R&S® FSV-K40
Firmware Option Phase Noise Measurements
Operating Manual

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Test & Measurement

Operating Manual

ROHDE&SCHWARZ

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

- R&S FSV-K40 (1310.8403.02)

This manual is applicable for the following R&S®FSV models:

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

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

Package	**Link**	**License**
Xitami	http://www.xitami.com	2.5b6
PHP	http://www.php.net	PHP v.3
DOJO-AJAX	http://www.dojotoolkit.org	BSD License
BOOST Library	http://www.boost.org	Boost Software v.1
ONC/RPC	http://www.plt.rwth-aachen.de	SUN
TightVnc	http://www.tightvnc.com	GPL v.3
DemoForgeMirageDriver	http://www.demoforge.com/dfmirage.htm	GPL v.3

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.

Contents

1 Documentation Overview

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

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

Quick Start Guide

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

Chapter 1	Front and Rear Panel
Chapter 2	Putting into Operation
Chapter 3	Firmware Update and Installation of Firmware Options
Chapter 4	Basic Operations
Chapter 5	Basic Measurement Examples
Chapter 6	Brief Introduction to Remote Control
Appendix A	Printer Interface
Appendix B	LAN Interface

Operating Manuals

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

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

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

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

- R&S FSV base unit; in addition:
  - R&S FSV-K9 Power Sensor Support
  - R&S FSV-K14 Spectrogram Measurement
- R&S FSV-K7 Analog Demodulation and R&S FSV-K7S FM Stereo Measurements
- R&S FSV-K10 GSM/EDGE Measurement
- R&S FSV-K30 Noise Figure Measurement
- R&S FSV-K40 Phase Noise Measurement
- R&S FSV-K70 Vector Signal Analysis
- R&S FSV-K72 3GPP FDD BS Analysis
- R&S FSV-K73 3GPP FDD UE Analysis
- R&S FSV-K76/77 3GPP TD-SCDMA BTS and UE Measurement
- R&S FSV-K82 CDMA2000 BS
- R&S FSV-K84 CDMA2000 BS 1xEV-DO
- 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 R&S FSV by replacing modules. The manual includes the following chapters:

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

Online Help

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

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding

firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

2 Conventions Used in the Documentation

The following conventions are used throughout this documentation:

Typographical conventions

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 parentheses.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by parentheses.

3 How to Use the Help System

For basic information on available keys on the front panel and other means of user interaction, see the Quick Start Guide, chapter 4 "Basic Operation".

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 "UPARROW" and "DNARROW" 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 screen.

Navigating in the help topics

- To scroll through a page, use the rotary knob or use the "UPARROW" and "DNARROW" keys.
- To jump to the linked topic, press the link text.

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 "UPARROW" or "DNARROW" 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 Firmware Option Phase Noise Measurements 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 R&S FSV 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 (≤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:

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 28
- chapter 4.1.7, "Softkeys of the Sweep Menu – SWEEP key (R&S FSV-K40)", on page 31
- chapter 4.1.8, "Softkeys of the Trace Menu – TRACE key (R&S FSV-K40)", on page 32
- chapter 4.1.11, "Softkeys of the Lines Menu – LINES key (R&S FSV-K40)", on page 37
- chapter 4.1.9, "Softkeys of the Marker Menu – MKR key (R&S FSV-K40)", on page 35
- chapter 4.1.10, "Softkeys of the Marker To Menu – MKR-> key (R&S FSV-K40)", on page 36

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 40
- chapter 4.1.17, "Trace Mode Overview", on page 43
- chapter 4.1.15, "Selecting the Appropriate Filter Type", on page 41
- chapter 4.1.16, "List of Available RRC and Channel Filters", on page 42
- chapter 4.1.18, "ASCII File Export Format", on page 45

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 38
- chapter 4.1.13, "Editing Limit Lines", on page 39

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.

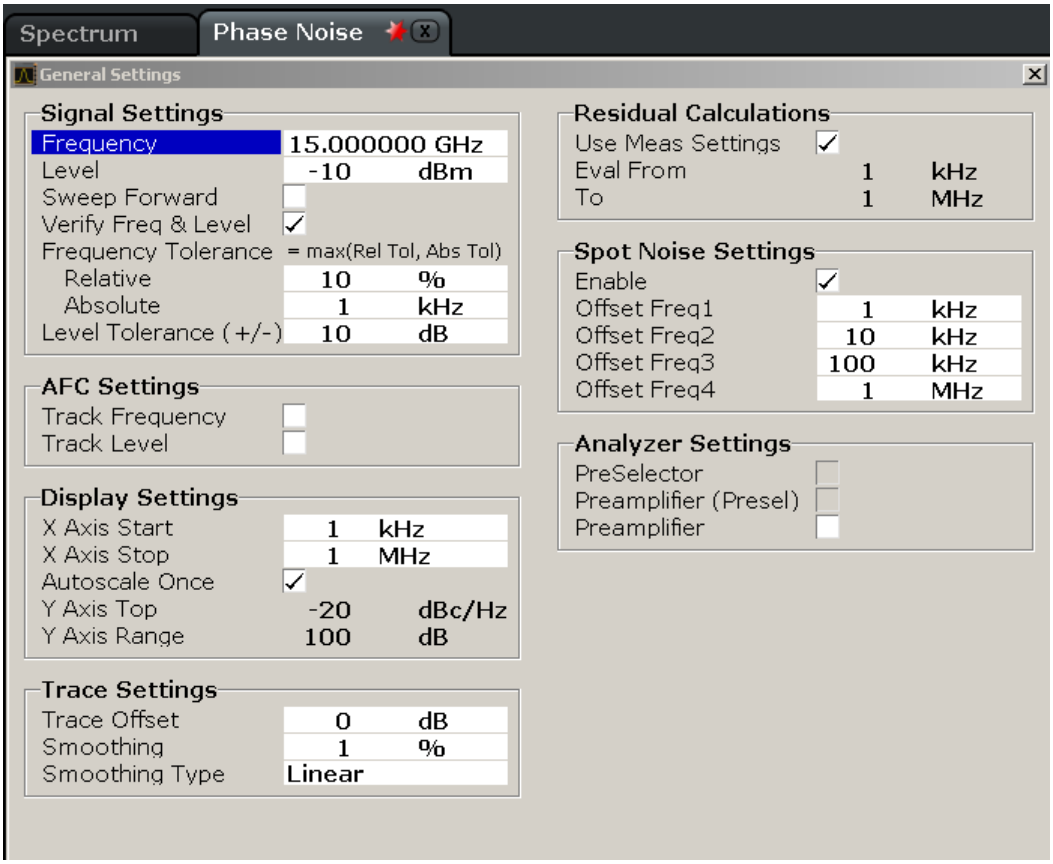


Fig. 4-1: "General Settings" view

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

Signal Settings
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 17
- "Level" on page 17
- "Sweep Forward" on page 18
- "Verify Freq and Level" on page 18
- "Frequency Tolerance" on page 18
- "Level Tolerance" on page 18

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<source>:]FREQuency:CENTer` on page 74

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 78

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 79

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 76

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 subspan'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 77
[SENSe]:FREQuency:VERify:TOLerance on page 77

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 mimum 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 78

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 76

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 79

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

- "X Axis Start" on page 19
- "X Axis Stop" on page 19
- "Autoscale Once" on page 19
- "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<source>:]FREQuency:STARt on page 75

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<source>:]FREQuency:STOP on page 75

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<1…4>]:TRACe<1…3>:Y[:SCALe]:AUTO on page 67

Y Axis Top ← Display Settings
Specifies the maximum phase noise level in the y-axis for the trace results.

SCPI command:
`DISPlay[:WINDow<1…4>]:TRACe<1…3>:Y[:SCALe]:AUTO` on page 67

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 78

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 34 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:

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

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:

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

If both trace averaging (see "Sweep Mode Settings" on page 23) 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<1…4>]:TRACe<1…3>:SMOothing:APERture` on page 66

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 69

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<1…4>]:TRACe<1…3>:SMOothing:APERture` on page 66

Smoothing Type ← Trace Settings
Defines whether linear or logarithmic smoothing is to be used.

SCPI command:
`DISPlay[:WINDow<1…4>]:TRACe<1…3>:SMOothing:TYPE` on page 67

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 21 and "To" on page 21 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 21 and "To" on page 21 fields become enabled. Use them to specify the range over which residual calculations are performed.

SCPI command:
`CALCulate<1…4>:EVALuation[:STATe]` on page 55

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 19 setting.

The maximum value that can be specified for the "Eval From" setting is the value of the "X Axis Stop" on page 19 setting.

When the "X Axis Start" on page 19 or "X Axis Stop" on page 19 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<1…4>:EVALuation:STARt` on page 55

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 19 setting.

The maximum value that can be specified for the "To" setting is the value of the "X Axis Stop" on page 19 setting.

When the "X Axis Start" on page 19or "X Axis Stop" on page 19 settings are modified, the "Eval From" on page 21 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 21 setting.

SCPI command:
`CALCulate<1…4>:EVALuation:STOP` on page 56

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:
`CALCulate1:SNOise<1…4>:STATe` on page 60
`CALCulate1:SNOise<1…4>:AOFF` on page 59

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:
`CALCulate1:SNOise<1…4>:X` on page 60

PreSelector
Activates or deactivates the preselector (if installed).

SCPI command:
`INPut:PRESelection[:STATe]` on page 70

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

SCPI command:
`INPut:GAIN:STATe` on page 70

Preamplifier
Activates or deactivates the preamplifier.

SCPI command:
`INPut:GAIN:STATe` on page 70

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 23
- "Span Settings" on page 24
- "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.

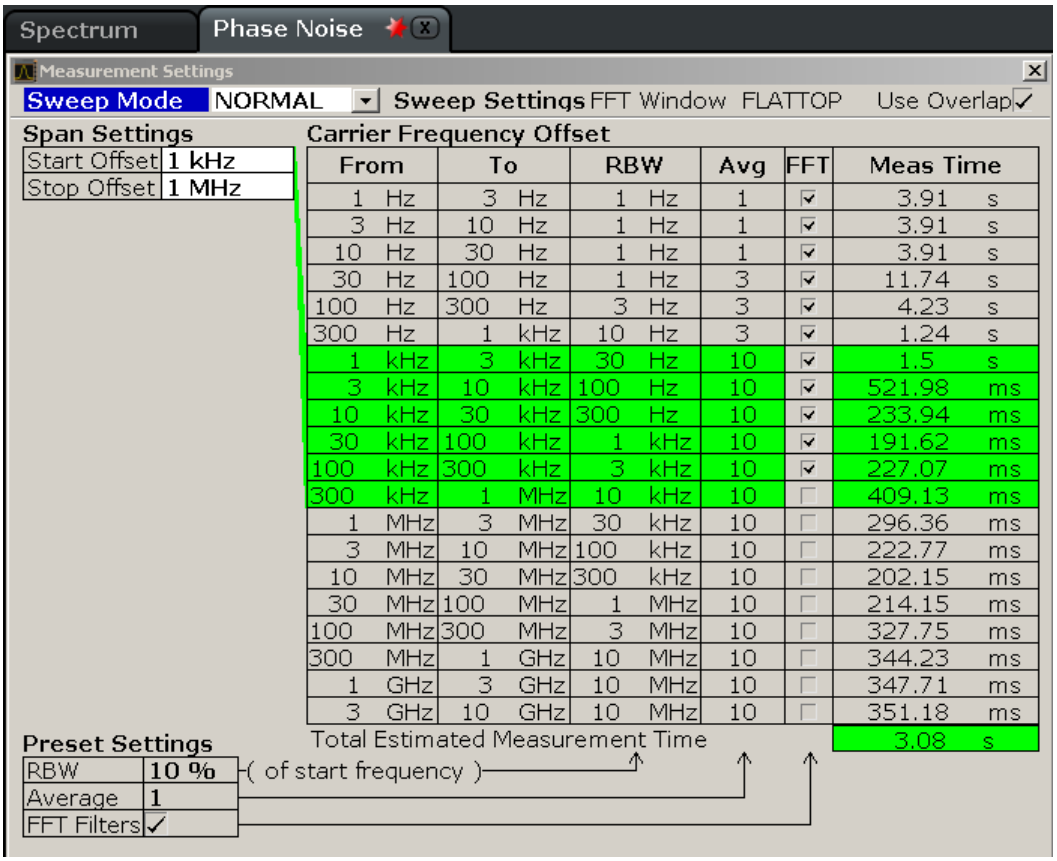


Fig. 4-2: Measurement Settings view

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 Ferquency 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:

Sweep type	FFT, Sweep or Auto
Window function	Window function for FFT, e.g. "Window FLATTOP"
Use overlap	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 19 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 19 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	☑	3.91	s
3	Hz	10	Hz	1	Hz	1	☑	3.91	s
10	Hz	30	Hz	1	Hz	1	☑	3.91	s
30	Hz	100	Hz	1	Hz	3	☑	11.74	s
100	Hz	300	Hz	3	Hz	3	☑	4.23	s
300	Hz	1	kHz	10	Hz	3	☑	1.24	s
1	kHz	3	kHz	30	Hz	10	☑	1.5	s
3	kHz	10	kHz	100	Hz	10	☑	521.98	ms
10	kHz	30	kHz	300	Hz	10	☑	233.94	ms
30	kHz	100	kHz	1	kHz	10	☑	191.62	ms
100	kHz	300	kHz	3	kHz	10	☑	227.07	ms
300	kHz	1	MHz	10	kHz	10	☐	409.13	ms
1	MHz	3	MHz	30	kHz	10	☐	296.36	ms
3	MHz	10	MHz	100	kHz	10	☐	222.77	ms
10	MHz	30	MHz	300	kHz	10	☐	202.15	ms
30	MHz	100	MHz	1	MHz	10	☐	214.15	ms
100	MHz	300	MHz	3	MHz	10	☐	327.75	ms
300	MHz	1	GHz	10	MHz	10	☐	344.23	ms
1	GHz	3	GHz	10	MHz	10	☐	347.71	ms
3	GHz	10	GHz	10	MHz	10	☐	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<source>:]FREQuency:STARt` on page 75

To ← Carrier Frequency Offset Table
The stop frequency of each sub-band.

SCPI command:
`[SENSe<source>:]FREQuency:STOP` on page 75

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.

SCPI command:
`[SENSe<source>:]BANDwidth|BWIDth[:RESolution]:TYPE` on page 74

Range ← Carrier Frequency Offset Table
0.1 % .. 30 % of the start frequency in that row.

SCPI command:
`[SENSe<source>:]BANDwidth|BWIDth[:RESolution]:RATio` on page 73

Average ← Carrier Frequency Offset Table
The number of sweeps to average over for each sub-band.

Range ← Carrier Frequency Offset Table
1 .. 10000

SCPI command:
`[SENSe<source>:]BANDwidth|BWIDth[:RESolution]:RATio` on page 73

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.

SCPI command:
`[SENSe<source>:]SWEep:TYPE` on page 76

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 30). 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 31 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 30
- "Preset Settings" on page 30
- "Autoscale Y Axis" on page 30
- "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.

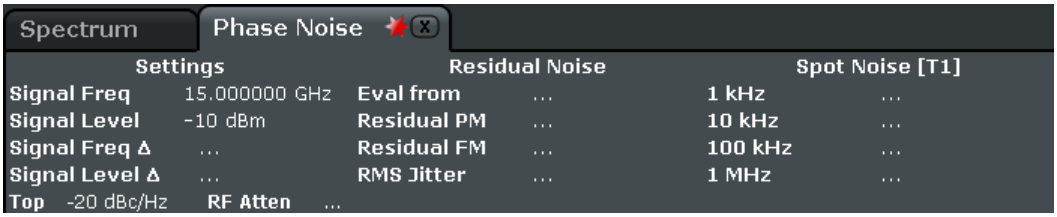


Fig. 4-3: Diagram header with measurement settings and results

The header includes the following information:

Signal Frequency	The frequency of the measured input signal.
Signal Level	The level of the input signal
Signal Freq Δ	The measured frequency difference (during verification and tracking)
Signal Level Δ	The measured level difference (during verification and tracking)
Top	The Y-Axis top (the maximum phase noise level in the y-axis for the trace results)
RF Atten	The RF attenuation
Eval from	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.
Residual PM	The residual PM result over the selected evaluation range.
Residual FM	The residual FM result over the selected evaluation range.
RMS Jitter	The RMS jitter result over the selected evaluation range

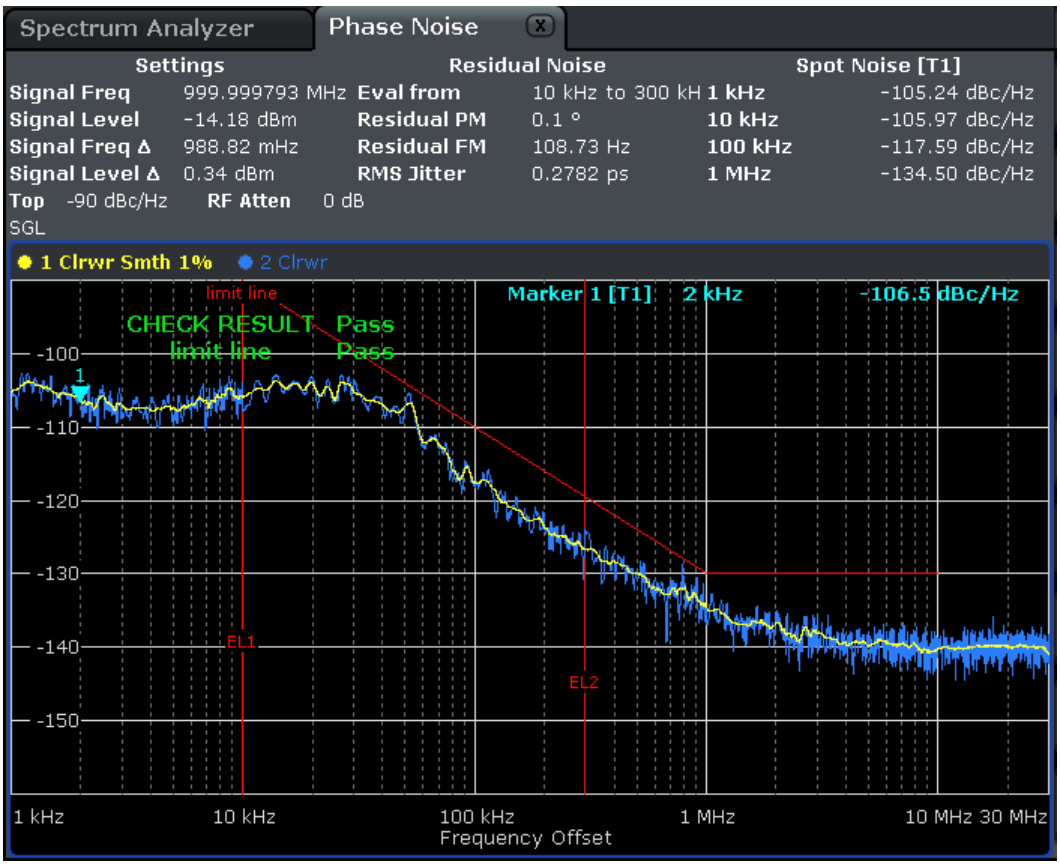


Fig. 4-4: Phase Noise Measurement Results

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
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<1…4>]:TRACe<1…3>: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 17).

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 24"Span Settings" on page 24).

4.1.5 AMPT key

This key opens the "General Settings" dialog box and jumps directly to the "Level" field (see "Level" on page 17).

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 23).

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 32).

SCPI command:
`INIT:CONT ON`, see `INITiate<n>:CONTinuous` on page 71

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 71

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.

SCPI command:
`[SENSe<source>:]SWEep:COUNt` on page 79

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
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 68

Max Hold ← Trace 1 / Trace 2 / Trace 3
The maximum value is determined over several sweeps and displayed. The R&S FSV 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 68

Min Hold ← Trace 1 / Trace 2 / Trace 3
The minimum value is determined from several measurements and displayed. The R&S FSV 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 68

Average ← Trace 1 / Trace 2 / Trace 3
The average is formed over several sweeps. The "Sweep Count" determines the number of averaging procedures (see "Sweep Count" on page 32).

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 40).

This mode is not available for statistics measurements.

SCPI command:
`DISP:TRAC:MODE AVER`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 68

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 R&S FSV 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 68

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 69

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.

SCPI command:
`[SENSe<source>:]SWEep:COUNt` on page 79

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 45.

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 34).

SCPI command:
`FORMat:DEXPort:DSEParator` on page 70
`MMEMory:STORe<n>:LIST` on page 71

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 70

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

- "T1-T3->T1" on page 35
- "T2-T3->T2" on page 35

T1-T3->T1 ← Trace Math
Activates/Deactivates the trace math function that substracts 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 64
`CALCulate<n>:MATH:STATe` on page 64

T2-T3->T2 ← Trace Math
Activates/Deactivates the trace math function that substracts 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 64
`CALCulate<n>:MATH:STATe` on page 64

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 64

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
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 active marker off.

SCPI command:
CALCulate<n>:MARKer<m>[:STATe] on page 57
CALCulate<n>:MARKer<m>:X on page 58
CALCulate<n>:MARKer<m>:Y on page 59
CALCulate<n>:DELTamarker<m>[:STATe] on page 52
CALCulate<n>:DELTamarker<m>:X on page 53
CALCulate<n>:DELTamarker<m>:X:RELative on page 54
CALCulate<n>:DELTamarker<m>:Y on page 54

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

SCPI command:
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 56

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 56

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
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 58
`CALCulate<n>:DELTamarker<m>:TRACe` on page 53

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 38.

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

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 39.

Name ← New
Switches to the "Name" field of the "Limit Line Editor". For details see chapter 4.1.13, "Editing Limit Lines", on page 39.

SCPI command:
`CALCulate<n>:LIMit<k>:NAME` on page 62

Value ← New
Switches to the "Frequency" field of the "Limit Line Editor". For details see chapter 4.1.13, "Editing Limit Lines", on page 39.

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 39.

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 39. 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 39.

Delete
Deletes the selected limit line.

SCPI command:
`CALCulate<n>:LIMit<k>:DELete` on page 61

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:

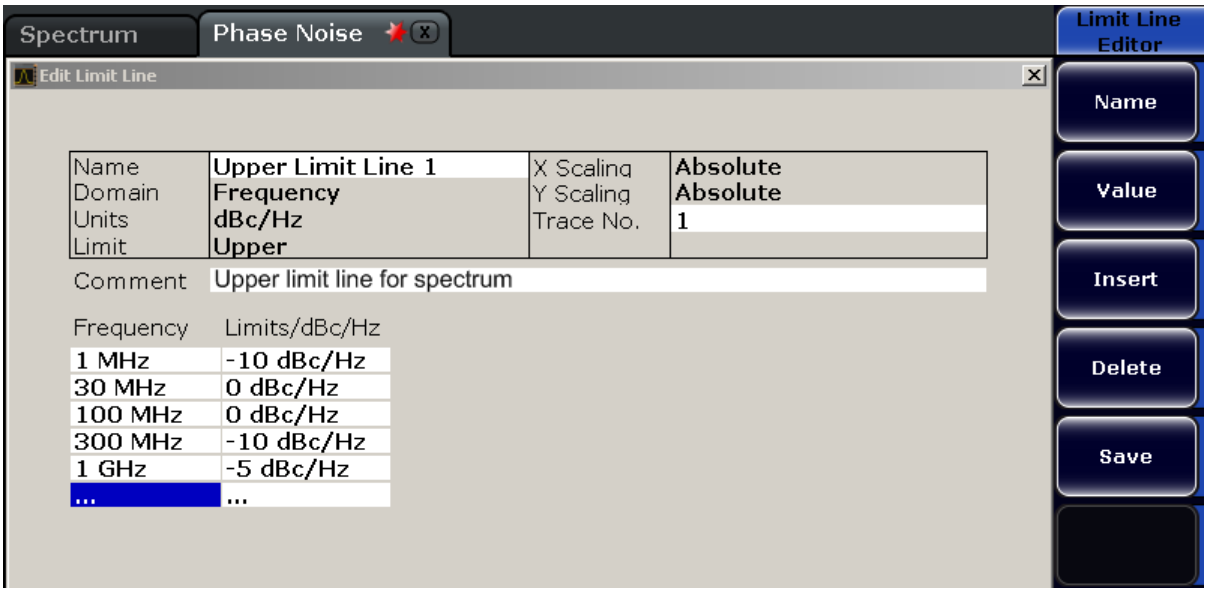
Name	Unique ID of the limit line as defined in the "Name" field (see chapter 4.1.13, "Editing Limit Lines", on page 39).
Domain	Frequency or time domain
Units	Unit of the y-axis
Limit	Type of limit (for phase noise: upper)
X Scaling	Absolute or relative scaling
Y Scaling	Absolute or relative scaling
Trace No.	Selected trace (defined in "Trace No." field, see chapter 4.1.13, "Editing Limit Lines", on page 39)
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 chapter 4.1.13, "Editing Limit Lines", on page 39).

2. 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 39.
3. 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 39.
4. To save a limit line, press the "Save" softkey.
   If data is missing or if some data is invalid, an error message is displayed.

5. 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 37), or the "Edit" softkey to edit an existing limit line (see "Edit" on page 38), the "Edit Limit Line" dialog box and the "Limit Line Editor" submenu are displayed.



To create or edit a limit line:

1. Enter the following settings as required:

Name	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.
Trace No.	Trace number for which the limit line is defined.
Comment	Description for the limit line. Any combination of alphanumeric characters is allowed.
Frequency	Receive frequencies (in Hz)
Limit	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.

2. 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.

3. 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.
4. 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 60

Specifies a description for the limit line.

`CALCulate<n>:LIMit<k>:CONTrol[:DATA]` on page 61

Specifies the receive frequencies.

`CALCulate<n>:LIMit<k>:LOWer[:DATA]` on page 62

`CALCulate<n>:LIMit<k>:UPPer[:DATA]` on page 63

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 R&S FSV. The detector activated for the specific trace is indicated in the corresponding trace display field by an abbreviation.

The detectors of the R&S FSV 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 a random 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, R&S FSV increments the first local oscillator in steps that are smaller than approximately 1/10 of the bandwidth. This ensures that the oscillator step speed is conform to the hardware settling times and does not affect the precision of the measured power.

The number of measured values taken during a sweep is independent of the number of oscillator steps. It is always selected as a multiple or a fraction of 691 (= default number of trace points displayed on the screen). Choosing less then 691 measured values (e.g. 125 or 251) will lead to an interpolated measurement curve, choosing more than 691 points (e.g. 1001, 2001 …) will result in several measured values being overlaid at the same frequency position.

RMS detector and VBW

If the RMS detector is selected, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used the sweep time should be increased to get more stable trace curves.

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 x RBW) for the amplitudes of pulses to be measured correctly.

The following filter types are available:

- Normal (3dB) (Gaussian) filters
  The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.
- EMI (6dB) filters
  The available bandwidths are specified in the data sheet.
- Channel filters
  For details see chapter 4.1.16, "List of Available RRC and Channel Filters", on page 42 .
  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 42 .
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.

Table 4-2: Filter types

Filter Bandwidth	Filter Type	Application
100 Hz 200 Hz 300 Hz 500 Hz	CFILter CFILter CFILter CFILter	A0
1 kHz 1.5 kHz 2 kHz 2.4 kHz 2.7 kHz 3 kHz 3.4 kHz 4 kHz 4.5 kHz 5 kHz 6 kHz 8.5 kHz 9 kHz	CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter CFILter	SSB DAB, Satellite ETS300 113 (12.5 kHz channels) AM Radio

Filter Bandwidth	Filter Type	Application
10 kHz 12.5 kHz 14 kHz 15 kHz 16 kHz 18 kHz, α=0.35 20 kHz 21 kHz 24.3 kHz, α=0.35 25 kHz 30 kHz 50 kHz	CFILter CFILter CFILter CFILter CFILter RRC CFILter CFILter RRC CFILter CFILter CFILter	CDMAone ETS300 113 (20 kHz channels) ETS300 113 (25 kHz channels) TETRA PDC IS 136 CDPD, CDMAone
100 kHz 150 kHz 192 kHz 200 kHz 300 kHz 500 kHz	CFILter CFILter CFILter CFILter CFILter CFILter	FM Radio PHS J.83 (8-VSB DVB, USA)
1 MHz 1.228 MHz 1.28 MHz 1.5 MHz 2 MHz 3 MHz 3.84 MHz, α=0.22 4.096 MHz, α=0.22 5 MHz	CFILter CFILter RRC CFILter CFILter CFILter RRC RRC CFILter	CDMAone CDMAone DAB W-CDMA 3GPP W-CDMA NTT DOCoMo

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 R&S FSV 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 68

Max Hold
The maximum value is determined over several sweeps and displayed. The R&S FSV 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 68

Min Hold
The minimum value is determined from several measurements and displayed. The R&S FSV 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 68

Average
The average is formed over several sweeps. The "Sweep Count" determines the number of averaging procedures (see "Sweep Count" on page 32).

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 40).

This mode is not available for statistics measurements.

SCPI command:
`DISP:TRAC:MODE AVER`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 68

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 R&S FSV 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 68

Blank
Hides the selected trace.

SCPI command:
`DISP:TRAC OFF`, see `DISPlay[:WINDow<n>]:TRACe<t>[:STATe]` on page 69

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	Description
Type;R&S FSV;	Instrument model
Version;5.00;	Firmware version
Date;01.Oct 2006;	Date of data set storage
Mode;ANALYZER;	Instrument mode
Center Freq;55000;Hz	Center frequency
Freq Offset;0;Hz	Frequency offset
Span;90000;Hz	Frequency range (0 Hz in zero span and statistics measurements)
x-Axis;LIN;	Scaling of x-axis linear (LIN) or logarithmic (LOG)
Start;10000;Hz Stop;100000;Hz	Start/stop of the display range. Unit: Hz for span > 0, s for span = 0, dBm/dB for statistics measurements
Ref Level;-30;dBm	Reference level
Level Offset;0;dB	Level offset
Ref Position;75; %	Position of reference level referred to diagram limits (0 % = lower edge)
y-Axis;LOG;	Scaling of y-axis linear (LIN) or logarithmic (LOG)
Level Range;100;dB	Display range in y direction. Unit: dB with x-axis LOG, % with x-axis LIN
Rf Att;20;dB	Input attenuation
RBW;100000;Hz	Resolution bandwidth

File contents: header	Description
VBW;30000;Hz	Video bandwidth
SWT;0.005;s	Sweep time
Trace Mode;AVERAGE;	Display mode of trace: CLR/WRITE,AVERAGE,MAXHOLD,MINHOLD
Detector;AUTOPEAK;	Detector set: AUTOPEAK,MAXPEAK,MINPEAK,AVERAGE,RMS,SAMPLE,QUASIPEAK
Sweep Count;20;	Number of sweeps set

File contents: data section of the file	Description
Trace 1:;;	Selected trace
x-Unit;Hz;	Unit of x values: Hz with span > 0; s with span = 0; dBm/dB with statistics measurements
y-Unit;dBm;	Unit of y values: dB*/V/A/W depending on the selected unit with y-axis LOG or % with y-axis LIN
Values; 691;	Number of measurement points
10000;-10.3;-15.7 10130;-11.5;-16.9 10360;-12.0;-17.4 ...;...;	Measured values: <x value>, <y1>, <y2>; <y2> being available only with detector AUTOPEAK and containing in this case the smallest of the two measured values for a measurement point.

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.

4.2.1 Notation

In the following sections, all commands implemented in the instrument are first listed and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Individual Description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	signal analysis
A-F	signal analysis – span > 0 only (frequency mode)
A-T	signal analysis – zero span only (time mode)
ADEMOD	analog demodulation (option R&S FSV-K7)
BT	Bluetooth (option R&S FSV-K8)
CDMA	CDMA 2000 base station measurements (option R&S FSV-K82)
EVDO	1xEV-DO base station analysis (option R&S FSV-K84)
GSM	GSM/Edge measurements (option R&S FSV-K10)
IQ	IQ Analyzer mode
OFDM	WiMAX IEEE 802.16 OFDM measurements (option R&S FSV-K93)
OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)

NF	Noise Figure measurements (R&S FSV-K30)
PHN	Phase Noise measurements (R&S FSV-K40)
PSM	Power Sensor measurements (option R&S FSV-K9)
SPECM	Spectogram mode (option R&S FSV-K14)
TDS	TD-SCDMA base station / UE measurements (option R&S FSV-K76/K77)
VSA	Vector Signal Analysis (option R&S FSV-K70)
WCDMA	3GPP Base Station measurements (option R&S FSV-K72), 3GPP UE measurements (option R&S FSV-K73)
WLAN	WLAN TX measurements (option R&S FSV-K91)

The signal analysis (spectrum) mode is implemented in the basic unit. For the other modes, the corresponding options are required.

Upper/Lower Case Notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see chapter 5 "Remote Control – Basics"). The instrument itself does not distinguish between upper and lower case letters.

Special Characters

|	A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example:

```
SENSe:FREQuency:CW|:FIXed
```

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

```
SENSe:FREQuency:CW 1E3
```

```
SENSe:FREQuency:FIXed 1E3
```

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example: Selection of the parameters for the command

```
[SENSe<1…4>:]AVERage<1…4>:TYPE VIDeo | LINear
```

If parameter SINGle is selected, full screen is displayed, in the case of SPLit, split screen is displayed.

[]	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

4.2.2.1 CALCulate:DELTamarker subsystem

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X <Reference>

For a measurement with a fixed reference value (see CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] on page 51), this command defines a new frequency reference (span > 0) or time (span = 0) for all delta markers in the window specified by the suffix <n>.

For phase-noise measurements (see CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO on page 51), the command defines a new frequency reference or time for delta marker 2.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Reference> **<numeric_value>**

*RST: ("CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed" is set to OFF)

Example: CALC:DELT:FUNC:FIX:RPO:X 128 MHz
Sets the frequency reference to 128 MHz.

Mode: A

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y <RefPointLevel>

For a measurement with a fixed reference point (CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe]), this command defines a new reference point level for all delta markers in the window specified by the suffix <n>.

For phase-noise measurements (CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] on page 52), the command defines a new reference point level for delta marker 2.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<RefPointLevel> **<numeric_value>**

*RST: ("CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed" is set to OFF)

Example: CALC:DELT:FUNC:FIX:RPO:Y -10dBm
Sets the reference point level for delta markers to -10 dBm.

Mode: A

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] <State>

This command switches the relative measurement to a fixed reference value on or off. Marker 1 is activated previously and a peak search is performed, if necessary. If marker 1 is activated, its position becomes the reference point for the measurement. The reference point can then be modified with the CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X commands and CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y independently of the position of marker 1 and of a trace. It applies to all delta markers in the window specified by the suffix <n> as long as the function is active.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:
<State> ON | OFF

*RST: OFF

Example: CALC:DELT:FUNC:FIX ON
Switches on the measurement with fixed reference value for all delta markers.
CALC:DELT:FUNC:FIX:RPO:X 128 MHZ
Sets the frequency reference to 128 MHz.
CALC:DELT:FUNC:FIX:RPO:Y 30 DBM
Sets the reference level to +30 dBm.

Mode: A

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO <State>

This command activates an automatic peak search for the reference fixed marker 1 at the end of each particular sweep in the window specified by the suffix <n>.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> irrelevant

Parameters:
<State> ON | OFF

*RST: OFF

Example: CALC:DELT:FUNC:PNO:AUTO ON
Activates an automatic peak search for the reference marker in a phase-noise measurement.

Mode: A

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] <State>

This command switches on or off the phase-noise measurement with all active delta markers in the window specified by the suffix <n>. The correction values for the bandwidth and the log amplifier are taken into account in the measurement.

Marker 1 is activated, if necessary, and a peak search is performed. If marker 1 is activated, its position becomes the reference point for the measurement.

The reference point can then be modified with the `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X` and `CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y` commands independently of the position of marker 1 and of a trace (the same commands used for the measurement with fixed reference point).

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> irrelevant
Note: marker 2 is always the deltamarker for phase noise measurement results.

Parameters:

<State> ON | OFF

*RST: OFF

Example:
```
CALC:DELT:FUNC:PNO ON
```
Switches on the phase-noise measurement with all delta markers.
```
CALC:DELT:FUNC:FIX:RPO:X 128 MHZ
```
Sets the frequency reference to 128 MHz.
```
CALC:DELT:FUNC:FIX:RPO:Y 30 DBM
```
Sets the reference level to +30 dBm

Mode: A

CALCulate<n>:DELTamarker<m>[:STATe] <State>

This command defines the marker specified by the suffix <m> as a delta marker for the window specified by the suffix <n>. If the corresponding marker was not already active, it is activated and positioned on the maximum of the measurement curve.

If no suffix is given for DELTamarker, delta marker 1 is selected automatically.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<State> ON | OFF

*RST: OFF

Example: CALC:DELT1 ON
Switches marker 1 to delta marker mode.

Mode: All

CALCulate<n>:DELTamarker<m>: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

Example: CALC:DELT3:TRAC 2
Assigns delta marker 3 to trace 2.

Mode: A, ADEMOD

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 or relative to marker 1 depending on the command CALCulate<n>:DELTamarker<m>[:STATe]. If fixed reference measurement is active (CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] is ON), relative values refer to the reference position are entered. The query always returns absolute values.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Position> 0 to maximum frequency or sweep time

Example: CALC:DELT:MOD REL
Switches the input for all delta markers to relative to marker 1.
CALC:DELT2:X 10.7MHz
Positions delta marker 2 10.7 MHz to the right of marker 1.
CALC:DELT:X?
Outputs the absolute frequency/time of delta marker 1.
CALC:DELT:X:REL?
Outputs the relative frequency/time/level of delta marker 1 (see CALCulate<n>:DELTamarker<m>:X:RELative on page 54).

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA

CALCulate<n>:DELTamarker<m>:X:RELative

This command queries the frequency (span > 0) or time (span = 0) of the selected delta marker relative to marker 1 or to the reference position (for CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] is ON) in the window specified by the suffix <n>. The command activates the corresponding delta marker, if necessary.

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

Example: CALC:DELT3:X:REL?
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA

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 CALCulate<n>:UNIT:POWer 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.
`CALC:DELT2 ON`
Switches on delta marker 2.
`INIT;*WAI`
Starts a sweep and waits for its end.
`CALC:DELT2:Y?`
Outputs measurement value of delta marker 2.

Mode: A, ADEMOD, BT, CDMA, EVDO, TDS, WCDMA

4.2.2.2 CALCulate:EVALuation Subsystem

CALCulate<1…4>:EVALuation[:STATe] <State>

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

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

ON (1)
The residual noise values are calculated over the range specified by `CALCulate<1…4>:EVALuation:STARt` on page 55 and `CALCulate<1…4>:EVALuation:STOP` on page 56

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<1…4>:EVALuation:STARt <Frequency>

This command specifies the start frequency for residual noise calculation when `CALCulate<1…4>:EVALuation[:STATe]` on page 55 is switched OFF.

Parameters:
<Frequency>

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<1…4>:EVALuation:STOP <Frequency>

This command specifies the stop frequency for residual noise calculation when `CALCulate<1…4>:EVALuation[:STATe]` on page 55 is switched ON. This command has no effect if `CALCulate<1…4>:EVALuation[:STATe]` on page 55is switched OFF.

Parameters:
<Frequency>
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:MARker subsystem

CALCulate<n>:MARKer<m>:AOFF

This command switches off all active markers and all delta markers and active marker/ delta marker measurement functions in the window specified by the suffix <n>.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC:MARK:AOFF`
Switches off all markers.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, GSM

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

*RST: OFF

Example: `CALC:MARK:FUNC:ZOOM ON`

Mode: WCDMA

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command positions the marker to the current maximum value of the corresponding trace in the window specified by the suffix <n>. The corresponding marker is activated first or switched to the marker mode.

If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC:MARK2:MAX`
Positions marker 2 to the maximum value of the trace.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command positions the marker to the current minimum value of the corresponding trace in the window specified by the suffix <n>. The corresponding marker is activated first or switched to marker mode, if necessary.

If no minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC:MARK2:MIN`
Positions marker 2 to the minimum value of the trace.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, SPECM

CALCulate<n>:MARKer<m>[:STATe] <State>

This command switches on or off the currently selected marker in the window specified by the suffix <n>. If no indication is made, marker 1 is selected automatically. If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK3 ON`
Switches on marker 3 or switches to marker mode.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, VSA, GSM

CALCulate<n>:MARKer<m>:TRACe <TraceNumber>

This command assigns the selected marker (1 to 16) to the indicated measurement curve in the window specified by the suffix <n>. The corresponding trace must be active, i.e. its status must be different from "BLANK".

If necessary the corresponding marker is switched on prior to the assignment.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:
<TraceNumber> 1 to 6

Example: `CALC:MARK3:TRAC 2`
Assigns marker 3 to trace 2.

Mode: A, ADEMOD, VSA

CALCulate<n>:MARKer<m>:X <Position>

This command positions the selected marker to the indicated frequency (span > 0), time (span = 0) or level (APD measurement or CCDF measurement ON) in the window specified by the suffix <n>.

If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:
<Position> 0 to MAX (frequency | sweep time | level)

Example: `CALC:MARK2:X 10.7MHz`
Positions marker 2 to frequency 10.7 MHz.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, GSM

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 between the activation of the marker and 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 IQ 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 IQ Analyzer mode, for "Real/Imag (I/Q)", for example:
```
1.852719887E-011,0
```

Usage: Query only

Mode: A, ADEMOD, BT, CDMA, EVDO, I/Q, GSM, TDS, WCDMA

4.2.2.4 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.

CALCulate1:SNOise<1…4>:AOFF

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

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

Mode: PHN

CALCulate1:SNOise<1…4>: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.

Parameters:
<State> ON | OFF

*RST: 1

Example: CALC1:SNO1:STATE ON
Switches the screen A marker ON.

Mode: PHN

CALCulate1:SNOise<1…4>:X <Frequency>

Positions the selected slot noise marker to the indicated frequency

Parameters:
<Frequency> <numeric value>

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

Mode: PHN

CALCulate1:SNOise<1…4>:Y?

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

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

4.2.2.5 CALCulate:LIM subsystem

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, TDS

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, TDS

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, TDS

CALCulate<n>:LIMit<k>:LOWer[:DATA] <LimitLineValues>

This command defines the values for the selected lower limit line.

The number of values for the CONTrol axis and for the corresponding LOWer limit line has to be identical. Otherwise default values are entered for missing values or not necessary values are deleted.

The unit must be identical with the unit selected by `CALCulate<n>:LIMit<k>:UNIT`. If no unit is indicated, the unit defined with `CALCulate<n>:LIMit<k>:UNIT` is automatically used.

If the measured values are smaller than the LOWer limit line, the limit check signals errors.

The units DEG, RAD, S, HZ, PCT are not available in the "Spectrum" mode.

Suffix:

<n> irrelevant

<k> 1...8
limit line

Parameters:

<LimitLineValues> numeric values, separated by commas

*RST: (LIMit:STATe is set to OFF)

Example: `CALC:LIM2:LOW -30,-40,-10,-40,-30`
Defines 5 lower limit values for limit line 2 in the preset unit.
`CALC:LIM2:LOW?`
Outputs the lower limit values of limit line 2 separated by a comma.

Mode: A, ADEMOD, CDMA, EVDO, NF, 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> 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>:UNIT <Unit>

This command defines the unit of the selected limit line.

Upon selection of the unit DB the limit line is automatically switched to the relative mode. For units different from DB the limit line is automatically switched to absolute mode.

The units DEG, RAD, S, HZ, PCT are not available in "Spectrum" mode.

Suffix:
<n> irrelevant
<k> limit line

Parameters:
<Unit> DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DB | DBUV_M | DBUA_M | DEG | RAD | S | HZ | PCT | (unitless)

*RST: DBM

Example: `CALC:LIM4:UNIT DBUV`
Sets the unit of limit line 4 to dBµV.

Mode: A, ADEMOD, CDMA, EVDO, 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

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

Example: `CALC:LIM2:UPP -10,0,0,-10,-5`
Defines 5 upper limit values for limit line 2 in the preset unit.
`CALC:LIM2:UPP?`
Outputs the upper limit values for limit line 2 separated by a comma.

Mode: A, ADEMOD, CDMA, EVDO, NF, TDS

4.2.2.6 Other CALCulate commands

CALCulate<n>:MATH[:EXPression][:DEFine] <Expression>

This command defines the mathematical expression for relating traces to trace1.

Suffix:
<n> irrelevant

Parameters:
<Expression> (TRACe1-TRACe2) | (TRACe1-TRACe3) | (TRACe1-TRACe4) | (TRACe1-TRACe5) | (TRACe1-TRACe6)

(TRACe1-TRACe2)
Subtracts trace 2 from trace 1.

(TRACe1-TRACe3)
Subtracts trace 3 from trace 1.

(TRACe1-TRACe4)
Subtracts trace 4 from trace 1.

(TRACe1-TRACe5)
Subtracts trace 5 from trace 1.

(TRACe1-TRACe6)
Subtracts trace 6 from trace 1.

Example: `CALC1:MATH (TRACe1 - TRACe2)`
Selects the subtraction of trace 2 from trace 1.

Mode: A, SPECM, PHN

CALCulate<n>:MATH:STATe <State>

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

Suffix:
<n> irrelevant

Parameters:
<State> ON | OFF

*RST: OFF

Example: `CALC:MATH:STAT ON`
Switches on the trace mathematics.

Mode: A, SPECM

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit for power.

The unit is defined globally for all windows.

Suffix:
<n> irrelevant

Parameters:

<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere

*RST: dBm

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

Mode: A, 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 <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<1…4>]:TRACe<1…3>: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, thus, the numeric suffixes for WINDow<1…4> and TRACe<1…3> are 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<1…4>]:TRACe<1…3>:SMOothing[:STATe] <State>

Specifies whether smoothing of a particular trace is carried out.

The numeric suffix at WINDow<1…4> is irrelevant:

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<1…4>]:TRACe<1…3>:SMOothing:TYPE <Type>

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

Parameters:

<Type> LINear|LOGarithmic

*RST: LIN

Example: `DISP:TRAC1:SMO:TYPE LIN`
Sets the smoothing type for trace 1

Usage: SCPI conform

Mode: PHN

DISPlay[:WINDow<1…4>]:TRACe<1…3>: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.

The numeric suffixes <1…4> and <1… 3> are irrelevant.

Parameters:

<State> ON | OFF

*RST: ON

Example: `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?

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[: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<source>:]AVERage<n>:COUNt` or `[SENSe<source>:]SWEep:COUNt` commands. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

If calculation of average values is active, selection between logarithmic and linear averaging is possible. For more detail see `[SENSe<source>:]AVERage<n>:TYPE` on page 73.

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 43.

Example: `SWE: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.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t> trace

Parameters:
<State> ON | OFF

*RST: ON for TRACe1, OFF for TRACe2 to 6

Example: `DISP:TRAC3 ON`

Mode: all

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

This command defines the offset of the reference level in the window specified by the suffix <n>.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t> irrelevant

Parameters:
<Value> -200dB to 200dB

*RST: 0dB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Mode: A, CDMA, EVDO, PSM, TDS, WCDMA, WLAN

4.2.7 FORMat subsystem

FORMat:DEXPort:DSEParator <Separator>

This command defines which decimal separator (decimal point or comma) is to be used for outputting measurement data to the file in ASCII format. Different languages of evaluation programs (e.g. MS-Excel) can thus be supported.

The suffix <1…4> is irrelevant, the separator is defined globally for all windows.

Parameters:

<Separator> POINt | COMMA

*RST: (factory setting is POINt; *RST does not affect setting)

Example: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

Mode: all

4.2.8 INPut Subsystem

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

INPut:PRESelection[:STATe] <State>

Switches the preselection on or off.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `INP:PRES:STAT ON`
- preselection is switched on.

Mode: PHN

The command is only available with the preselector option B2.

4.2.9 INPut subsystem

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.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `INP:GAIN:STAT ON`
Switches on 20 dB preamplification.

Mode: A, CDMA, EVDO, NF, WCDMA, GSM

4.2.10 INITiate subsystem

INITiate<n>:CONTinuous <State>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

In the **"Spectrum" mode**, this setting refers to the sweep sequence (switching between continuous/single sweep).

Suffix:

<n> irrelevant

Parameters:

<State> ON | OFF

*RST: ON

Example: `INIT:CONT OFF`
Switches the sequence single sweep.
`INIT:CONT ON`
Switches the sequence to continuous sweep.

Mode: all

4.2.11 MMEMory subsystem

MMEMory:STORe<n>:LIST <FileName>

This command stores the current list evaluation results in a `<file name>.dat` file. The file consists of a data section containing the list evaluation results.

Suffix:

<n> irrelevant

Parameters:

<FileName> <file name>

Example: `MMEM:STOR:LIST 'test'`
Stores the current list evaluation results in the `test.dat` file.

Mode: A

4.2.12 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<source>:]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.

<source> irrelevant

Parameters:

<NoMeasurements> 0 to 32767

*RST: 0

Example: `SWE:CONT OFF`
Switching to single sweep mode.
`AVER:COUN 16`
Sets the number of measurements to 16.
`AVER:STAT ON`
Switches on the calculation of average.
`INIT;*WAI`
Starts the measurement and waits for the end of the 16 sweeps.

Mode: all

[SENSe<source>:]AVERage<n>:TYPE <FunctionType>

This command selects the type of average function in the window specified by the AVERage<n> suffix.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<source> irrelevant

Parameters:

<FunctionType> VIDeo | LINear | POWer

VIDeo
The logarithmic power values are averaged.

LINear
The power values are averaged before they are converted to logarithmic values.

POWer
The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

*RST: VIDeo

Example: `AVER:TYPE LIN`
Switches to linear average calculation.

Mode: A

[SENSe<source>:]BANDwidth|BWIDth[:RESolution]:RATio <Ratio>

This command defines the ratio resolution bandwidth (Hz)/span (Hz). The ratio to be entered is reciprocal to the ratio span/RBW used in manual operation.

Suffix:

<source> irrelevant

Parameters:

<Ratio> 0.0001 to 1

*RST: 0.01

Example: `BAND:RAT 0.1`

Mode: A, CDMA, EVDO, TDS

[SENSe<source>:]BANDwidth|BWIDth[:RESolution]:TYPE <FilterType>

This command switches the filter type for the resolution bandwidth between "normal" analog or FIR filters in 1, 3, 10 steps and the FFT filtering for bandwidths <100 kHz.

For detailed information on filters see chapter 4.1.15, "Selecting the Appropriate Filter Type", on page 41 and chapter 4.1.16, "List of Available RRC and Channel Filters", on page 42.

When changing the filter type, the next larger filter bandwidth is selected if the same filter bandwidth is not available for the new filter type.

5 Pole filters are not available when using the sweep type "FFT".

Suffix:

<source> irrelevant

Parameters:

<FilterType> NORMal | FFT | CFILter | RRC | P5 | PULSe

NORMal
Gaussian filters

FFT
FFT filters

CFILter
channel filters

RRC
RRC filters

PULSe
EMI (6dB) filters

P5
5 Pole filters

*RST: NORMal

Example: `BAND:TYPE NORM`

Mode: all, except ADEMOD

[SENSe<source>:]FREQuency:CENTer <Frequency>

This command defines the center frequency of the analyzer or the measuring frequency for span = 0.

Suffix:

<source> irrelevant

Parameters:

<Frequency> <numeric_value>

Range: 0 to fmax
*RST: fmax/2 with fmax = maximum frequency
Default unit: Hz
f_{max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example: `FREQ:CENT 100 MHz`

Mode: all

[SENSe<source>:]FREQuency:STARt <Frequency>

This command defines the start frequency of the analyzer. This command is only available with span > 0.

Suffix:

<source> irrelevant

Parameters:

<Frequency> 0 to fmax

*RST: 0
f_{max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example: `FREQ:STAR 20MHz`

Mode: A-F, CDMA, EVDO, TDS, NF

[SENSe<source>:]FREQuency:STOP <Frequency>

This command defines the stop frequency of the analyzer. This command is only available with span > 0.

Suffix:

<source> irrelevant

Parameters:

<Frequency> 0 to fmax

*RST: fmax
f_{max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example: `FREQ:STOP 2000 MHz`

Mode: A-F, CDMA, EVDO, TDS, NF

[SENSe<source>:]SWEep:TYPE <Type>

Parameters:

<Type> SWE | AUTO | FFT

SWE
Sweep list

AUTO
Automatic selection of the sweep type.

FFT
FFT mode

*RST: AUTO
Sets the sweep type.

Example: `SWE:TYPE FFT`

Mode: A

[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 78.

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 76 or
`[SENSe]:POWer:RLEVel:VERify[:STATe]` on page 78 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 76 or
`[SENSe]:POWer:RLEVel:VERify[:STATe]` on page 78 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<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: Mode

[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 76.

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 76 or `[SENSe]:POWer:RLEVel:VERify[:STATe]` on page 78 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<source>:]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.

Suffix:

<source> irrelevant

Parameters:

<NumberSweeps> 0 to 32767

*RST: 0 (GSM: 200)

Example: `SWE:COUN 64`
Sets the number of sweeps to 64.
`INIT:CONT OFF`
Switches to single sweep mode.
`INIT;*WAI`
Starts a sweep and waits for its end.

Mode: A, ADEMOD, CDMA, EVDO, TDS, WCDMA, GSM

[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

*RST: OFF

Example: SENS:SWEep:FORWard 1
The sweep direction is set to sweep from start to stop frequency

Usage: SCPI conform

Mode: PHN

4.2.13 STATus Subsystem

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

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 81. 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 80 and

`STATus:QUEStionable:PNOise[:EVENt]?`.

Return values:

<Result> Bit No | 0 | 1 | 2 | 3 to 14 | 15

Bit No
Meaning

0
No traces are active
This bit is set when all the traces are switch off.

1
"SIGNal not found"
This bit is set if no valid signal is detected

2
"VERify signal failed"
This bit is set if verification failed to detect a signal within the supplied tolerances.

3 to 14
These bits are not used

15
This bit is always 0

4.2.14 Error Reporting

Error reporting for the K40 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.

List of Commands

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