\[:STATe\]](#) on page 82.

**Parameters:**

<State> ON | OFF

\*RST: ON

**Example:**

SENS:FREQ:VER ON

Specifies that frequency and level verification is to be performed

**Usage:**

SCPI conform

**Mode:**

PHN

**[SENSe:]FREQuency:VERify:TOLerance** <FreqTolerance>

Specifies the absolute frequency tolerance for the verification of the signal. If the signal frequency varies from the specified center frequency by a value greater than the tolerance then the verification fails.

The setting for this parameter only has an effect if the `[SENSe:]FREQuency:VERify[:STATe]` on page 79 or `[SENSe:]POWer:RLEVel:VERify[:STATe]` on page 82 command is set to ON.

The tolerance used during the measurement is the highest of the absolute and the relative tolerance values.

**Parameters:**

<FreqTolerance> <numeric value>

\*RST: 1 PCT

**Example:**

SENS:FREQ:VER:TOL 1KHZ

Sets the absolute frequency tolerance for the verification measurement to 1 kHz

**Usage:** SCPI conform

**Mode:** PHN

**[SENSe:]FREQuency:VERify:TOLerance:RELative <FreqTolerance>**

Specifies the relative frequency tolerance for the verification of the signal. If the signal frequency varies from the specified center frequency by a value greater than the tolerance then the verification fails.

The setting for this parameter only has an effect if the `[SENSe:]FREQuency:VERify[:STATe]` on page 79 or `[SENSe:]POWer:RLEVel:VERify[:STATe]` on page 82 command is set to ON.

The tolerance used during the measurement is the highest of the absolute and the relative tolerance values.

**Parameters:**

<FreqTolerance> <numeric value> from 0 to 100

\*RST: 1 PCT

**Example:**

SENS:FREQ:VER:TOL:REL 10

Sets the relative frequency tolerance for the verification measurement to 10 %

**Usage:** SCPI conform

**Mode:** PHN

**[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: depends on sub-band



**Example:** LIST:RANG2:BAND:RES 5000  
Sets the RBW for range 2 to 5 kHz.

**Mode:** PHN

**[SENSe:]LIST:RANGe<range>:FILTer:TYPE <Type>**

This command sets the filter type for the specified range (sub-band).

**Suffix:**  
<range> 1...20  
range (sub-band)

**Parameters:**  
<Type> **NORMAL**  
Gaussian filters  
**FFT**  
FFT filter  
**\*RST: NORM**  
The available bandwidths of the filters are specified in the data sheet.

**Example:** LIST:RANG1:FILT:TYPE FFT  
Sets the FFT filter type for range 1.

**Mode:** PHN

**[SENSe:]LIST:RANGe<1..20>:SWEep:COUNT <Value>**

Selects the sweep count for the specified sub-band:

**Parameters:**  
<Value> <numeric value>  
**\*RST: sub-band dependent**

**Example:** SENS:LIST:RANG2:SWE:COUN 1  
Sets the sweep count to 1

**Usage:** SCPI conform

**Mode:** PHN

**[SENSe:]POWer:RLEVel <Power>**

This command specifies the expected power.

**Parameters:**  
<Power> **numeric value in dB**  
Range: -100 to 30  
**\*RST: 10 dB**

**Example:** SENS:POW:RLEV 0 DB  
Sets the expected power level to 0 dB.

**Usage:** SCPI conform

**Mode:** PHN

**[SENSe:]POWer:RLEVel:VERify[:STATe]** <State>

Specifies whether frequency and level verification are to be performed before a phase noise measurement.

This command is synonymous with [\[SENSe:\]FREQuency:VERify\[:STATe\]](#) on page 79.

**Parameters:**

<State> ON | OFF

\*RST: ON

**Example:**

SENS:POW:RLEV:VER 1

Specifies that frequency and level verification is to be performed

**Usage:**

SCPI conform

**Mode:**

PHN

**[SENSe:]POWer:RLEVel:VERify:TOLerance** <PowerTolerance>

Specifies the power tolerance for the verification of the signal. If the signal level varies from the specified level by a value greater than the tolerance then the verification fails.

The setting for this parameter only has an effect if the [\[SENSe:\]FREQuency:VERify\[:STATe\]](#) on page 79 or [\[SENSe:\]POWer:RLEVel:VERify\[:STATe\]](#) on page 82 command is set to ON.

**Parameters:**

<PowerTolerance> <numeric value>

\*RST: 10 dB

**Example:**

SENS:POW:RLEV:TOLerance 5DB

Sets the level tolerance for the verification measurement to 1 dB

**Usage:**

SCPI conform

**Mode:**

PHN

**[SENSe:]POWer:TRACk** <State>

Switches the automatic level control on and off.

**Parameters:**

<State> ON | OFF

\*RST: ON

**Example:**

SENS:POW:TRACk ON

Sets the automatic level control to ON.

**Usage:**

SCPI conform

**Mode:**

PHN

**[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

**Example:**

\*RST: 0 (GSM: 200)

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:FORWARD** <State>

Specifies the sweep direction. When switched on the sweep direction is from the start frequency to the stop frequency. When switched off the sweep direction is reversed

**Parameters:**

<State> ON | OFF

**Example:**

\*RST: OFF

SENS:SWEep:FORWARD 1

The sweep direction is set to sweep from start to stop frequency

**Usage:** SCPI conform

**Mode:** PHN

**[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

**Example:**

\*RST: AUTO

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

\*RST: 691 (NF: 11)

**Example:** SWE:POIN 251

**Mode:** A, ADEMOD, BT, CDMA, EVDO, TDS, NF, PHN, WCDMA

## 4.2.14 STATus Subsystem

The STATus subsystem contains the commands for the status reporting system. \*RST does not influence the status registers.

STATus:QUEStionable:PNOise:CONDition.....	84
STATus:QUEStionable:PNOise:ENABLE.....	84
STATus:QUEStionable:PNOise:PTRansition.....	85
STATus:QUEStionable:PNOise:NTRansition.....	85
STATus:QUEStionable:PNOise Register.....	85

**STATus:QUEStionable:PNOise:CONDition?**

Queries the contents of the CONDition section of the STATus:QUEStionable:PNOise register. Readout does not delete the contents of the CONDition section.

**Parameters:**

\*RST: 0

**Example:** STAT:QUES:PNOI:COND?

**Usage:** Query only  
SCPI conform

**Mode:** PHN

**STATus:QUEStionable:PNOise:ENABLE** <BitDefinition>

Sets the bits of the ENABLE section of the STATus:QUEStionable:PNOise Register on page 85. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

**Parameters:**

<BitDefinition>

Range: 0 to 65535

\*RST: 65535

**Example:** STAT:QUES:PNOI:ENAB 65535  
All events bits are represented in the PNOise summary bit.

**Mode:** PHN

#### STATus:QUESTionable:PNOise:PTRansition <BitDefinition>

Determines what bits in the STATus:QUESTionable:PNOise Condition register sets the corresponding bit in the STATus:QUESTionable:PNOise Event register when that bit has a positive transition (0 to 1). The variable <number> is the sum of the decimal values of the bits that are to be enabled.

**Parameters:**

<BitDefinition>

Range: 0 to 65535

\*RST: 65535

**Example:** STAT:QUES:PNOi:PTR 65535

All condition bits are summarised in the Event register when a positive transition occurs.

**Mode:** PHN

#### STATus:QUESTionable:PNOise:NTRansition <BitDefinition>

Determines which bits in the STATus:QUESTionable:PNOise Condition sets the corresponding bit in the STATus:QUESTionable:PNOise Event register when that bit has a negative transition (1 to 0). The variable <number> is the sum of the decimal values of the bits that are to be enabled.

**Parameters:**

<BitDefinition>

Range: 0 to 65535

\*RST: 0

**Example:** STAT:QUES:PNOi:NTR 65535

All condition bits are summarised in the Event register when a positive transition occurs.

**Mode:** PHN

#### STATus:QUESTionable:PNOise Register

Contains information about phase noise measurements.

The bits can be queried with commands `STATus:QUESTionable:PNOise:CONDition` on page 84 and

`STATus:QUESTionable:PNOise[:EVENT]?`.

**Return values:**

<Result>	Bit No   0   1   2   3 to 14   15
	<b>Bit No</b>
	Meaning
	<b>0</b>
	No traces are active This bit is set when all the traces are switch off.
	<b>1</b>
	"SIGNal not found" This bit is set if no valid signal is detected
	<b>2</b>
	"VERify signal failed" This bit is set if verification failed to detect a signal within the supplied tolerances.
	<b>3 to 14</b>
	These bits are not used
	<b>15</b>
	This bit is always 0

#### 4.2.15 Error Reporting

Error reporting for the R&S FSVK40 option is carried out using the Service Request (SRQ) interrupt in the GPIB interface. When an error occurs, a service request interrupt is generated. The master can then query the slave instrument for the error that triggered the interrupt. Errors are queried through the "SYSTem:ERRor" command.

#### 4.2.16 TRACe subsystem

---

**TRACe<n>[:DATA]? <ResultType>**

This command returns the current trace data or measurement results. In case of several result displays, you have to use specific parameters to query the results.

**Suffix:**

<n>	1...4
	window; For applications that have only one measurement screen, the suffix is irrelevant.

**Query parameters:**

<ResultType> TRACe1 | TRACe2 | TRACe3 | TRACe4 | TRACe5 | TRACe6 | 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 4-3](#)

**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 4-4](#) below.

**SPURious**

Returns the peak list of the Spurious Emissions measurement (Spectrum mode only)

**Example:**

TRAC? TRACe1

Returns the trace data for Trace 1.

**Usage:**

Query only

**Mode:**

A, ADEMOD, BT, NF, PHN, TDS

**Table 4-3: Results for <TRACe...> ResultTypes**

<p>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 <a href="#">[SENSe:]SWEep:POINts</a> on page 84.</p> <p>FORMat REAL, 32 is used as format for binary transmission, and FORMat ASCii for ASCII transmission.</p> <p>With the auto peak detector, only positive peak values can be read out.</p> <p>In <b>IQ Analyzer mode</b>, 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:</p> <p>&lt;result&gt;= I<sub>1</sub>,I<sub>2</sub>,...,I<sub>n</sub>, Q<sub>1</sub>,Q<sub>2</sub>,...,Q<sub>n</sub></p>
---

**Table 4-4: Results for <LIST> ResultType**

<p>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:</p> <p>&lt;no&gt;, &lt;start&gt;, &lt;stop&gt;, &lt;rbw&gt;, &lt;freq&gt;, &lt;power abs&gt;, &lt;power rel&gt;, &lt;delta&gt;, &lt;limit check&gt;, &lt;unused1&gt;, &lt;unused2&gt;</p> <p>where:</p>																
<table border="1"> <tr> <td>&lt;no&gt;:</td> <td>peak number</td> </tr> <tr> <td>&lt;start&gt;:</td> <td>start frequency of range</td> </tr> <tr> <td>&lt;stop&gt;:</td> <td>stop frequency of range</td> </tr> <tr> <td>&lt;rbw&gt;:</td> <td>resolution bandwidth of range</td> </tr> <tr> <td>&lt;freq&gt;:</td> <td>frequency of peak</td> </tr> <tr> <td>&lt;power abs&gt;:</td> <td>absolute power in dBm of peak</td> </tr> <tr> <td>&lt;power rel&gt;:</td> <td>relative power in dBc (related to the channel power) of peak</td> </tr> <tr> <td>&lt;delta&gt;:</td> <td>distance to the limit line in dB (positive indicates value above the limit, fail)</td> </tr> </table>	<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)
<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)															

<b>&lt;limit check&gt;:</b>	limit fail (pass = 0, fail =1)
<b>&lt;unused1&gt;:</b>	reserved (0.0)
<b>&lt;unused2&gt;:</b>	reserved (0.0)

#### 4.2.17 Other Commands Referenced in this Document

[SENSe:]AVERAge<n>:COUNT.....88

##### [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

##### Example:

```
*RST: 0
```

```
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



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